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Smokeless Tobacco and Public Health: A Global Perspective

National Cancer Institute
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Editors

Dorothy K. Hatsukami, Ph.D.
Forster Family Professor in Cancer Prevention
Professor of Psychiatry
University of Minnesota
Minneapolis, MN

Mitch Zeller, J.D.
Director
Center for Tobacco Products
U.S. Food and Drug Administration
Rockville, MD

Prakash Gupta, D.Sc., FACE
Director
Healis–Sekhsaria Institute for Public Health
Mumbai, India

Mark Parascandola, Ph.D., M.P.H.
Epidemiologist
Tobacco Control Research Branch
Behavioral Research Program
Division of Cancer Control and
Population Sciences
National Cancer Institute
Bethesda, MD

Samira Asma, D.D.S., M.P.H.
Chief
Global Tobacco Control Branch
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Contributing Authors

Chapter 1

Dorothy K. Hatsukami, Ph.D.
Forster Family Professor in Cancer Prevention
Professor of Psychiatry
University of Minnesota
Minneapolis, MN

Mark Parascandola, Ph.D., M.P.H.
Epidemiologist
Tobacco Control Research Branch
Behavioral Research Program
Division of Cancer Control and
Population Sciences
National Cancer Institute
Bethesda, MD

Chapter 2

Krishna Mohan Palipudi, Ph.D.
Team Lead
Global Tobacco Surveillance System
Global Tobacco Control Branch
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Samira Asma, D.D.S., M.P.H.
Chief
Global Tobacco Control Branch
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Prakash Gupta, D.Sc., FACE
Director
Healis–Sekhsaria Institute for Public Health
Mumbai, India

The authors of chapter 2 acknowledge Luhua Zhao and Edward Rainey for their contributions.

Chapter 3

Stephen B. Stanfill, M.S.
Research Chemist/Team Lead,
Smokeless Tobacco
Tobacco Analysis Laboratory
National Center for Environmental Health
Centers for Disease Control and Prevention
Atlanta, GA

Irina Stepanov, Ph.D.
Assistant Professor
Environmental Health Sciences
Masonic Cancer Center
University of Minnesota
Minneapolis, MN

Chapter 4

S. Jane Henley, M.S.P.H.
Epidemiologist
Division of Cancer Prevention and Control
National Center for Chronic Disease Prevention
and Health Promotion
Centers for Disease Control and Prevention
Atlanta, GA

Michael J. Thun, M.D., M.S.
Vice President, Emeritus
Surveillance and Epidemiology Research
American Cancer Society
Atlanta, GA

Chapter 5

Hana Ross, Ph.D.
Managing Director
Intramural Research
American Cancer Society, Inc.
Atlanta, GA

Alex Liber, M.S.P.H.
Data Analyst
Intramural Research
American Cancer Society, Inc.
Atlanta, GA

Chapter 6
Richard J. O'Connor, Ph.D.
Associate Professor of Oncology
Roswell Park Cancer Institute
Buffalo, NY

Olalekan A. Ayo-Yusuf, Ph.D., M.P.H., M.Sc.
Associate Professor
Department of Community Dentistry
Faculty of Health Sciences
University of Pretoria
Pretoria, South Africa

The authors of chapter 6 acknowledge Maansi Bansal-Travers and Kaila Norton for their contributions.

Chapter 7
Herb Severson, Ph.D.
Senior Research Scientist
Oregon Research Institute
Eugene, OR

Monica Arora, Ph.D.
Director, Health Promotion and Tobacco Control
Adjunct Assistant Professor
Public Health Foundation of India
New Delhi, India

Jon O. Ebbert, M.D.
Professor
Primary Care Internal Medicine
Nicotine Dependence Center
Mayo Clinic
Rochester, MN

Chapter 8
Mitch Zeller, J.D.
Director
Center for Tobacco Products
U.S. Food and Drug Administration
Rockville, MD

Ghazi Zaatari, M.D.
Chair, WHO Study Group on Tobacco Product Regulation (TobReg)
Professor and Chair
Department of Pathology and Laboratory Medicine
American University of Beirut
Beirut, Lebanon

Vinayak M. Prasad
Project Manager
Prevention of Noncommunicable Diseases (PND)
World Health Organization
Geneva, Switzerland

Chapter 9
Scott Tomar, D.M.D., Dr.PH., M.P.H.
Professor
Department of Community Dentistry and Behavioral Science
College of Dentistry
University of Florida
Gainesville, FL

Caroline C. Renner, M.P.H., CTTS
Director of Research and Program Development
Cardiology Department
Alaska Native Medical Center
Anchorage, AK

Ricardo Granero
Epidemiology Unit
ASCARDIO
Barquisimeto, Venezuela

Ana Claudia Bastos de Andrade, J.D.
General Manager of Tobacco Products Department (GGTAB)
Agência Nacional de Vigilância Sanitária (ANVISA)
Rio de Janeiro, Brazil

Andre Luiz Oliveira da Silva, Ms.C.
Chief of Tobacco Product Control Unit
UNCOP/GGTAB
Agência Nacional de Vigilância
Sanitária (ANVISA)
Rio de Janeiro, Brazil

Chapter 10

Ray Croucher, Ph.D.
Professor of Community Oral Health
Queen Mary University of London
London, United Kingdom

Hans Giljam, M.D.
Professor
Department of Public Health Sciences
Karolinska Institutet
Stockholm, Sweden

The authors of chapter 10 acknowledge Manu Dahiya, Siddharth Shanbhag, and Ann McNeill for their contributions.

Chapter 11

Ghazi Zaatari, M.D.
Chair, WHO Study Group on Tobacco
Product Regulation (TobReg)
Professor and Chair
Department of Pathology and
Laboratory Medicine
American University of Beirut
Beirut, Lebanon

Ali M. Idris, Ph.D.
Professor, Oral Pathology, Epidemiology
and Biostatistics
Director, Research and International Relations
College of Dentistry
Jazan University
Jazan, Saudi Arabia

Khalil Kreidieh
Medical Laboratory Sciences
Faculty of Health Sciences
American University of Beirut
Beirut, Lebanon

Chapter 12

Olalekan A. Ayo-Yusuf, Ph.D., M.P.H., M.Sc.
Associate Professor
Department of Community Dentistry
Faculty of Health Sciences
University of Pretoria
Pretoria, South Africa

Masego Rantao, M.P.H.
Lecturer, Department of Community Dentistry
Faculty of Health Sciences
University of Pretoria
Pretoria, South Africa

Chapter 13

Prakash Gupta, D.Sc., FACE
Director
Healis–Sekhsaria Institute for Public Health
Mumbai, India

Cecily S. Ray
Senior Research Assistant
Healis–Sekhsaria Institute for Public Health
Mumbai, India

Dhirendra N. Sinha, Ph.D., M.S.
Tobacco Free Initiative
Regional Office for South-East Asia
World Health Organization
New Delhi, India

Chapter 14

Annette M. David, M.D., M.P.H.
Adjunct Research Faculty
Cancer Research Center, University of Guam
Mangilao, Guam

Clinical Associate Professor
Cancer Research Center of Hawaii, University of Hawaii at Manoa
Honolulu, Hawaii

Reviewers

Olalekan A. Ayo-Yusuf, Ph.D., M.P.H., M.Sc.
Associate Professor
Department of Community Dentistry
Faculty of Health Sciences
University of Pretoria
Pretoria, South Africa

Stephen Babb, M.P.H.
Public Health Analyst
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Cathy Backinger, Ph.D., M.P.H.
Deputy Director for Research
Office of Science
Center for Tobacco Products
U.S. Food and Drug Administration
Rockville, MD

Sarah Barber, Ph.D.
Health Policy and Systems Advisor
Health Sector Development
World Health Organization
Beijing, China

Raman Bedi, D.Sc., D.D.S., M.Sc.
Professor
King's College London
London, United Kingdom

Laura Beebe, Ph.D.
Associate Professor of Biostatistics and Epidemiology
Health Sciences Center
College of Public Health
University of Oklahoma
Oklahoma City, OK

Douglas W. Bettcher, M.D., Ph.D.
Director
Tobacco Free Initiative
World Health Organization
Geneva, Switzerland

Michele Bloch, M.D., Ph.D.
Chief
Tobacco Control Research Branch
Behavioral Research Program
Division of Cancer Control and Population Sciences
National Cancer Institute
Bethesda, MD

Paolo Boffetta, M.D., M.P.H.
Professor of Medicine, Hematology and Medical Oncology
Professor, Preventive Medicine
Director, Institute for Translational Epidemiology
Mount Sinai Hospital
New York, NY

David Burns, M.D.
Professor
School of Medicine
University of California San Diego
Del Mar, CA

Ralph Caraballo, Ph.D.
Chief, Health Communications Branch
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Frank J. Chaloupka, Ph.D.
Professor
Department of Economics
University of Illinois at Chicago
Chicago, IL

Simon Chapman, Ph.D., FASSA
Professor
Director of Research
Associate Dean, Communications
School of Public Health
The University of Sydney
Sydney, Australia

Ray Croucher, Ph.D.
Professor of Community Oral Health
Queen Mary University of London
London, United Kingdom

Manu Dahiya, M.Sc.
Queen Mary University of London
Barts and the London School of Medicine and Dentistry
Institute of Dentistry
London, United Kingdom

Cristine Delnevo, Ph.D., M.P.H.
Associate Professor
Chair, Department of Health Education and Behavioral Science
Director, Center for Tobacco Surveillance and Evaluation Research
University of Medicine and Dentistry of New Jersey School of Public Health
New Brunswick, NJ

Mirjana Djordjevic
Program Director
Tobacco Control Research Branch
Behavioral Research Program
Division of Cancer Control and Population Sciences
National Cancer Institute
Bethesda, MD

Lucinda England, M.D.
Team Lead, Research
Epidemiology Branch
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Geoffrey T. Fong, Ph.D.
Professor of Psychology
Department of Psychology
University of Waterloo
Ontario, Canada

Rajani George, M.D.S.
A.J. Institute of Dental Sciences
Mangalore, Karnata, India

Gary A. Giovino, Ph.D.
Professor
Department of Community Health and Health Behavior
School of Public Health and Health Professions
University at Buffalo, The State University of New York
Buffalo, NY

Thomas J. Glynn, Ph.D.
Director, Cancer Science and Trends
Director, International Cancer Control
American Cancer Society, Inc.
Washington, DC

Prakash Gupta, D.Sc., FACE
Director
Healis–Sekhsaria Institute for Public Health
Mumbai, India

Jack E. Henningfield, Ph.D.
Vice President
Research and Health Policy
Pinney Associates
Bethesda, MD

Ali M. Idris, Ph.D.
Professor, Oral Pathology, Epidemiology and Biostatistics
Director, Research and International Relations
College of Dentistry
Jazan University
Jazan, Saudi Arabia

Javaid A. Khan, FRCP (Edin)
Chair, National Alliance for Tobacco Control
Professor of Medicine
Section Head of Pulmonary and Critical Care Medicine Consultant Chest Physician
Department of Medicine
The Aga Khan University
Karachi, Pakistan

Robert Klesges, Ph.D.
Professor
Department of Preventive Medicine
University of Tennessee Health Science Center
Memphis, TN

Gaurav Kumar, M.P.H., P.G.D.H.H.M.
Public Health Foundation of India
Project STEPS
New Delhi, India

Manu Mathur, Ph.D., M.P.H.
Public Health Foundation of India
New Delhi, India

Tim McAffee, M.D., M.P.H.
Director
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Andre Luiz Oliveira da Silva, Ms.C.
Chief of Tobacco Product Control Unit
UNCOP/GGTAB
Agência Nacional de Vigilância Sanitária (ANVISA)
Rio de Janeiro, Brazil

Antoon Opperhuizen, Ph.D., M.Sc.
Vice Chair
WHO Tobacco Laboratory Network
Bilthoven, Netherlands

Krishna Mohan Palipudi, Ph.D.
Team Lead
Global Tobacco Surveillance System
Global Tobacco Control Branch
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Terry Pechacek, Ph.D.
Associate Director for Science
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Linda L. Pederson, Ph.D.
McKing Consulting Corporation
Atlanta, GA

Mariann Piano, Ph.D., FAAN
Professor and Interim Head
Department of Biobehavioral Health Science
College of Nursing
University of Illinois at Chicago
Chicago, IL

Gabbi Promoff, M.A.
Associate Director
Policy, Planning, and Coordination Unit
Office on Smoking and Health
Centers for Disease Control and Prevention
Atlanta, GA

Vaughan Rees, Ph.D.
Senior Research Scientist, Deputy Director
Center for Global Tobacco Control
Department of Society, Human Development and Health
Harvard School of Public Health
Boston, MA

Caroline C. Renner, M.P.H., CTTS
Director of Research and Program Development
Cardiology Department
Alaska Native Medical Center
Anchorage, AK

Laura Rosen, Ph.D.
Sackler Faculty of Medicine
School of Public Health
Tel Aviv University
Tel Aviv, Israel

Jonathan M. Samet, M.D., M.S.
Professor
Department of Preventive Medicine
Keck School of Medicine
Institute for Global Health
University of Southern California
Los Angeles, CA

Jean J. Schensul, Ph.D.
Senior Scientist and Founding Director
Institute for Community Research
Hartford, CT

Omar Shafey, Ph.D., M.P.H.
Senior Officer
Medical Research Public Health and Policy
Health Authority
Abu Dhabi, United Arab Emirates

Siddharth Shanbhag, M.Sc.
Queen Mary University of London
Barts and the London School of Medicine and Dentistry
Institute of Dentistry
London, United Kingdom

Surendra S. Shastri, M.D., D.Ph., D.H.A.
Head, Department of Preventive Oncology
Head, WHO Collaborating Centre for Cancer Prevention, Screening and Early Detection
Tata Memorial Centre
Mumbai, India

Dhirendra N. Sinha, Ph.D., M.S.
Tobacco Free Initiative
Regional Office for South-East Asia
World Health Organization
New Delhi, India

Stephen A. Tamplin, M.S.E.
Associate Scientist
Department of Health, Behavior and Society
Center for Global Health
Johns Hopkins University
Baltimore, MD

Scott Tomar, D.M.D., Dr.PH., M.P.H.
Professor
Department of Community Dentistry and Behavioral Science
College of Dentistry
University of Florida
Gainesville, FL

Gemma Vestal, J.D., M.P.H., M.B.A.
Senior Adviser on Tobacco Product Regulation, Legislation, and Enforcement
Tobacco Free Initiative
World Health Organization
Geneva, Switzerland

Ghazi Zaatari, M.D.
Chair, WHO Study Group on Tobacco Product Regulation (TobReg)
Professor and Chair
Department of Pathology and Laboratory Medicine
American University of Beirut
Beirut, Lebanon

Other Contributors

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BLH Technologies, Inc.

Lisa Adams, Graphic Artist

Elmer Alcantara, Graphic Artist

Allyson Austin, Copy Editor

Holly Bowers, Copy Editor

Julie Bromberg, M.H.S., CHES, Senior Research Associate

Dana Chomenko, M.A., PMP, Project Director

Ruth Clark, Design Coordinator and 508 Compliance Specialist

Amanda Huffman, M.P.H., Quality Control Specialist

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Marcia McCann, M.S.W., Senior Editor

Lindsay Pickell, M.F.A., Managing Editor

Jennifer Schindler-Ruwisch, M.P.H., Public Health Specialist

Isaac Smith, M.P.P., Copy Editor

Alexandra Stern, M.P.H., Quality Control Specialist

Gaby Suarez, 508 Compliance Specialist

Simon Weavers, Quality Control Specialist

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Acronyms and Abbreviations

°C	degrees Celsius
ANVISA	Agência Nacional de Vigilância Sanitária (National Agency of Health Surveillance [Brazil])
BAT	British American Tobacco
BRFSS	U.S. Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CI	confidence interval
CNMI	Commonwealth of the Northern Mariana Islands
COP5	Conference of the Parties
CTUMS	Canadian Tobacco Use Monitoring Survey
DHS	Demographic and Health Surveys
EC	European Commission
EU	European Union
FCTC	Framework Convention on Tobacco Control
FDA	U.S. Food and Drug Administration
g	gram
GATS	Global Adult Tobacco Survey
Gluc	glucuronide
GTCR	*WHO Report on the Global Tobacco Epidemic, 2011*
GYTS	Global Youth Tobacco Surveys
Hb	hemoglobin
IARC	International Agency for Research in Cancer
kg	kilogram
km	kilometer
mg/g	milligram per gram
MI	myocardial infarction
ml	milliliter
MYTRI	Mobilizing Youth for Tobacco-Related Initiatives in India
NAB	*N'*-nitrosoanabasine
NAT	*N'*-nitrosoanatabine

NCI	National Cancer Institute
NDMA	*N*-nitrosodimethylamine
NDSHS	National Drug Strategy Household Survey
ng/g	nanogram per gram
NGL	*N*-nitrosoguvacoline
NGO	nongovernmental organization
NNAL	4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol
NNK	4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone
NNN	*N'*-nitrosonornicotine
NRT	nicotine replacement therapy
NSDUH	National Survey on Drug Use and Health
NYTS	National Youth Tobacco Survey
OR	odds ratio
OSF	oral submucous fibrosis
oz	ounce
PAH	polycyclic aromatic hydrocarbon
pmol/mg	picomole per milligram
ppm	parts per million
RCT	randomized controlled trial
RR	relative risk
SCENIHR	Scientific Committee on Emerging and Newly Identified Health Risks
SD	standard deviation
ST	smokeless tobacco
TobLabNet	WHO Tobacco Laboratory Network
TobReg	WHO Study Group for Tobacco Product Regulation
TSNA	tobacco-specific nitrosamine
µg/g	microgram per gram
UST	U.S. Smokeless Tobacco Company
WHO	World Health Organization
WHO STEPS	WHO STEPwise Approach to Surveillance
YSS	Youth Smoking Survey

Chapter 1

The Global Challenge of Smokeless Tobacco

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Introduction

Smokeless tobacco (ST) products present a complex and widespread challenge to public health that has so far received limited attention from researchers and policymakers. In many regions and countries of the world, such as South-East Asia, ST use is the predominant form of tobacco use. Indeed, data from the Global Youth Tobacco Survey show that students aged 13–15 surveyed in 132 countries were more likely to report using non-cigarette tobacco products including ST products (11.2%) than to report smoking cigarettes (8.9%).[1] Yet international tobacco control efforts have largely focused on cigarettes, devoting only limited attention to other types of products, including smokeless tobacco.

The Global Challenge

The serious health effects of ST have been documented. A 2004 International Agency for Research on Cancer (IARC) review found that there is sufficient evidence, based on epidemiologic and laboratory studies, to conclude that ST causes oral cancer, esophageal cancer, and pancreatic cancer in humans.[2,3] More than 30 carcinogens have been identified in ST products, including tobacco-specific nitrosamines (TSNAs), which cause tumors affecting the nasal cavity, lung, trachea, pancreas, liver, and esophagus in animal models.[4] Smokeless tobacco use also causes adverse oral health outcomes including oral mucosal lesions, leukoplakia, and periodontal disease.[5,6] Additionally, ST products contain nicotine, and users of ST products demonstrate signs of dependence similar to those of cigarette smokers, including tolerance with repeated use and symptoms of withdrawal upon cessation of use.[7]

Although ST use, like tobacco smoking, causes serious health damage, ST use poses substantial challenges for science and public health that are distinct from those presented by tobacco smoking.

Wide Range of Products in Use

Understanding the use and impact of ST products is complicated by the diversity of products and related user behaviors. A wide range of ST products with different characteristics are in use around the world, including chewing tobacco, snuff, gutka, betel quid with tobacco, snus, toombak, iqmik, tobacco lozenges, and others. Yet limited data are available on the properties of these products, how they are used, and their prevalence within different population groups. This diversity makes it difficult to generalize about these products as a class. Additionally, the ways in which ST products are produced, sold, used, and regulated (such as through taxes or marketing restrictions) differ widely across countries and regions. (This report's occasional use of the word "traditional" to describe ST products that are unique to specific groups or have been used historically by those groups should not be taken to imply that these products have a played a significant cultural role.)

Complex and Limited Data

In addition to the known biologic effects of ST, the overall public health impact of ST use depends on a range of health and environmental factors, including the prevalence and patterns of use of different products in the population, the impact of marketing messages, and the effectiveness of prevention and cessation efforts. While certain groups have been identified as being at increased risk for ST use, limited data are available on why particular populations begin to use ST and what factors are most important in preventing or promoting initiation of ST use.

Novel Products and Marketing

Tobacco manufacturers have introduced a new generation of ST products that may have broad consumer appeal due to use of attractive flavorings, such as mint or fruit flavors, and new delivery methods, such as lozenges or small pouches that eliminate the need to spit. Major multinational cigarette companies Philip Morris and R.J. Reynolds have introduced snus products carrying the well-known Marlboro and Camel brand names, thereby adding new product lines to these existing brand names and putting their marketing expertise and brand recognition to work for this new class of products. Tobacco control experts warn that increased marketing of these products may have an adverse impact on population health by appealing to young, new users or by helping current smokers maintain their nicotine dependence.[8] Novel nicotine delivery devices, such as electronic cigarettes, which use heat (rather than combustion) to release nicotine, are also being marketed in many countries as an alternative to conventional cigarettes. These products are not addressed in this report, but they may also have an important impact on patterns of tobacco use behavior[9] and therefore should be examined.

Some tobacco companies have also responded to the tremendous growth in smoke-free indoor air laws by advertising ST products to smokers as a temporary alternative to cigarettes for situations where they cannot smoke. In addition to increasing ST use, this marketing strategy may impede smoking cessation efforts by making it easier for smokers to maintain their nicotine addiction between cigarettes and in situations where cigarette smoking is not permitted, thus reducing their motivation to quit. This is an example of how progress made in one area of tobacco control, such as through smoke-free indoor air laws, has been followed by tobacco manufacturers' efforts to adapt, this time by introducing new products and marketing strategies.

Impact on Youth and Development of Ongoing Tobacco Use Behaviors

The potential for increased initiation of ST use among youth also poses a major ongoing public health challenge. This increased initiation may be caused by increased marketing and the introduction of new, flavored products. Indeed, ST use among teens and young adults rose substantially in the United States during the 1970s after the introduction of products that were more accessible to new users, in that these products had attractive flavorings and lower nicotine content.[10] Evidence suggests that users who begin with low-nicotine "starter" products are more likely to subsequently "graduate" to products with higher nicotine content.[11] Moreover, a number of studies suggest that ST use is associated with and reinforces use of other tobacco products, including cigarettes. Thus, adolescents who use ST products may also be more likely to move on to cigarette smoking.[12,13]

Limited Treatment Options

Intervention strategies for ST use cessation have had mixed success. Clinical trials have shown that behavioral interventions in particular settings, such as dental offices, may increase abstinence rates among ST users, although the available evidence is insufficient to support recommendations about the specific intervention components that should be applied.[14,15] In contrast, trials of pharmacotherapies in ST users, including the nicotine patch, nicotine gum, and bupropion, have shown no impact on abstinence rates over the long term (>6 months).[16] Some individual study results suggest that pharmacotherapies may help reduce symptoms associated with cessation, such as craving and weight gain, but such symptom reduction has not been shown to have any impact on cessation

outcomes.[17] Moreover, evidence suggests that people who use both cigarettes and ST demonstrate higher nicotine exposure levels and find cessation more difficult to achieve than those who only use ST or those who only smoke.[18–20]

Tobacco "Harm Reduction"

The response to the hazards of ST use is complicated by discussions about the possibility of using ST as a means of harm reduction for cigarette smokers. Some scientists have suggested that ST use may actually reduce harm to smokers by providing an alternative to cigarettes—that is, smokers who switch completely to ST, which does not carry the same risk of lung cancer and respiratory diseases as cigarette smoking, might reduce their overall risk. While smokeless tobacco also causes cancer and other diseases, the overall health risks for a lifetime ST user may be lower than those for a lifetime cigarette smoker.

This inference requires a number of assumptions, however. Given the tremendous diversity of ST products and patterns of use around the world, it is difficult to support broad generalizations about the level of harm associated with ST products as a category. Little is known about the constituents of some ST products or the amount of exposure users receive from them. Will smokers who begin using ST products completely replace their cigarettes, or will they instead become dual product users, which may not yield any health benefit and could potentially increase their risk? Additionally, it is essential to consider the overall population-level impact of increased ST use. For example, will increased promotion of ST products lead to an increase in tobacco use initiation or have an adverse impact on smoking cessation efforts? Although the body of evidence on this topic is expanding, definitive studies to answer key questions are lacking. In short, there remain more questions than answers.

Discussions regarding harm reduction have been limited primarily to high-income countries, such as in North America and Western Europe, where cigarette smoking is the predominant form of tobacco use and there is a long history of tobacco control measures. Because tobacco products, patterns of use, disease profiles, and policy structures vary so widely across regions, these discussions are of limited relevance for other regions and are not explored in this global report.

Report Framework and Process

With this information in mind, the goals for the report are as follows:

1. Bring together experts and information on ST use from all regions of the globe. The aim of this report is not to provide a comprehensive review of all the science on the health effects of ST use, which has been covered elsewhere, but to provide a snapshot of current knowledge and data sources on ST use, characteristics of products, and related policy efforts.
2. Summarize current survey information about the prevalence and characteristics of ST use and its health effects in different regions, as well as laboratory data on the contents of different products from around the world.
3. Outline what is currently known about the changing ST product market, industry marketing efforts, and economic and policy factors.

4. Provide an overview of the current state of scientific knowledge, public health information, and policy initiatives focused on ST in each major region.
5. Identify gaps and needs related to monitoring and surveillance of ST products and other information collection, and make recommendations for strengthening international collaboration and building a scientific basis for ST product control and regulation.

Thirty-two authors with expertise in ST, representing all six World Health Organization (WHO) regions, were involved in planning, researching, and writing this report. Two in-person author meetings were held to ensure coordination and consistency across chapters. Each chapter was reviewed by external expert peer reviewers not otherwise involved in the report, and the authors were charged with revising their chapters in response to the reviews. In all, 35 peer reviewers from 12 countries participated in this process. Additionally, information was compiled from a wide range of data sources, including data from the Global Tobacco Surveillance System, some of which are being reported for the first time. Given the wide variety and complexity of the ST product landscape, the report is also accompanied by a series of factsheets describing the characteristics and use of specific products (see Appendix B). These factsheets were developed and reviewed by individuals with expertise about the products. Each factsheet contains a description of the product, common and brand names, and geographic locations where the product is used, as well as information about mode of absorption, use patterns, main ingredients, processing/ manufacturing data, and when available, an illustration and chemical measurements. For additional explanation of key terms and definitions, please refer to the glossary.

The report is divided into two parts:

Part 1—An overview of information on the global impact of ST from a variety of perspectives. Individual chapters in Part 1 describe patterns of use, characteristics of different products, health consequences, economics, marketing trends, interventions, and policies related to smokeless tobacco. Additionally, these chapters describe available tools, such as existing surveillance infrastructure, as well as gaps and research needs.

Part 2—Separate regional chapters providing information on all six WHO regions: Africa, the Americas, South-East Asia, Europe, the Eastern Mediterranean, and the Western Pacific. Because of the diversity of ST products and regional differences in tobacco and non-tobacco risk factors, conditions of use, and cultural and policy environments, it is essential to examine these regions independently. Each chapter describes patterns of use, types of products, known toxicity information, specific health effects, industry marketing practices, policies and interventions, and future needs and directions for the region.

Report Background

A series of meetings and reports dating back to 1991 have identified some crucial research and policy gaps related to smokeless tobacco.[4] The 3rd International Conference on Smokeless Tobacco, held in Stockholm in 2002, defined research needs in a range of areas, including the chemistry and constituents of ST products, ST addiction and cessation, patterns of tobacco use, policy interventions, and harm reduction. One of the major outcomes of this conference was a set of factsheets profiling the range of ST products, traditional and manufactured, that are in use around the world. However, limited data were

available about the characteristics and use of these products. The conference speakers discussed ST use as the predominant form of tobacco use in some countries (such as Bangladesh), and its association with serious adverse population effects. These experts also described the available data on the relationship of ST use to other tobacco use as unclear, and they urged placing a high priority on further research on this topic. The need for more research on innovative cessation treatments for ST users was also highlighted.

In June 2006, the National Institutes of Health (United States) held its first ever State-of-the-Science Conference on tobacco control, "Tobacco Use: Prevention, Cessation, and Control."[21] One of the key questions posed to the panel was "What is the effect of smokeless tobacco product marketing and use on population harm from tobacco use?" The panel heard testimony from leading experts in tobacco research and identified some substantial research gaps. The panel concluded that ST products were of great concern for three reasons: (1) ST use is associated with health risks, (2) data about the effect of ST on public health are limited, and (3) new products and aggressive marketing may increase use of ST in the United States. The panel stressed that more research is needed to determine the overall effect of marketing and use of these products. In particular, they concluded that "the paucity of evidence about ST in the United States leaves many questions unanswered."[21,p.13]

The WHO Study Group on Tobacco Product Regulation has addressed research and regulatory needs related to ST products in two recent reports. A 2008 publication in this series urged that all ST products be subjected to comprehensive regulatory control by an independent scientific government agency. Moreover, the study group noted that "research on the health hazards and risks to individuals and populations of use of ST products is essential for governments and for implementation of the Framework Convention [on Tobacco Control]."[22,p.12] This research should address how the design and manufacture of tobacco products could be modified to alter their health effects. A subsequent report in the series, published in 2009, proposed establishing upper limits for two tobacco-specific nitrosamines (TSNAs) [*N'*-nitrosonornicotine (NNN) and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)] and one polycyclic aromatic hydrocarbon [benzo(*a*)pyrene (BaP)] in ST products. This report also recommended that regulation of the distribution and sale of ST products should include measures to limit increases in TSNAs, including storage requirements and expiration dates. Although the authors acknowledged that existing evidence is not sufficient to establish whether reducing the levels of individual constituents in tobacco products will have a measurable impact on cancer risks, they asserted that "it is difficult to justify allowing high levels of known carcinogenic constituents in a product that is known to cause cancer, when lower levels are readily achievable with existing technology."[9,p.41]

A second international conference focused on ST, the International Smokeless Tobacco Symposium, was held March 8, 2009, in Mumbai, India, in conjunction with the World Conference on Tobacco or Health. More than 150 participants representing dozens of countries from around the world attended the 1-day meeting. Presentations highlighted a number of challenges related to ST products, including relatively low prices for these products (which makes them appealing), the targeting of products toward youth, and the lack of organized public health and policy efforts focused on smokeless tobacco. At the end of the conference, participants agreed on several key conclusions:

- Smokeless tobacco use adversely affects all countries and regions.
- Increasing use and industry promotion of ST represents an increasing threat to public health worldwide.
- All forms of ST have an adverse impact on health.
- Smokeless tobacco should not be promoted as a harm-reduction product.
- Smokeless tobacco poses substantial challenges to regulatory and control efforts because of the wide variety of products and production methods in use, including individual point-of-use production, home- and village-based production, as well as manufacture by international corporations.
- Smokeless tobacco has not received adequate attention from researchers and policymakers, including the WHO Framework Convention on Tobacco Control (FCTC).
- Smokeless tobacco should receive increased attention (such as increased surveillance and monitoring) in all parts of the world.

Another important conference was the 2010 International Smokeless Tobacco Meeting hosted by the Tobacco Harm Reduction Network (THRN), funded by the National Cancer Institute (United States), in collaboration with the Centers for Disease Control and Prevention and the American Cancer Society. This meeting brought together leading global ST researchers to develop a coordinated and collaborative process to better understand and address the public health burden of ST worldwide. The meeting agenda included presentations highlighting findings and recommendations from previous meetings and reports; regional ST trends among populations in Asia, Africa, Europe, North America, South America, and the Eastern Mediterranean; existing research surveillance tools, databases, and networks; and opportunities and implications for ST product regulation through the FCTC and the U.S. Food and Drug Administration's new authority under the 2009 Family Smoking Prevention and Tobacco Control Act.

Among other recommendations and conclusions, the meeting identified three critical action steps to expand efforts against the ST epidemic.

- First, coordinate action to elevate the profile of ST within the broader tobacco control community. Specifically, it is urgent that reducing ST use be included as a priority in ongoing tobacco control efforts. These efforts should also focus on capacity building by attracting and supporting new researchers, especially those in low- and middle-income countries.
- Second, develop and expand global ST product monitoring and surveillance systems. These systems must address the significant heterogeneity of ST products, both commercial and local or homegrown, and their toxic constituents and additives; systems should also monitor and assess product trends and prevalence across population groups.
- Third, build the infrastructure needed to expand the evidence base critical for effective regulatory action. Strategies for developing this infrastructure should focus on building collaborations between scientists, tobacco control advocates, and policymakers. Research is urgently needed to address the diversity of ST products, changing patterns of ST use, and varied types of ST production. Timely and high-quality research is essential to the development and implementation of effective regulatory action.

Presentations at the International Smokeless Tobacco Meeting provided the basis for organizing and structuring the current report, which is an effort to address these critical action steps by raising the profile of the global challenge posed by ST use, identifying sources of information and gaps, and identifying research and policy needs related to smokeless tobacco.

Major Conclusions

- Smokeless tobacco use is a global problem that is present in at least 70 low-, middle-, and high-income countries and affects more than 300 million people. The greatest burden from ST use is in the South-East Asia Region, which experiences the highest prevalence of ST use (including the majority [89%] of the world's users), carries the highest attributable disease burden, and has the greatest diversity in product types and forms of use.[23–29] Smokeless tobacco use is highly prevalent in India, where it exceeds cigarette smoking among both men and women.
- The magnitude of disease risks directly associated with ST use appears to differ across countries and regions, likely due in part to differences between ST products and patterns of use. Laboratory analyses have shown widely varying levels of known carcinogens and nicotine in ST products from different regions, and epidemiologic studies of ST users in different regions have reached varying risk estimates for cancer and cardiovascular disease from country to country. Yet data to precisely quantify these differences in disease risk and to identify the factors that drive them are lacking.
- Smokeless tobacco use and marketing present distinct public health challenges in different countries and regions. In particular, there is a divide between some high-income countries (such as in Scandinavia) with high prevalence of low-nitrosamine ST use, reductions in smoking prevalence, and strong tobacco control and regulatory frameworks, and low- or middle-income countries (such as India) where ST products are associated with very high levels of harmful constituents, where marketing of cigarettes is increasing, and a large unorganized business sector makes product control and regulation extremely challenging. Changes in product marketing, patterns of use, and tobacco control programs and interventions may have very different results in these different environments.
- Changing tobacco industry marketing strategies may influence the future public health impact of ST use. In some high-income countries where restrictions on public smoking have increased and smoking prevalence has decreased, tobacco companies have marketed oral tobacco products to smokers. However, the impact of this trend on smoking behavior, and possible dual or poly-tobacco use, remains uncertain. At the same time, multinational tobacco companies have an increasing presence among low- and middle-income countries with both smoked and smokeless products.
- In many regions, even those where ST use is highly prevalent, policies and programs aimed at ST use prevention and cessation are generally weaker than those that address smoked tobacco products. Prices are lower, warning labels are weaker, surveillance is less developed, fewer proven interventions are available, and fewer resources are devoted to prevention and control programs.

- Significant challenges exist in monitoring the use and health effects of smokeless tobacco. These challenges include the diversity of ST products and their use; the lack of information to characterize products and manner of use; the informal, unorganized nature of the ST market in some regions; and the limited attention given to tailored educational and intervention programs.
- A wide range of research gaps remain for ST products, including lack of surveillance data and data on: characteristics of diverse ST products; health consequences from use of different products, including fetal exposure and reproductive outcomes; economic policies concerning ST products and their use; and effective region-specific ST education, prevention, and treatment interventions.
- A range of different policies have been proposed or implemented for ST products in some countries, but data are often lacking on their impact or effectiveness. Greater attention is needed to strengthen the use of evidence-based policies for control of ST use, which could include: having tobacco industries disclose the contents of ST products; establishing performance standards for toxicants and maximum pH levels; banning flavorants; establishing effective and relevant health warning labels; increasing taxes on ST products; banning or restricting ST promotions, sponsorship, or marketing; and raising public awareness of the toxicity and health effects of ST products. In sum, prevention and cessation of ST use should form an integral part of any comprehensive tobacco control effort.
- Capacity for research and public health action around ST is limited in many countries, especially those where the public health burden is greatest. Development of international infrastructure for research and information sharing could enhance the ability of many countries to reduce the consequences of ST use. International collaboration and shared capacity building could include the following: (a) creating regional but globally accessible information clearinghouses for ST; (b) strengthening infrastructure for networking, communication, and collaboration; (c) building collaborations across disciplines and professions (e.g., scientists with policymakers and tobacco control advocates); and (d) developing ways to build research capacity by leveraging existing resources.

Chapter Summaries and Key Findings

Part 1—Overview

Chapter 1. The Global Challenge of Smokeless Tobacco

Chapter 1 introduces and provides a framework for this report, summarizes its chapters, and sets out its major conclusions.

Chapter 2. Global Prevalence of Smokeless Tobacco Use Among Youth and Adults

Chapter 2 describes available data on the prevalence of ST use by youth and adults in 114 countries of the 194 WHO member states. Data on ST use in many of these countries were available for the first time. Major data sources for ST prevalence included the 2007–2010 school-based Global Youth Tobacco Surveys (GYTS), the 2008–2010 Global Adult Tobacco Survey (GATS), and the 2005–2010 Demographic and Health Surveys (DHS) on adults, along with other national and subnational surveys.

Key findings:

- More than 300 million adults in 70 countries across all WHO regions use smokeless tobacco. The largest share, 89%, are in South-East Asia. More than 250 million adult ST users are in low- and middle-income countries.[23–29] In a few countries, notably India and Bangladesh, ST use is very high and surpasses smoking.
- Smokeless tobacco use prevalence varies significantly across individual countries and regions, between youth and adults, and between males and females.
- Among youth and adults, males generally show higher prevalence of use than females. However, among adults, use by women is similar to or greater than use by men in some countries, including Bangladesh, Thailand, Cambodia, Malaysia, Vietnam, and some African countries, such as South Africa, Mauritania, and Sierra Leone.
- Current ST use prevalence is especially high (>15%) among adults in Myanmar, Bangladesh, India, Bhutan, Nepal, Sweden, and Sri Lanka, and among youth in Congo and Namibia. All six WHO regions reported prevalence of greater than 10% among boys, men, or overall in at least one country.
- Although data were available to measure overall prevalence for many countries, longitudinal data and data on patterns of use are lacking in most regions.

Chapter 3. A Global View of Smokeless Tobacco Products

Chapter 3 provides information on the contents of the various types of ST products that are used around the world, including their levels of toxicants, carcinogens, and nicotine. This chapter presents a method of classifying the variety of ST products based on the inclusion or exclusion of alkaline modifiers, areca nut, or other chemical and plant ingredients with biologic activity. This chapter also describes the factors and processes that lead to the presence or formation of toxic and carcinogenic agents in ST products, and discusses the use of species of tobacco that can contribute to extremely high nicotine levels (*Nicotiana rustica*) and toxicity (*Nicotiana glauca*).

Key findings:

- Globally, ST products vary greatly in chemical composition, with some products containing extremely high levels of nicotine, free nicotine, and carcinogens. Hence, the wide spectrum of ST products appears to represent differing levels of addictiveness, toxicity, carcinogenicity, and harmful health effects. For example, levels of certain carcinogenic TSNAs, such as NNN and NNK, can vary by several orders of magnitude among ST products distributed globally.[30]
- Smokeless tobacco products may be premade (sold ready to use) or custom-made (assembled by the user or a vendor according to user preferences). Premade products range from manufactured products made in factories or large production facilities to cottage industry products made in market stalls or shops.

- Levels of toxicity, carcinogens, and free nicotine in ST products are influenced by the tobacco species/type used, growing conditions (e.g., soil nitrate and metals concentrations), curing methods (air curing vs. fire curing), tobacco processing (fermentation vs. pasteurization), production methods, including the addition of certain ingredients (areca nut, tonka bean, alkaline agents), and product storage conditions.
- The presence of microorganisms (e.g., bacteria, fungi) in tobacco or their formation during production can potentially increase the levels of some carcinogens or toxicants in tobacco products.
- Reduction or elimination of fire-cured tobacco, microbial contamination, fermentation, and certain ingredients (areca nut, tonka bean) and improvements in storage conditions are potential means of reducing carcinogens or toxicants in ST products.
- Elimination of nicotine-enriched tobacco species and greatly reduced use of alkaline agents are means of reducing users' exposure to high nicotine levels and the addictive potential of some ST products.

Future research requires more thorough characterization of contents and harmful chemicals, including those not previously studied, in the wide variety of ST products that are used worldwide.

Chapter 4. Health Consequences of Smokeless Tobacco Use

Chapter 4 summarizes the evidence on the adverse health consequences associated with ST products and their use, including addiction, oral conditions and precancerous lesions, cancer, cardiovascular disease, diabetes and insulin resistance, conditions of the nasal cavity, and reproductive outcomes. The chapter builds on previous reports and systematic reviews that have provided thorough assessments of the evidence. The chapter also provides estimates of the public health impact of ST product use in three countries where sufficient data are available—India, Sweden, and the United States.

Key findings:

- Compared with the vast amount of information linking adverse health effects to cigarette smoking, studies on ST use are not comprehensive. Epidemiologic studies of ST use have less information about what levels of use are associated with particular outcomes and, in some countries, fewer numbers of ST users on which to base conclusions. Also, because ST products contain varying levels of many known carcinogens as well as other plant materials, such as areca nut or tonka bean, comprehensive risk assessments must address complex mixtures of ingredients.
- There is sufficient evidence that ST products cause addiction; precancerous oral lesions; cancer of the oral cavity, esophagus, and pancreas; and adverse reproductive and developmental effects including stillbirth, preterm birth, and low birth weight. Some, but not all, ST products are associated with increased risk of fatal ischemic heart disease, type 2 diabetes, and fatal stroke.
- The extent of ST-related risks appears to vary by region, most likely due in part to differing levels of harmful constituents and ways in which these products are used.

- The proportion of cases of cancers of the oral cavity, esophagus, and pancreas that can be attributed to ST use (i.e., the attributable fraction) is greater in countries where ST use is highly prevalent. A high burden of ST-related cancers is estimated to occur in India because of the large population, high prevalence of ST use, and high incidence of cancers known to be associated with ST use.
- The public health impact of ST use can be estimated from the disease risk associated with the particular product, the prevalence and manner of use, and the population burden of disease known to be associated with ST use. The impact of ST use may be difficult to quantify where data specific to a product or region are lacking.

Chapter 5. The Economics of Smokeless Tobacco

Chapter 5 summarizes the literature and available data on the economics of smokeless tobacco. It provides the first systematic overview of ST excise tax rates and points out the vast gaps in both economic data and economic research related to ST use.

Key findings:

- Very limited data exist on ST prices, tax rates, and tax structures, which makes research into the impact of ST taxes and prices on ST use very difficult, if not impossible. Very little is known about the extent to which higher ST taxes translate into higher ST prices and how these prices affect the affordability of ST products. Little is known about the comparability of tax levels between smoked and smokeless products.
- The best available estimates indicate that, by volume, 91% of ST products sold worldwide are sold through "traditional" markets (cottage industry and custom-made).[31]
- The tax system that best suits public health goals is likely to be country-specific. The excise tax system that should be favored is that which most effectively raises the prices of ST products and makes ST products less affordable over time, because this will discourage ST consumption. The current best practice for cigarette taxation favors the use of a specific excise tax that is regularly adjusted for inflation.
- The effectiveness of tax collection systems and the impact of higher taxes on ST use will also depend on the standardization of ST products. A standard unit may be based on dosage (average amount of a product used in a single session), the weight of the dry tobacco leaf used in a product, or the weight of a product (weight of the tobacco, water content, and all other additives). Lack of standardization complicates not only tax collection but also scientific research, as it hinders the use of econometric methods.
- Data on ST prices, taxes, ST tax revenue, and ST trade (both licit and illicit) are needed. Currently WHO FCTC reporting standards do not require collection of data on all types of tobacco products. Attention should be dedicated to monitoring and regulating the ST supply chain (manufacturing, trade, distribution) in order to develop an effective ST tax regime.

Chapter 6. Changing Smokeless Tobacco Products and Marketing Practices by Industry

Chapter 6 describes novel ST products introduced over the past decade, how these products differ from more traditional ST products, and how they are being marketed.

Key findings:

- In some high-income countries, tobacco manufacturers have introduced novel ST products, using product innovations such as portion pouches, dissolvable tobacco, unique flavorings, and varying nicotine levels which may make novel products more attractive to consumers, including those who have not previously used ST products. Tobacco manufacturers, including cigarette manufacturers, have marketed new ST products to smokers for use in situations where they cannot smoke or do not want to smoke, such as at work, in airplanes, in smoke-free bars, or around family members. These marketing strategies may have an adverse public health impact if they encourage dual use or use of multiple tobacco products, discourage cessation, or encourage new tobacco use initiation.
- In low- and middle-income countries, product innovations may also make sale and use of products more convenient. For example, in India the gutka industry has promoted a packaged ready-to-use product based on a traditional custom-made mixture.
- Marketing encompasses more than advertising. Marketing practices of the ST industry should be thought of in terms of the "4 P's": product, price, placement, and promotion. Products are designed to appeal to targeted consumers, they are offered at a desirable price, and they are promoted effectively using multiple communication and placement channels.
- Understanding consumer perceptions of and responses to novel products is essential to assessing the public health impact of changing product and marketing strategies. Research is needed into the perceptions of consumers and their attitudes toward marketing messages, product packaging, and product characterization in order to support evidence-based control and regulation of ST products.
- Greater monitoring and research is needed regarding marketing practices in low- and middle-income countries.

Chapter 7. Prevention and Cessation Interventions

Chapter 7 describes evidence-based prevention and treatment programs that have been tested in a range of countries. The interventions vary from community, to organizational, to individual levels of treatment. This chapter also explores treatments that have been targeted to specific populations of ST users.

Key findings:

- School-based and community-based prevention programs lead to short-term reductions in prevalence. Involvement of youth in the planning and implementation of programs is an important contributor to their success. School programs that are supplemented by effective family-based and mass media programs improve success over school programs alone.

- For adult ST users, dental office interventions and clinic interventions involving multiple sessions and counselor support have been shown to be effective treatments, although most studies have been conducted in high-income countries. Phone counseling and oral exam feedback appear to be key elements of an effective intervention. Training oral health professionals to intervene with ST users may also be an effective avenue for intervention.
- For resource-constrained countries, mailed self-help materials with follow-up contact by telephone or using mobile technology may be a cost-effective intervention method.
- Pharmacotherapies, with the possible exception of varenicline, have not been found effective in improving ST cessation rates. However, these medications may reduce withdrawal symptoms in individuals who stop using ST products.
- Public awareness and understanding of the detrimental health effects of ST use is incomplete and in some countries, extremely limited. Educational efforts on these harmful effects through media or health care systems are essential to support implementation of large-scale interventions.
- More research is necessary in order to develop country-specific ST intervention programs and to explore the best ways to make these interventions accessible to ST users, especially in countries were resources are limited.

Chapter 8. Smokeless Tobacco Regulation and Policy

Chapter 8 describes the different types of regulations that have been implemented in different countries and regions and those countries' regulatory experiences. It also examines the challenges involved in regulating ST products and provides recommendations on how to address these challenges.

Key findings:

- Key provisions in the WHO Framework Convention on Tobacco Control as applied to ST have been implemented to varying degrees in some countries but not others. Almost all of the provisions in the FCTC have direct and distinct implications for ST products and, to be fully implemented, will require guidance specific to ST products. For example, demand-reduction measures—such as regulation of tobacco product contents, packaging and labeling, education and communication efforts, and dependence and cessation interventions—should be tailored to ST product users and to the context of their use. Additionally, WHO's TobReg committee has published recommended upper limits for key tobacco carcinogens in ST products.
- Countries and regions have had varied regulatory experiences, ranging from banning all or some ST products (Singapore, Brazil, Bahrain, United Arab Emirates, and the European Union except Sweden), following FCTC recommendations for ST products (Turkey), prohibiting ST sales to minors, restricting promotion, and requiring product reports by manufacturers (United States, Canada), requiring text-based warning labels on ST products (United States, Canada, India), to a total absence of regulation of ST (most countries in the Eastern Mediterranean Region).
- Key challenges for effective ST regulation and policy include: (a) low cost, high social acceptance, and easy availability of ST products; (b) tax evasion due to illicit sales and production in traditional markets, and illicit trade and low levels of taxation in other markets; (c) lack of standards for testing ST products; (d) industry marketing strategies for ST;

(e) heterogeneity of ST products in their composition and their manner of production, sale, and use; and (f) the introduction of newer tobacco products, which may impact efforts to quit tobacco use and may lead to dual use or use of multiple tobacco products.

- To support product regulation and control, research is needed on regular surveillance and monitoring of ST products, including laboratory testing, sales and pricing data, marketing and packaging, and consumer response. Additionally, research is needed on the characteristics of diverse products, their manner of use, and the effectiveness of policies and interventions in a variety of environments. Capacity building will also be needed to support laboratory testing and regular data collection on smokeless tobacco products.
- Overall, policies and regulation to control ST product use have been given less support by governments and public health leaders compared with efforts directed at cigarette smoking. Policies and interventions targeted to ST products should be an integral part of any comprehensive tobacco control policy and regulatory regime.

Part 2—Regional Chapters

Chapters 9 through 14 describe the types of ST products, their production and patterns of use, as well as the regulatory environment in countries of the World Health Organization Regions: the American, European, Eastern Mediterranean, African, South-East Asian, and Western Pacific Regions.

Chapter 9. Smokeless Tobacco Use in the Region of the Americas

Key findings:

- Among youth, reported current ST use ranged from 1.8% in Canada to 9.8% in Barbados.[32,33] Smokeless tobacco use was more prevalent among boys than girls in nearly all countries and localities, with the greatest sex difference in the United States. The prevalence of ST use among boys ranged from 2.6% in Canada to 11.5% in Barbados, and among girls, from 0.8% in Canada to 8.5% in Jamaica.[32,33]
- For adult men, the highest reported prevalence of use was in the United States (7.1%), while use by adult women was highest in Haiti (2.5%).[24,29] However, detailed information on ST use for youth and adults is sparse or nonexistent for most countries in the region.
- Two types of snuff are manufactured and used in the United States: moist snuff and dry snuff. Moist snuff is by far the most widely consumed type in the United States and Canada. Loose leaf, plug, and twist are the three types of chewing tobacco sold in North America.
- In the United States, ST products have been marketed using flavorings and in pouches or lozenges, which may appeal to new ST users. Dissolvable forms of ST have been introduced in the U.S. market and a few other countries. Some of these products are compressed tobacco lozenges that resemble breath mints: Camel Orbs (R.J. Reynolds), Ariva (Star Scientific), and Stonewall (Star Scientific). (The latter two products were discontinued at the beginning of 2013.) Some of these products are produced by large cigarette companies and have been marketed to smokers to use in situations where they cannot smoke.

- Other types of products in the region include iqmik, traditionally used by Alaskan natives; chimó, the main smokeless product in Venezuela; and rapé, a type of dry snuff used in Brazil.
- Little is known about potential adverse health effects of many of the locally used products or the newer dissolvable products. More research is needed, including human and laboratory studies, to characterize the health effects of diverse products, including their use in combination with smoked tobacco products.
- Regulation of ST products in the Americas is generally weak or absent. Brazil prohibits sale of ST products by law, but they are still available in some areas of the country. Compared with cigarettes, ST products are taxed at a lower rate, have weaker warning labels, and fewer cessation supports throughout the region.

Chapter 10. Smokeless Tobacco Use in the European Region

Key findings:

- European regional data on tobacco use are largely focused on smoking; limited information is available on smokeless tobacco. WHO datasets report adult ST prevalence for less than one-third of the European Region's countries. Additionally, limited data are available on youth ST use.
- From the available national evidence, prevalence of ST use among adults varies from 0.1% in Latvia and Switzerland to 17% in Sweden.[25] Men have higher rates of current use of these products than women, with 17% of Norwegian men, 22.5% of Uzbek men, and 26% of Swedish men reporting ST use.[25] Subnational surveys show higher ST prevalence among specific groups—for example, Bangladeshi women residents of the UK.
- Europeans use a variety of ST products. Moist snuff, or snus, originated in the Nordic countries of Sweden, Norway, Finland, and Iceland; a range of products are imported for use by communities of South Asian origin (India, Pakistan, Bangladesh, Sri Lanka) in the UK; and three national companies produce twisted tobacco for oral use primarily in Denmark. In Kyrgyzstan and Uzbekistan, nasway or nasvay is used, which is similar to the product known as nass or naswar in Iran, Pakistan, and surrounding countries. Snus and South-East Asian products have demonstrably different health risk profiles and negative health impacts.
- In Western Europe, the European Union (EU) has provided a regulatory framework for tobacco products. This framework is less rigorous for ST products compared to smoked tobacco products, particularly with respect to health warnings. Sale of moist snuff, or snus, is allowed in Sweden but prohibited in all other EU member countries, and snus is acquired illicitly in Finland, particularly by its Swedish-speaking minority. The prohibition of snus sales within the EU has repeatedly been challenged by the Swedish Match Company and by the Swedish Ministries of Trade and of Health and Social Affairs.
- The UK is home to the largest South Asian community within Europe. To varying degrees, members of these groups have brought their traditional ST use practices with them from their countries of origin, which have the highest global prevalence and negative health impacts.

- With the exception of Scandinavia, there is limited research available on the health effects of ST use in the region. Studies of long-term snus use in Sweden have yielded sometimes mixed results, but overall have shown elevated risk for cancer risk and cardiovascular mortality. Studies of communities of South-East Asian origin in the United Kingdom have shown high rates of oral cancers linked to tobacco use.
- The GothiaTek standard is a voluntary form of industry self-regulation of snus manufacturing and storage intended to reduce levels of carcinogens in the product. Because the GothiaTek standard was formally introduced by the Swedish tobacco industry in the late 1990s, the health effects of long-term exposure to modern snus manufactured under this standard are as yet largely unknown.

Chapter 11. Smokeless Tobacco Use in the Eastern Mediterranean Region

Key findings:

- Data on ST use are not available for most countries in this region.
- Where there is documented use of ST, adult prevalence varies widely across this region and between specific subgroups. Smokeless tobacco is widely consumed in a few countries, including Yemen,[34] Pakistan,[35–37] and Sudan (unpublished results, Sudan Toombak and Smoking Research Center, 2012). While ST use has been documented among women, prevalence is substantially higher among men than among women in the region.
- The most frequently used products in the region include toombak (Sudan), shammah (Yemen), paan (Pakistan), and nass (Pakistan and Iran). Specific toxicity and nicotine profiles are only available for nass and toombak. Toombak has been reported to have the highest levels of nicotine and TSNAs ever measured in tobacco products.
- Studies in several countries in the region have documented associations between precancerous abnormalities, oral cancers, and head and neck cancers and the use of toombak, shammah, nass, and paan.
- In this region the production and marketing of ST products are primarily cottage industries, centered in tobacco farming areas and relying on locally available resources. Some ST products originating in South-East Asia are marketed to the large immigrant Asian labor force in the Gulf region.
- Well-structured interventions to prevent ST use or promote cessation of ST use are lacking in the region. The price of ST products remains low, and countries have generally not made use of taxation as a tobacco control policy. In 2009 the government of Bahrain banned the importation of chewable tobacco products.

Chapter 12. Smokeless Tobacco Use in the African Region

Key findings:

- Prevalence of ST use varies across countries and across geographic areas within countries. For example, the national prevalence was as high as 28.3% for women in Mauritania and 22.6% for men in Madagascar, and as low as 0.2% for men in Zambia and 0.5% for women in Nigeria and Zimbabwe.[24,25] Data collected from a state in the northeastern geopolitical zone of Nigeria in 2007 indicated high rates among people aged 15 years and older—10.8% for men and 4% for women.[38] For some countries, however, prevalence data are lacking.
- Smokeless tobacco products are sniffed, chewed, sucked, or applied to teeth and gums. Except in a few countries where imported premade manufactured products are marketed, most products are produced by small cottage industries or are handmade for personal use. These products are typically sold by street vendors, kiosks, convenience stores, or tobacconists.
- Customs associated with ST use vary widely across different parts of the African Region. Data suggest that there is a widespread perception that snuff possesses medicinal properties, such as relief of headache, toothache, or sinus problems.
- Based on limited existing data, the toxicity and nicotine levels of ST products appear to vary widely. Generally, commercially manufactured products tend to have lower levels of tobacco-specific nitrosamines than custom-made products, although there are exceptions.
- Very little data exist on the health effects of ST in this region, although existing data for some parts of Africa suggest oral ST use is associated with increased risk for oral pathologies and increased blood pressure. Nasal snuff use is associated with increased risk for nasopharyngeal cancer and respiratory disease.
- In general, no organized public health education programs or cessation programs for ST exist in the African Region. Polices regarding ST use vary from a ban on the sale of ST in Tanzania (but with limited enforcement) to no regulations on the distribution and marketing of ST products in other countries. South Africa bans advertisement and promotion of ST and requires a warning label on manufactured products. Smokeless tobacco products tend to be cheaper than cigarettes throughout the region.

Chapter 13. Smokeless Tobacco Use in the South-East Asia Region

Key findings:

- Prevalence of ST use among men is high across most of the region, varying between 25% and 51% in five countries, but less than 2% in Thailand.[25] Among women, ST use is high in India (18.4%), Bangladesh (28%), and Myanmar (16%).[23,25] Prevalence is also high across the region, equivalent to cigarettes, among youth aged 13 to 15 years.[23]
- This region is home to over 250 million ST users aged 15 and older. Rural users in India and Bangladesh make up 80% of total ST users in the world.[39,40] Smoking remains more common than ST use in Indonesia, Thailand, Bangladesh, Sri Lanka, and Nepal, but ST use is predominant in India and Myanmar among men.

- In India, the most common forms of ST used are tobacco with lime (khaini), gutka, and betel quid. Betel quid is typically freshly prepared by the user or a vendor. Pan masala and gutka have become increasingly popular as alternatives to traditional betel quid; they are manufactured on an industrial scale and sold in dried form.
- High levels of TSNAs have been recorded in some products, including khaini and zarda. Areca nut used as an ingredient in betel quid contains additional harmful constituents. The fact that some products are produced and sold in cottage industries complicates efforts to characterize typical products in the region.
- Incidence of oral and pharyngeal cancers is high in South-East Asia Region countries compared to most of the rest of the world, and this high rate has been attributed in large part to ST and areca nut use. Historically, only 10% to 15% of people with oral cancer in India are diagnosed when their cancers are in an early, localized stage, which results in poor survival rates.[41]
- Most of the epidemiologic studies of specific health effects of ST use in the region come from India. Studies have documented associations between ST use and oral precancerous lesions, oral cancers, adverse reproductive outcomes, and cardiovascular diseases.
- A number of intervention programs—including school-based interventions, community interventions, and mass media campaigns, primarily in India—have been evaluated and shown to have some impact in the region. However, resources and capacity for large-scale intervention programs are limited in some countries.
- All member states in the region except Indonesia have ratified the FCTC. However, implementation of ST control policies in the region has been limited. In contrast to cigarettes, taxes on ST products are low or nonexistent. Unprocessed tobacco sold in loose form, including betel quid with tobacco, is often not taxed and does not display any package warning labels. Some countries have prohibited advertising of ST, including Bhutan, India, Maldives, Myanmar, Sri Lanka, and Thailand. Bhutan has banned the sale of all forms of tobacco, and several states in India have used national food safety regulations to ban gutka.

Chapter 14. Smokeless Tobacco Use in the Western Pacific Region

Key findings:

- Prevalence data on ST use in this region are scant. Of the few countries that have ST use data, the rates vary from 22.4% among men aged 25–64 years in Micronesia, to 0.3% among males older than 15 years in Vietnam.[23,25] In some countries (Cambodia, Malaysia, and Vietnam), the rates of ST use are higher in females than males.[23,25]
- Forms of ST use involve areca nut/betel quid with or without tobacco, although in some countries tobacco is not traditionally added to areca nut/betel quid.
- Areca nut contains an alkaloid, arecoline, which is carcinogenic. The lack of data on health effects and toxicity of using areca nut with tobacco represents a significant data gap for this region. Potential health consequences include oral pathologies (leukoplakia and oral submucous fibrosis), head and neck cancer, and low birth weight in infants of mothers who used ST products during pregnancy.

- Current policies and interventions vary across countries in this region. Some countries have instituted bans on ST (Australia, New Zealand), bans on ST manufacturing (Taiwan), or bans on ST importation (Japan, Hong Kong, Singapore, Taiwan). However, these bans may not affect the use of areca nut/betel quit with tobacco, which sometimes is obtained from cigarettes. In addition, some of these bans remain weak because they do not prohibit importation of ST products for personal consumption.
- Some of the challenges associated with policy implementation include the notion that chewing areca nut/betel quid is symbolic of cultural identity, the belief that it has medicinal properties, and the lack of awareness of its harmful effects. Educational efforts on ST will require also addressing areca nut/betel quid, because use of these two substances is closely linked with ST use.

Chapter 15. Global Smokeless Tobacco Use: Future Research Needs and Policy Recommendations

Chapter 15 summarizes the major conclusions of this report, discusses gaps in ST research, and describes needed policy changes.

Key findings:

- A wide range of research gaps remain in relation to understanding and addressing the global public health impact of ST products. Research needs include ongoing surveillance of patterns of use across product types, further characterization of diverse ST products and their constituents, assessment of the health consequences of using different products in different regions, evaluation of the economic impact of ST use and the impact of taxation policies across regions, as well as assessment of cost-effective, region-specific ST education, prevention, and treatment interventions.
- Implementation of effective strategies for control of ST use and related health effects will require increased scientific and public health capacity, particularly in low- and middle-income countries affected by high burdens of ST use. International collaboration and shared capacity building could be applied to: (a) create regional but globally accessible information clearinghouses for ST; (b) strengthen infrastructure for networking, communication, and collaboration; and (c) develop ways to build research capacity by leveraging existing resources. Collaborations are needed across disciplines and professions, such as between scientists, policymakers, and tobacco control advocates.
- Prevention and cessation of ST use should be fundamental to every comprehensive tobacco control effort. In all regions, greater awareness is needed about ST use and its health effects, including education of health professionals, consumers, policymakers, and community leaders. Effective interventions tailored specifically to ST users should be developed, evaluated, and implemented where appropriate.

- Specific guidelines are needed to ensure that the WHO FCTC requirements can be and are appropriately applied to ST products as well as cigarettes. Such guidance must also take into account the diversity of product types, patterns of use, and local contexts that are found around the world.
- A range of policies have been proposed or implemented for ST products in some countries, but data are often lacking on their impact or effectiveness. Greater attention should be directed toward strengthening the use of evidence-based policies for controlling ST use. These policies could include: requiring tobacco industries to disclose the contents of ST products; establishing performance standards for toxicants and maximum pH levels; banning flavorants; establishing effective and relevant health warning labels; increasing taxes on ST products; banning or restricting ST promotions, sponsorship, or marketing; and raising public awareness of the toxicity and health effects of ST products.

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Chapter 2

Global Prevalence of Smokeless Tobacco Use Among Youth and Adults

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Introduction

Smokeless tobacco (ST) is used in a wide variety of forms in many countries of the world. Used orally, tobacco can be chewed, sucked, applied to the teeth or gums (e.g., topical toothpaste or powder), dissolved in the mouth, gargled, or inserted in betel quid. It can also be applied directly to the skin. These products may be intentionally swallowed or the juices alone may be swallowed. Nasal use consists of inhaling a mixture of a small quantity of very fine tobacco powder and aromatic substances, called dry snuff.[1]

Oral use of ST is widely prevalent in South-East Asia.[2] Orally, ST may be used alone or in combination with products such as areca nut, ash, and slaked lime. In India, the most common ST products taken orally are betel quid with tobacco (a combination of betel leaf, areca nut, and slaked lime [calcium hydroxide]), khaini (sun-dried or fermented, coarsely crushed tobacco leaves), gutka (sun-dried finely chopped tobacco, areca nut, slaked lime, catechu, flavorings, and sweeteners), and products that are applied to teeth and gums such as gul (powdered tobacco, molasses, and other ingredients) and mishri (roasted, powdered tobacco).[3] In Bangladesh, the most prevalent forms of ST are betel quid with tobacco, gul, khoini (similar to khaini in India), and sada pata (powdered or dried tobacco leaves).[4] In Myanmar, oral or nasal snuff, chewing tobacco, and betel quid are most common.[5] All three of these countries have high rates of consumption of oral products.

In Europe and North America, chewing tobacco and snuff are the two major oral ST products. In North America, moist snuff is the most widely used product. In Scandinavia, Swedish snus, a particular type of moist snuff product, dominates.[1] Since the mid-1990s, ST use has increased in Scandinavia and the United States,[6–9] particularly among teenagers and young adults. Smokeless tobacco is also widely used in parts of Central and South-East Asia.[10] Nass (also called naswar or niswar), a form of oral tobacco, is common in some countries of Central Asia,[11] whereas nasal snuff is used among some specific populations in Nigeria,[12] South Africa,[13] and other African nations.

This chapter attempts to delineate the magnitude of the problem of ST use among youth and adults globally by drawing on national or subnational data available for various countries. The chapter describes usage patterns taken from the available literature to delineate the burden of ST use and to characterize the prevalence of use among youth and adults in countries where usage rates are high.

Sources of Data

In this chapter, most of the estimates of ST use among youth come from a single survey, the school-based Global Youth Tobacco Survey (GYTS), conducted during 2007−2010. This chapter also draws on the Youth Smoking Survey (YSS) (2008−2009) for Canada and the 2009 National Youth Tobacco Survey (NYTS) for the United States. (Information about these surveys and surveys of adults is shown in Table 2-1.) To report prevalence of ST use among adults, data from the Global Adult Tobacco Survey (GATS), conducted in 13 low- and middle-income countries during 2008−2010, were used. In countries where GATS was not implemented—mostly in Africa, Latin America, and Asia—national-level data from the 2005–2010 Demographic and Health Surveys (DHS) of adults were used. In addition, this chapter presents data from the following surveys in individual countries: for Australia, the 2004 National Drug Strategy Household Survey (NDSHS); for Canada, the 2010 Canadian Tobacco Use Monitoring Survey (CTUMS); and for the United States, the 2012 National Survey on Drug Use and Health (NSDUH). These surveys are designed to be nationally representative for the countries in which they are implemented, but there may be differences across surveys in how smokeless tobacco use is measured (Table 2-1). Therefore, caution should be exercised in making comparisons among the different survey estimates.

The World Health Organization (WHO) *Report on the Global Tobacco Epidemic, 2011* was referred to for estimates on ST use from the WHO STEPwise Approach to Surveillance (WHO STEPS) survey and other national or subnational surveys in various countries (referred to in this report as individual country surveys, or ICS). Brief descriptions of the methodologies of these surveys are given below; they are described in detail elsewhere.[6,14–22] Data on ST are available for some additional countries but were not reported in this chapter due to major differences in comparability resulting from the methodology of surveys.

Table 2-1. Data sources on prevalence of smokeless tobacco use and related indicators among youth and adults

Survey/year	Type of survey	Method of administration	Sample characteristics	List of countries	No. of countries	Questions asked on smokeless tobacco use
Youth						
Global Youth Tobacco Survey (GYTS), 2007–2010	Cross-sectional, nationally representative, or subnational	Self-administered	School-going children aged 13–15	Albania, 2009; Argentina, 2007; Bahamas, 2009; Bangladesh, 2007; Barbados, 2007; Botswana, 2008; Brazil, 2009; Bhutan, 2009; Burkina Faso, 2009; Cameroon, 2008; Central Africa, 2008; Congo, 2009; Cook Island, 2008; Côte d'Ivoire, 2009; Croatia, 2007; Democratic Republic of the Congo, 2008; Djibouti, 2009; Dominica, 2009; El Salvador, 2009; Estonia, 2007; Gambia, 2008; Grenada, 2009; Guyana, 2010; Hungary, 2008; India, 2009; Indonesia, 2009; Iran, 2007; Iraq, 2008; Jamaica, 2010; Kyrgyzstan, 2008; Lebanon, 2008; Lesotho, 2008; Liberia, 2008; Libya, 2010; Macau, 2010; Macedonia, 2008; Madagascar, 2008; Malawi, 2009; Malaysia, 2009; Mexico, 2008; Moldova, 2008; Montenegro, 2008;	73	During the past 30 days (one month), did you use any form of smokeless tobacco products (e.g., chewing tobacco, snuff, dip)? (or) During the past 30 days (one month), on how many days did you use smokeless tobacco? (or) During the past 30 days (one month), how often have you used chew, snuff, or dip? (or) How often in the past month did you chew tobacco, use snuff or dip? (or) During the past 30 days (one month), on how many days did you try chewing tobacco? (or) During the past 30 days (one month), on how many days did you use chewing or applying or snuff tobacco? (or) During the past 30 days (one month) did you use any form of smokeless tobacco products (e.g., chewing tobacco, chewing betel with tobacco)? (or) During the past 30 days (one month), did you use any form of smokeless tobacco (chewing or applying or snuff) even once or twice? (or) During the last 30 days (1 month), have you ever used any form of tobacco products

Survey/year	Type of survey	Method of administration	Sample characteristics	List of countries	No. of countries	Questions asked on smokeless tobacco use
				Myanmar, 2007; Namibia, 2008; Nepal, 2007; Oman, 2010; Pakistan, 2008; Palestine, 2008; Panama, 2008; Peru, 2007; Poland, 2009; Qatar, 2007; Rwanda, 2008; South Korea, 2008; Saudi Arabia, 2010; Serbia, 2008; Seychelles, 2007; Sierra Leone, 2008; Slovenia, 2007; Sri Lanka, 2007; Srpska, 2008; Swaziland, 2009; Syrian Arab Republic, 2010; Tanzania, 2008; Thailand, 2009; Togo, 2007; Trinidad and Tobago, 2007; Tunisia, 2010; Uganda, 2007; Venezuela, 2010; Yemen, 2008; Zambia, 2007; Zimbabwe, 2008		other than cigarettes (such as chewing, snuff or quid tobacco)?
Youth Smoking Survey (YSS), Canada, 2008–2009	Cross-sectional, nationally representative	Classroom-based, self-administered, 30-minute questionnaire	School-aged children in grades 6–12 in most provinces; this volume reports data only from grades 6–9.	Canada, 2008–2009	1	In the last 30 days, did you use any of the following: smokeless tobacco (chewing tobacco, pinch, snuff, or snus)?

Survey/year	Type of survey	Method of administration	Sample characteristics	List of countries	No. of countries	Questions asked on smokeless tobacco use
National Youth Tobacco Survey (NYTS), United States, 2009	Cross-sectional, nationally representative	Self-administered survey via pencil and paper	Middle school students in grades 6–8 and high school students in grades 9–12; this volume reports data from grades 6–8 only.	United States, 2009	1	During the past 30 days, on how many days did you use chewing tobacco, snuff, or dip?
Adults						
Global Adult Tobacco Survey (GATS), 2008–2010	Cross-sectional, nationally representative	Face-to-face personal interviews	All adults aged 15 years and over	Bangladesh, 2010; Brazil, 2009–10; China, 2009; Egypt, 2009; India, 2009–10; Mexico, 2009; Philippines, 2009; Poland, 2010; Russian Federation, 2009; Thailand, 2009; Ukraine, 2008; Uruguay, 2009; Vietnam, 2009	13	Do you currently use smokeless tobacco on a daily basis, less than daily, or not at all? On an average, how many times a day do you use the following products: betel quid with tobacco, gul, khoinee, gutka, khaini, pan masala with tobacco, etc.?

Survey/year	Type of survey	Method of administration	Sample characteristics	List of countries	No. of countries	Questions asked on smokeless tobacco use
Demographic and Health Surveys (DHS), 2005–2010	Cross-sectional, nationally representative	Face-to-face interviews	Males aged 15–49 years (in some countries, 15–54 or 15–59) and females aged 15–49 years	Armenia, 2005; Azerbaijan, 2006; Dominican Republic, 2007; Ethiopia, 2005; Ghana, 2008; Haiti, 2005–06; Kenya, 2008–09; Lesotho, 2009; Liberia, 2007; Madagascar, 2008–09; Maldives, 2009; Moldova, 2005; Namibia, 2006–07; Nigeria, 2008; Sierra Leone, 2008; Timor-Leste, 2009–10; Uganda, 2006; Zambia, 2007; Zimbabwe, 2005–06	19	Do you currently smoke or use any other type of tobacco? What (other) type of tobacco do you currently smoke or use?
World Health Organization STEPwise Approach to Surveillance (WHO STEPS), 2002–2010	Cross-sectional, nationally representative, or subnational	Face-to-face interviews	All adults aged 15–64, or 25–64, or 25–74, or 25 years and above	Barbados, 2007; Benin, 2008; Bhutan, 2007; Gambia, 2010; Georgia, 2010; Guinea, 2009; Libya, 2009; Malawi, 2009; Mali, 2007; Mauritania, 2006; Micronesia (Federated States of), 2002; Mongolia, 2009; Myanmar, 2009; Saint Kitts and Nevis, 2007; Sao Tome and Principe, 2009; Saudi Arabia, 2004; Sri Lanka, 2006; Swaziland, 2007	18	Do you currently use any smokeless tobacco such as [snuff, chewing tobacco, betel]? Do you currently use smokeless tobacco products daily?

Survey/year	Type of survey	Method of administration	Sample characteristics	List of countries	No. of countries	Questions asked on smokeless tobacco use
Individual country surveys (ICS) (various years; from *WHO Report on the Global Tobacco Epidemic, 2011*)	Cross-sectional, nationally representative	Face-to-face interviews	All adults aged 25–64, or 15–64, or 15 years and above	Algeria, 2010; Cambodia, 2010; Cape Verde, 2007; Chad, 2008; Denmark, 2010; Finland, 2009; Iceland, 2008; Kyrgyzstan, 2005; Latvia, 2008; Malaysia, 2006; Nepal, 2008; Norway, 2009; South Africa, 2003; Sweden, 2010; Switzerland, 2009; Tunisia, 2005–06; Uzbekistan, 2006; Yemen, 2003	18	Not available
National Drug Strategy Household Survey (NDSHS), Australia, 2004	Cross-sectional, nationally representative	Telephone survey	All people aged 12 years and older	Australia, 2004	1	Which, if any, of the following tobacco products have you ever used, and which have you used in the last 12 months? (Chewing tobacco, snuff/snus, hookah/nargila)
Canadian Tobacco Use Monitoring Survey (CTUMS), 2010	Cross-sectional, nationally representative	Telephone survey	All adults aged 15 years and over	Canada, 2010	1	Current use of any chewing tobacco, pinch, or snuff in the last 30 days?
National Survey on Drug Use and Health (NSDUH), United States, 2012	Cross-sectional, nationally representative	Face-to-face interviews	All people 18 years of age and over; for adults	United States, 2012	1	Now think about the past 30 days -- that is, from [fill in date] up to and including today. During the past 30 days, have you used chewing tobacco, even once? Which of these two brands [sic] did you use most often during the past 30 days? (Chewing tobacco, snuff)

Youth Data

Global Youth Tobacco Survey, 2007–2010

The Global Youth Tobacco Survey (GYTS) is a school-based survey designed to provide primarily cross-sectional, nationally representative estimates on tobacco use among youth, along with key tobacco control measures. The survey collects information on schoolchildren aged 13 to 15 years; however, in some countries the average level of education is below this age bracket so the data may not always be representative of all youth. In the GYTS, the area covered can be a country, a province, a city, or any other geographic entity. The methodology of the GYTS is standardized with respect to sample design, questionnaires, field procedures, and processing of data and analysis.[14] Questions are included on tobacco use, knowledge and attitudes regarding tobacco, exposure to secondhand smoke, exposure to pro-tobacco and anti-tobacco media messages and advertising, interest in cessation, access to tobacco products, and having been taught in school about the harmful effects of tobacco use. As of 2012, the GYTS is active in more than 180 countries and has yielded data on ST use in 73 countries. The GYTS was this chapter's primary source of data on the prevalence of ST use among youth, providing national estimates for 55 countries and 46 subnational estimates for 18 countries.

Youth Smoking Survey, 2008–2009

The Youth Smoking Survey (YSS)[15] provides timely and accurate monitoring of tobacco use by Canadian school-aged children; its main objective is to collect data that will serve as a basis for sound, effective tobacco control policies and programs. The YSS is a classroom-based survey of a representative sample of schools in the 10 Canadian provinces, which reports current information on tobacco use behavior as well as correlates of smoking behavior and other policy-related initiatives for Canadian youth. Students in grades 6−12 are surveyed. (In the province of Quebec, students in primary/elementary grades 5 and 6 or secondary school grades 1–3 [U.S. school grades 7–9] are surveyed.) This report presents data on Canadian children only in grades 6–9.

National Youth Tobacco Survey, 2009

The National Youth Tobacco Survey (NYTS)[16] provides estimates of the prevalence of tobacco use among a nationally representative sample of U.S. students in middle school (grades 6–8) and high school (grades 9–12). The survey obtains data on the use of various tobacco products (cigarettes, cigars, ST, tobacco pipes, bidis, and kreteks); exposure to secondhand smoke; smoking cessation; school curriculum on tobacco prevention; minors' ability to purchase or obtain tobacco products; and knowledge and attitudes about tobacco and familiarity with pro-tobacco and anti-tobacco media messages. The NYTS provides data on tobacco use among students in grades 6–12, but this volume reports data for grades 6–8 only.

Adult Data

Global Adult Tobacco Survey, 2008−2010

The Global Adult Tobacco Survey (GATS)[17,18,23] is the global standard for systematically monitoring tobacco use (smoking and smokeless) among adults and tracking key indicators of tobacco control. The GATS is a nationally representative face-to-face household survey of people aged 15 years and older (termed "adults" for this report). Using a globally standardized methodology, the survey elicits information on respondents' background characteristics, tobacco use (smoking and smokeless), cessation, exposure to secondhand smoke, economic status, awareness of media related to smokeless tobacco, knowledge about tobacco, and attitudes toward and perceptions about tobacco use. In its first phase, the GATS was conducted in 14 low- and middle-income countries, which accounted for more than 60% of the world population during 2008−2010.The survey was designed to provide estimates at the national level and by residence (urban or rural) and gender. Survey information was collected using handheld devices. This chapter reports GATS data on ST use from 13 countries (one country, Turkey, did not include questions on ST use).

Demographic and Health Surveys, 2005−2010

The Demographic and Health Surveys (DHS)[24] are nationally representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. Most DHS surveys also provide information on tobacco use behavior. The DHS surveys include a questionnaire for households, a questionnaire for women, and one for men. The household questionnaire is used to identify all usual household members and visitors in the selected households and to determine the members' eligibility for the individual women's and men's surveys. For almost all of the countries, the estimates of tobacco use presented in this report are based on data collected from the individual women's and men's questionnaires. This chapter presents data on ST use from 19 countries that conducted DHS surveys between 2005 and 2010, representing both males and females aged 15–49 years. (In some countries, however, estimates on males were provided for ages 15–54 or 15–59 years.) In countries where multiple DHS surveys have been conducted, the most recent data were used in order to ensure the most up-to-date estimates of tobacco use.

WHO STEPwise Approach to Surveillance, 2002–2010

The WHO STEPS assessments of risk factors for chronic disease provide an entry point for low- and middle-income countries to undertake public health surveillance.[19] The WHO STEPS instrument covers three levels of "steps" for assessing risk factors: questionnaires, physical measurements, and biochemical measurements. The target population is, at minimum, all adults aged 25–64 years residing in the survey area; this age range may be expanded to include additional age groups if desired. WHO STEPS survey data reported in the *WHO Report on the Global Tobacco Epidemic, 2011*[6] were used here for reporting the prevalence of adult use of ST in 18 countries (13 national and 5 subnational estimates).

WHO Report on the Global Tobacco Epidemic, 2011

The *WHO Report on the Global Tobacco Epidemic, 2011,*[6] known as the GTCR, provided information on ST use among adults. This information was compiled from various surveys (national or subnational), with GATS (13 countries) and WHO STEPS (17 countries) being the predominant sources. This chapter reports data on adult ST use taken from 18 additional surveys presented in the GTCR (16 national and 2 subnational estimates), including the National Health and Morbidity Survey in Malaysia, Cambodia's National Adult Tobacco Survey, the Family Health Survey in Yemen, Sweden's National Survey on Public Health, the National Epidemiological Study of Tobacco Use Prevalence in Kyrgyzstan, and the Monitoring of Danish Smoking Habits in Denmark.

National Drug Strategy Household Survey, 2004

Data from the 2004 National Drug Strategy Household Survey (NDSHS),[20] conducted by the Australian Institute of Health and Welfare, were used to report the prevalence of ST use in Australia. The NDSHS surveyed almost 30,000 Australians about their tobacco use, including any lifetime use and use of snuff and chewing tobacco within the last 12 months. The survey methodology has been reported in detail by the Australian Institute of Health and Welfare.[20]

Canadian Tobacco Use Monitoring Survey, 2010

The 2010 Canadian Tobacco Use Monitoring Survey (CTUMS)[21] was developed to provide Health Canada, a national health agency located in Ottawa, and its partners with timely, reliable, and continuous data on tobacco use and related issues. The CTUMS is a telephone survey of all people aged 15 years and above living in Canada, the primary objective of which is to track changes in smoking status and amount smoked, especially for 15- to 24-year-olds, who are most at risk for taking up smoking.

National Survey on Drug Use and Health, 2012

The National Survey on Drug Use and Health (NSDUH)[22] provides information on the use of illegal drugs, alcohol, and tobacco by the U.S. civilian, non-institutionalized population aged 18 years and older. Conducted by the U.S. federal government since 1971, the survey collects data by administering questionnaires to a representative sample of the population through face-to-face interviews at respondents' homes. The 2012 NSDUH employed a state-based design to provide estimates for each of the 50 states and the District of Columbia.

Smokeless Tobacco Use Prevalence

Current ST use is the primary indicator used in this report for most countries, with the exception of data on adults in Canada and South Africa, where ever use of ST is reported, and data on Iceland and Saudi Arabia, where prevalence of daily use of ST is reported. For this chapter, *current users* of ST are defined as people who used any ST product either daily or occasionally in the 30 days preceding the survey. *Ever users* of ST are those who have tried ST at least once in their lifetimes, and *daily users* are those who use ST products on a daily basis. Table 2-1 displays the questions that define ST use in each survey system for youth and adults.

As of 2013, WHO includes 194 member states. This chapter reports the prevalence of ST use among youth in 75 countries and adults in 70 countries. Prevalence data are reported by WHO regions.

In only 16 countries were overall estimates—that is, for male and female respondents combined—available for both youth and adults (the "Total" column in Tables 2-2 and 2-4). For the remaining countries, estimates were only available either for adults or youth, but not for both. For countries with national estimates, ST use was considered high if the prevalence in a country exceeded 10%, medium if the prevalence was between 5% and 10%, low if the prevalence was between 1% and 5%, and very low if the prevalence was below 1%. Using these categories, Maps 2-1–2-3 show the prevalence of ST use among youth, and Maps 2-4–2-6 show prevalence among adults in countries around the world.

Smokeless Tobacco Use Among Youth

Table 2-2 provides nationally representative prevalence data by gender. Table 2-3 displays subnational data within various countries, also by gender. These estimates were taken from different sources that together spanned the years 2007–2010. Of the countries with national youth estimates, 11 were in the African Region, 9 in the Eastern Mediterranean Region, 11 in the European Region, 14 in the Americas Region, 8 in the South-East Asia Region, and 4 in the Western Pacific Region.

Of the 75 countries for which youth ST use prevalence was reported (Table 2-2), national-level estimates were available for 57 countries, and a total of 46 subnational estimates were reported for 18 countries. Among the 57 national estimates, the prevalence of current use of ST ranged from 16.4% in Congo to 1.1% in Montenegro (Figure 2-1). For boys, national prevalence was highest at 18.3% in Congo and lowest at 1.1% in Montenegro (Figure 2-2); for girls, prevalence ranged from 15.8% in Namibia to 0.7% in Serbia (Figure 2-3). Total ST use prevalence was high (greater than 10%) in 5 countries (Botswana, Djibouti, Lesotho, Namibia, and Congo). The prevalence exceeded 10% among boys in 12 countries and among girls in 4 countries (Table 2-2).

In the 18 countries where subnational estimates were reported (Table 2-3), the prevalence among youth ranged from 22.7% in rural western Sierra Leone to 1.4% in the Mazovia province of Poland. Among boys, use ranged from 21.9% in Bangui in the Central Africa Republic to 1.3% in Warsaw, Poland. Among girls, the prevalence of use ranged from 24.5% in rural western Sierra Leone to 1.0% in the Mazovia province in Poland.

Table 2-2 indicates that, among countries assessed in the African Region, overall prevalence ranged from 16.4% in Congo to 5.4% in Swaziland. Among countries assessed in the Eastern Mediterranean Region, overall prevalence ranged from 12.6% in Djibouti to 1.6% in Oman. In the European Region, the highest prevalence was reported in Estonia (6.9%) and the lowest in Montenegro (1.1%). In the Americas Region, the highest prevalence was in Barbados (9.8%) and the lowest in Canada (1.8%). In the South-East Asia Region, prevalence was highest in Bhutan (9.4%) and lowest in Indonesia (2.8%). In the Western Pacific Region, Cook Island had the highest prevalence (8.7%) and Macau the lowest (2.1%) (Table 2-2).

Map 2-1. Prevalence (%) of current use of smokeless tobacco—boys

Note: Prevalence shown for countries with national-level data.
Sources: Global Youth Tobacco Survey, 2007–2010 (25); National Youth Tobacco Survey, United States, 2009 (16); Youth Smoking Survey, Canada, 2008–2009 (15).

Map 2-2. Prevalence (%) of current use of smokeless tobacco—girls

Note: Prevalence shown for countries with national-level data.
Sources: Global Youth Tobacco Survey, 2007–2010 (25); National Youth Tobacco Survey, United States, 2009 (16); Youth Smoking Survey, Canada, 2008–2009 (15).

Map 2-3. Prevalence (%) of current use of smokeless tobacco—boys and girls

Note: Prevalence shown for countries with national-level data.
Sources: Global Youth Tobacco Survey, 2007–2010 (25); National Youth Tobacco Survey, United States, 2009 (16); Youth Smoking Survey, Canada, 2008–2009 (15).

Map 2-4. Prevalence (%) of current use of smokeless tobacco—men

Notes: Prevalence shown for countries with national-level data. Ever use of smokeless tobacco was reported in South Africa. Daily use of smokeless tobacco was reported in Iceland and Saudi Arabia.
Sources: Global Adult Tobacco Survey, 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2012 (22); Individual country surveys from: *WHO Report on the Global Tobacco* Epidemic, *2011* (6).

Map 2-5. Prevalence (%) of current use of smokeless tobacco—women

Notes: Prevalence shown for countries with national-level data. Ever use of smokeless tobacco was reported in South Africa. Daily use of smokeless tobacco was reported in Saudi Arabia.
Sources: Global Adult Tobacco Survey, 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2012 (22); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Map 2-6. Prevalence (%) of current use of smokeless tobacco—men and women

Notes: Prevalence shown for countries with national-level data. A rate for males and females combined was not available for Ethiopia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Namibia, Nigeria, Sierra Leone, South Africa, Uganda, Zambia, Zimbabwe, Saudi Arabia, Armenia, Azerbaijan, Finland, Moldova, Dominican Republic, Haiti, Maldives, Timor-Leste. For each of these countries, a total figure was calculated by averaging the available male and female rates. Daily use of smokeless tobacco was reported in Iceland.

Sources: Global Adult Tobacco Survey (GATS), 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2012 (22); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Table 2-2. Prevalence (national level, %) of current use of any form of smokeless tobacco among boys and girls, by World Health Organization region, 2007–2010

Region*	Country/year	Source†	Age group (years)	Prevalence (%)		
				Total	Boys	Girls
AFR	Botswana, 2008	GYTS	13–15	11.3	11.3	11.4
	Congo, 2009	GYTS	13–15	16.4	18.3	14.1
	Côte d'Ivoire, 2009	GYTS	13–15	5.6	6.2	4.9
	Lesotho, 2008	GYTS	13–15	14.4	14.7	13.6
	Madagascar, 2008	GYTS	13–15	5.7	6.2	5.4
	Namibia, 2008	GYTS	13–15	16.0	15.6	15.8
	Rwanda, 2008	GYTS	13–15	7.4	8.3	6.0
	Seychelles, 2007	GYTS	13–15	5.5	5.2	5.4
	Swaziland, 2009	GYTS	13–15	5.4	6.0	5.0
	Togo, 2007	GYTS	13–15	6.2	6.9	4.8
	Uganda, 2007	GYTS	13–15	9.4	8.6	9.6
EMR	Djibouti, 2009	GYTS	13–15	12.6	15.2	9.0
	Iran, 2007	GYTS	13–15	5.1	5.4	4.8
	Libya, 2010	GYTS	13–15	2.3	2.0	2.3
	Oman, 2010	GYTS	13–15	1.6	2.5	0.9
	Qatar, 2007	GYTS	13–15	7.0	7.6	6.1
	Saudi Arabia, 2010	GYTS	13–15	3.4	4.8	1.8
	Syrian Arab Republic, 2010	GYTS	13–15	5.7	7.9	3.5
	Tunisia, 2010	GYTS	13–15	2.3	3.9	0.9
	Yemen, 2008	GYTS	13–15	8.6	8.2	8.4
EUR	Albania, 2009	GYTS	13–15	2.0	2.3	1.7
	Croatia, 2007	GYTS	13–15	1.9	2.7	1.1
	Estonia, 2007	GYTS	13–15	6.9	9.4	4.5
	Hungary, 2008	GYTS	13–15	1.7	2.1	0.9
	Kyrgyzstan, 2008	GYTS	13–15	2.5	3.3	1.8
	Macedonia, 2008	GYTS	13–15	3.0	3.2	2.8
	Moldova, 2008	GYTS	13–15	3.8	5.2	2.6
	Montenegro, 2008	GYTS	13–15	1.1	1.1	0.9
	Serbia, 2008	GYTS	13–15	1.2	1.6	0.7
	Slovenia, 2007	GYTS	13–15	2.2	2.0	1.8
	Srpska, 2008	GYTS	13–15	1.4	1.8	1.1

Region*	Country/year	Source†	Age group (years)	Prevalence (%)		
				Total	Boys	Girls
AMR	Argentina, 2007	GYTS	13–15	4.3	5.5	3.2
	Bahamas, 2009	GYTS	13–15	6.6	7.5	5.5
	Barbados, 2007	GYTS	13–15	9.8	11.5	8.2
	Canada, 2009	YSS	Grades 6–9	1.8	2.6	0.8
	Dominica, 2009	GYTS	13–15	8.4	10.2	6.4
	El Salvador, 2009	GYTS	13–15	3.7	4.5	2.8
	Grenada, 2009	GYTS	13–15	8.4	10.1	6.9
	Guyana, 2010	GYTS	13–15	7.5	7.9	6.6
	Jamaica, 2010	GYTS	13–15	8.5	8.5	8.5
	Panama, 2008	GYTS	13–15	3.5	3.8	3.2
	Peru, 2007	GYTS	13–15	4.7	4.3	4.8
	Trinidad and Tobago, 2007	GYTS	13–15	5.5	5.4	5.5
	United States, 2009	NYTS	Grades 6–8	2.6	4.1	1.2
	Venezuela, 2010	GYTS	13–15	5.1	6.9	2.6
SEAR	Bangladesh, 2007	GYTS	13–15	4.9	5.8	4.2
	Bhutan, 2009	GYTS	13–15	9.4	14.1	5.3
	India, 2009	GYTS	13–15	9.0	11.1	6.0
	Indonesia, 2009	GYTS	13–16	2.8	3.3	2.3
	Myanmar, 2007	GYTS	13–15	6.5	10.3	2.7
	Nepal, 2007	GYTS	13–15	6.1	8.8	2.9
	Sri Lanka, 2007	GYTS	13–15	6.8	9.6	3.9
	Thailand, 2009	GYTS	13–15	5.7	7.3	4.1
WPR	Cook Island, 2008	GYTS	13–15	8.7	10.5	7.3
	Macau, 2010	GYTS	13–15	2.1	2.2	2.1
	Malaysia, 2009	GYTS	13–15	4.0	4.5	3.2
	South Korea, 2008	GYTS	13–15	6.2	7.2	5.0

*Regions: AFR = African Region; EMR = Eastern Mediterranean Region; EUR = European Region; AMR = Region of the Americas; SEAR = South-East Asia Region; WPR = Western Pacific Region.
†GYTS = Global Youth Tobacco Survey, 2007–2010 (25); NYTS = National Youth Tobacco Survey, United States, 2009 (16); YSS = Youth Smoking Survey, Canada, 2008–2009 (15).

Table 2-3. Prevalence (subnational level, %) of current use of any form of smokeless tobacco among youth, by World Health Organization region, GYTS, 2007–2009

Region*	Country/year	Location	Age group (years)	Prevalence (%) Total	Boys	Girls
AFR	Burkina Faso, 2009	Bobo Dioulasso	13–15	13.2	12.1	14.0
		Ouagadougou	13–15	10.2	11.2	9.2
	Cameroon, 2008	Yaounde	13–15	5.1	5.4	4.4
		Outside Yaounde	13–15	10.9	12.0	9.4
	Central African Republic, 2008	Bangui	13–15	15.4	21.9	8.0
	Democratic Republic of the Congo, 2008	Kinshasa	13–15	20.8	20.6	20.1
		Lubumbashi	13–15	17.8	18.3	16.4
	Gambia, 2008	Banjul	13–15	21.9	20.1	23.3
	Liberia, 2008	Monrovia	13–15	8.3	9.0	6.6
	Malawi, 2009	Lilongwe	13–15	11.0	10.3	11.7
		Rest of country	13–15	8.9	11.3	6.7
	Sierra Leone, 2008	West urban	13–15	17.3	13.6	18.8
		West rural	13–15	22.7	18.9	24.5
	Tanzania, 2008	Arusha	13–15	6.2	6.9	5.5
		Dar es Salaam	13–15	4.6	4.6	4.3
		Kilimanjaro	13–15	5.7	5.6	5.7
	Zambia, 2007	Lusaka	13–15	15.6	15.9	15.4
		Kafue	13–15	16.7	17.0	16.5
		Chongwe and Luangwa	13–15	14.1	15.3	13.2
	Zimbabwe, 2008	Bulawayo	13–15	5.4	7.5	3.5
		Harare	13–15	5.7	6.4	5.0
		Manicarland	13–15	7.6	8.3	6.3
EMR	Iraq, 2008	Baghdad	13–15	6.9	7.2	5.8
	Lebanon, 2008	UNRWA	13–15	6.5	6.5	6.4
	Pakistan, 2008	Karachi	13–15	10.8	13.8	7.4
		Quetta	13–15	7.5	6.8	7.9
		Lahore	13–15	4.2	5.8	3.1
		Peshawar	13–15	6.0	8.0	2.6
	Palestine, 2008	UNRWA Gaza	13–15	8.9	9.2	8.3
		UNRWA West Bank	13–15	9.1	7.7	9.2

Region*	Country/year	Location	Age group (years)	Prevalence (%) Total	Boys	Girls
EUR	Poland, 2009	Warsaw	13–15	1.8	1.3	2.2
		Mazovia Province	13–15	1.4	1.5	1.0
AMR	Brazil, 2009	Campo Grande	13–15	8.2	9.1	7.5
		Vitoria	13–15	3.6	5.0	2.4
		São Paulo	13–15	5.5	6.3	4.6
	Mexico, 2008	Pachuca	13–15	5.3	6.6	4.1
		Tlaxcala	13–15	5.3	7.9	3.0
		Saltillo	13–15	4.5	4.9	3.9
		Campeche	13–15	6.3	5.1	7.2
		Villahermosa	13–15	5.0	5.8	4.4
		Aguascalientes	13–15	2.8	3.3	2.2
		Colima	13–15	8.4	8.7	8.0
		Morelia	13–15	4.4	5.6	3.3
		Queretaro	13–15	4.1	4.6	3.5
		La Paz	13–15	7.3	7.7	5.3
		San Luis Potosi	13–15	4.1	5.3	3.1

*Regions: AFR = African Region; EMR = Eastern Mediterranean Region; EUR = European Region; AMR = Region of the Americas.
Source: GYTS = Global Youth Tobacco Survey, 2007–2010 (25).

Figure 2-1. Current smokeless tobacco use (%) among boys and girls, 2007–2010

Sources: Global Youth Tobacco Survey, 2007–2010 (25); National Youth Tobacco Survey, United States, 2009 (16); Youth Smoking Survey, Canada, 2008–2009 (15).

Figure 2-2. Current smokeless tobacco use (%) among boys, 2007–2010

Sources: Global Youth Tobacco Survey, 2007–2010 (25); National Youth Tobacco Survey, United States, 2009 (16); Youth Smoking Survey, Canada, 2008–2009 (15).

Figure 2-3. Current smokeless tobacco use (%) among girls, 2007–2010

Sources: Global Youth Tobacco Survey, 2007–2010 (25); National Youth Tobacco Survey, United States, 2009 (16); Youth Smoking Survey, Canada, 2008–2009 (15).

Smokeless Tobacco Use Among Adults

Table 2-4 provides nationally representative estimates of ST use for 64 countries and subnational estimates for 7 countries, for various age groups and in most cases by gender. Countries are grouped by WHO region, and surveys span the years 2002 through 2010. Countries in the South-East Asia Region generally appear to have higher rates than those in other regions. Of the 64 countries with national estimates, 20 were in the African Region, 5 in the Eastern Mediterranean Region, 16 in the European Region, 8 in the Americas Region, 8 in the South-East Asia Region, and 7 in the Western Pacific Region.

Subnational estimates were reported for 4 countries in the African Region and 1 each in the Americas, South-East Asia, and Western Pacific Regions. In the 49 countries included in Table 2-4 that had a total estimate, current use of ST among adults ranged from a high of 29.6% in Myanmar to 0.0% in Uruguay (Figure 2-4). Among men, prevalence ranged from 51.4% in Myanmar to 0.0% in Barbados and Uruguay (Figure 2-5), whereas among women the prevalence ranged from 28.3% in Mauritania to 0.0% in six countries (Armenia, China, Moldova, Switzerland, Ukraine, and Uruguay) (Figure 2-6).

Overall prevalence among adults was high—10.0% or greater—in 11 countries (Bangladesh, Bhutan, India, Micronesia, Myanmar, Nepal, Norway, Sri Lanka, Sweden, Yemen, and Uzbekistan). Six of these were located in the South-East Asia Region (only 7 countries in that region had reports on overall prevalence). Prevalence exceeded 10.0% among men in 15 countries and among women in 7 countries. A review of the prevalence of ST use among adults, by WHO region (Table 2-4), indicates that in the African Region the rate was highest in Benin (9.2%) and lowest in Gambia (1.1%). In the Eastern Mediterranean Region, it was highest in Yemen (10.7%) and lowest in Libya (1.2%). In the European Region, the highest prevalence was in Sweden (17.0%) and the lowest in Latvia and Switzerland (both 0.1%). In the Americas Region, the highest prevalence of use among adults was in the United States (3.2%) and the lowest in Uruguay (0.0%), in contrast to findings for youth, where prevalence was lowest in Canada. In the South-East Asia Region, prevalence was highest in Myanmar (29.6%) and lowest in Thailand (3.9%). In the Western Pacific Region, Micronesia had the highest prevalence (11.4%) and China the lowest (0.4%).

Table 2-4. Prevalence (%) of use of smokeless tobacco among men and women, by World Health Organization region, 2002–2012

Region*	Country/year	Source†	Age group (years)	Coverage	Prevalence (percent) Total	Men	Women	Description of indicator
AFR	Algeria, 2010	ICS	15+	Subnational	5.7	10.4	0.8	Current users of ST
	Benin, 2008	WHO STEPS	25–64	National	9.2	12.7	5.7	Current users of ST
	Cape Verde, 2007	ICS	25–64	National	4.6	3.5	5.8	Current users of ST
	Chad, 2008	ICS	25–64	Subnational	1.2	1.9	0.4	Current users of ST
	Ethiopia, 2005	DHS	Men, 15–59; Women, 15–49	National	—	3.0	0.6	Current users of ST
	Gambia, 2010	WHO STEPS	25–64	National	1.1	0.8	1.4	Current users of ST
	Ghana, 2008	DHS	Men, 15–59; Women, 15–49	National	—	0.9	0.2	Current users of ST
	Guinea, 2009	WHO STEPS	15–64	Subnational	1.4	1.4	1.5	Current users of ST
	Kenya, 2008–09	DHS	Men, 15–54; Women, 15–49	National	—	1.8	1.3	Current users of ST
	Lesotho, 2009	DHS	Men, 15–59; Women, 15–49	National	—	1.3	9.1	Current users of ST
	Liberia, 2007	DHS	15–49	National	—	2.3	2.4	Current users of ST
	Madagascar, 2008–09	DHS	Men, 15–59; Women, 15–49	National	—	22.6	19.6	Current users of ST
	Malawi, 2009	WHO STEPS	25–64	National	3.5	1.9	5.0	Current users of ST
	Mali, 2007	WHO STEPS	15–64	Subnational	2.7	5.0	1.2	Current users of ST
	Mauritania, 2006	WHO STEPS	15–64	National	9.0	5.7	28.3	Current users of ST
	Namibia, 2006–07	DHS	15–49	National	—	1.8	2.3	Current users of ST
	Nigeria, 2008	DHS	Men, 15–59; Women, 15–49	National	—	3.2	0.5	Current users of ST
	Sao Tome and Principe, 2009	WHO STEPS	25–64	National	2.8	3.8	1.9	Current users of ST
	Sierra Leone, 2008	DHS	Men, 15–59; Women, 15–49	National	—	1.3	4.7	Current users of ST
	South Africa, 2003	ICS	15+	National	—	2.4	10.9	Ever users of ST daily

Region*	Country/year	Source†	Age group (years)	Coverage	Prevalence (percent) Total	Men	Women	Description of indicator
	Swaziland, 2007	WHO STEPS	25–64	National	1.6	2.6	0.8	Current users of ST
	Uganda, 2006	DHS	Men, 15–54; Women, 15–49	National	—	3.9	2.6	Current users of ST
	Zambia, 2007	DHS	Men, 15–59; Women, 15–49	National	—	0.2	1.2	Current users of ST
	Zimbabwe, 2005–06	DHS	Men, 15–54; Women, 15–49	National	—	1.9	0.5	Current users of ST
EMR	Egypt, 2009	GATS	15+	National	2.2	4.1	0.3	Current users of ST
	Libya, 2009	WHO STEPS	25–64	National	1.2	2.2	0.1	Current users of ST
	Saudi Arabia, 2004	WHO STEPS	15–64	National	—	1.3	0.5	Daily users of ST
	Tunisia, 2005–06	ICS	35–70	National	5.4	8.6	2.2	Current users of snuff
	Yemen, 2003	ICS	15+	National	10.7	15.1	6.2	Current users of El–shama
EUR	Armenia, 2005	DHS	15–49	National	—	1.8	0.0	Current users of ST
	Azerbaijan, 2006	DHS	Men, 15–49	National	—	0.3	—	Current users of ST
	Denmark, 2010	ICS	15+	National	2.0	3.0	1.0	Current users of ST
	Finland, 2009	ICS	15–64	National	—	5.5	0.4	Current snuff users
	Georgia, 2010	WHO STEPS	18–64	National	0.6	1.0	0.2	Current users of ST
	Iceland, 2008	ICS	15–89	National	2.9	6.0	—	Daily users of ST
	Kyrgyzstan, 2005	ICS	15+	National	3.4	7.0	0.3	Current users of ST (nasvay users)
	Latvia, 2008	ICS	15–64	National	0.1	0.2	—	Current users of chewing tobacco
	Moldova, 2005	DHS	Men, 15–59; Women, 15–49	National	—	0.1	0.0	Current users of ST
	Norway, 2009	ICS	16–74	National	10.0	17.0	5.0	Current users of ST
	Poland, 2009	GATS	15+	National	0.5	1.0	0.1	Current users of ST
	Russian Federation, 2009	GATS	15+	National	0.6	1.0	0.2	Current users of ST
	Sweden, 2010	ICS	16–84	National	17.0	26.0	7.0	Current snuff users

Region*	Country/year	Source†	Age group (years)	Coverage	Prevalence (percent) Total	Men	Women	Description of indicator
	Switzerland, 2009	ICS	14–65	National	0.1	0.2	0.0	Current users of chewing tobacco
	Ukraine, 2009	GATS	15+	National	0.2	0.5	0.0	Current users of ST
	Uzbekistan, 2006	ICS	15+	National	11.3	22.5	0.4	Current users of ST
AMR	Barbados, 2007	WHO STEPS	25+	National	0.3	0.0	0.6	Current users of ST
	Brazil, 2008	GATS	15+	National	0.4	0.6	0.3	Current users of ST
	Canada, 2010	CTUMS	15+	National	1.0	1.0	—	Current users of ST
	Dominican Republic, 2007	DHS	Men, 15–59; Women, 15–49	National	—	1.9	0.3	Current users of ST
	Haiti, 2005–06	DHS	Men, 15–59; Women, 15–49	National	—	—	2.5	Current users of ST
	Mexico, 2009	GATS	15+	National	0.3	0.3	0.3	Current users of ST
	Saint Kitts and Nevis, 2007	WHO STEPS	25–64	Subnational	0.1	0.3	0.1	Current users of ST
	United States, 2012	NSDUH	18+	National	3.6	7.1	0.4	Current users of ST
	Uruguay, 2009	GATS	15+	National	0.0	0.0	0.0	Current users of ST
SEAR	Bangladesh, 2009	GATS	15+	National	27.2	26.4	27.9	Current users of ST
	Bhutan, 2007	WHO STEPS	25–74	Subnational	19.4	21.1	17.3	Current users of ST
	India, 2009–10	GATS	15+	National	25.9	32.9	18.4	Current users of ST
	Maldives, 2009	DHS	Men, 15–64; Women, 15–49	National	—	6.0	4.2	Current users of ST
	Myanmar, 2009	WHO STEPS	15–64	National	29.6	51.4	16.1	Current users of ST
	Nepal, 2008	ICS	15–64	National	18.6	31.2	4.6	Current users of ST
	Sri Lanka, 2006	WHO STEPS	15–64	National	15.8	24.9	6.9	Current users of ST
	Thailand, 2009	GATS	15+	National	3.9	1.3	6.3	Current users of ST
	Timor-Leste, 2009–10	DHS	15–49	National	—	2.5	1.9	Current users of ST
WPR	Australia, 2004	NDSHS	12+	National	0.6	0.8	0.4	Current users of ST
	Cambodia, 2010	ICS	15+	National	7.3	0.7	12.7	Current users of ST
	China, 2009	GATS	15+	National	0.4	0.7	0.0	Current users of ST

Region*	Country/year	Source†	Age group (years)	Coverage	Prevalence (percent)			Description of indicator
					Total	Men	Women	
	Malaysia, 2006	ICS	18+	National	0.6	0.5	3.1	Current tobacco chewers
	Micronesia (Federated States of), 2002	WHO STEPS	25–64	Subnational	11.4	22.4	3.0	Current users of ST
	Mongolia, 2009	WHO STEPS	15–64	National	1.7	2.8	0.5	Current users of ST
	Philippines, 2009	GATS	15+	National	1.9	2.7	1.2	Current users of ST
	Vietnam, 2010	GATS	15+	National	1.3	0.3	2.3	Current users of ST

*Regions: AFR = African Region; EMR = Eastern Mediterranean Region; EUR = European Region; AMR = Region of the Americas; SEAR = South-East Asia Region; WPR = Western Pacific Region.

†GATS = Global Adult Tobacco Survey, 2008–2010 (23); DHS = Demographic and Health Surveys, 2005–2010 (24); WHO STEPS = World Health Organization STEPwise Approach to Surveillance, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); NDSHS = National Drug Strategy Household Survey, Australia, 2004 (20); CTUMS = Canadian Tobacco Use Monitoring Survey, 2010 (21); NSDUH = National Survey on Drug Use and Health, United States, 2012 (22); ICS = individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Abbreviation: ST = smokeless tobacco.

Figure 2-4. Current smokeless tobacco use (%) among men and women, 2002–2012

Note: Daily use of smokeless tobacco was reported in Iceland.
Sources: Global Adult Tobacco Survey, 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2012 (22); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Figure 2-5. Current smokeless tobacco use (%) among men, 2002–2012

Note: Daily use of smokeless tobacco was reported in Iceland and Saudi Arabia, and ever use of smokeless tobacco was reported in South Africa.

Sources: Global Adult Tobacco Survey, 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2012 (22); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Figure 2-6. Current smokeless tobacco use (%) among women, 2002–2012

Note: Ever use of smokeless tobacco was reported in South Africa, and daily use of smokeless tobacco was reported in Saudi Arabia.

Sources: Global Adult Tobacco Survey, 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2012 (22); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Number of Adult Smokeless Tobacco Users

To translate prevalence rates into an estimate of the number of ST users among adults, the adult prevalence rate was multiplied by the total adult population in the age group on which the survey was conducted. Although the prevalence of ST use (either national or subnational) was available for 71 countries across all WHO regions, South Africa was excluded from the calculations because only ever users of ST were available; thus, prevalence rates for 70 countries were used. Estimated prevalence rates for males and for females were added together to get an overall estimate. The world's total adult population was derived from the United Nations' *World Population Prospects,* 2010 revision.[26] In 2010, these 70 countries represented about 70% of the world's adult population, or more than 3.5 billion people.

These calculations indicate that these 70 countries contain more than 300 million ST users (302.4 million, specifically) (Figure 2-7), with the number of users varying across countries. The largest number of ST users, more than 220 million, was in India. Other countries where the number of ST users exceeded 10 million were Bangladesh (28 million) and Myanmar (11.1 million). It is important to note that these three countries are in the South-East Asia Region. The number of ST users was less than 5 million in each country except the United States, which has 8.2 million ST users. By WHO region, the number of ST users varied greatly (Africa, 8.1 million; Eastern Mediterranean, 3.1 million; Europe, 5.3 million; the Americas, 10.1 million; South-East Asia, 268.6 million; and the Western Pacific, 7.2 million) (Figure 2-7). According to these calculations, the South-East Asia Region alone accounts for almost 89% of the total users of ST in these 70 countries (Figure 2-7).[27]

Figure 2-7. Number (in millions) and proportion (%) of smokeless tobacco users among adults in 70 countries, by World Health Organization region

*Because only ever use of smokeless tobacco was reported for South Africa, it was excluded from the calculations.
†Daily use of smokeless tobacco was reported in Iceland and Saudi Arabia.
Note: Percentages do not equal 100% because of rounding.
Sources: Global Adult Tobacco Survey, 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2011 (22); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Gender Differences in Smokeless Tobacco Use Across Countries

Gender Differences Among Youth

In several countries with available national data, the rate of ST use was more than 10.0% either among boys or girls (Table 2-2). Among boys, rates higher than 10.0% were found in: Botswana (11.3%), Congo (18.3%), Lesotho (14.7%), and Namibia (15.6%) in the African Region; Djibouti (15.2%) in the Eastern Mediterranean Region; Barbados (11.5%), Dominica (10.2%), and Grenada (10.1%) in the Americas Region; Bhutan (14.1%), India (11.1%), and Myanmar (10.3%) in the South-East Asia Region; and Cook Island (10.5%) in the Western Pacific Region. Among girls, the prevalence of ST exceeded 10.0% only in the African Region: Botswana (11.4%), Congo (14.1%), Lesotho (13.6%), and Namibia (15.8%).

In 36 (63%) of the 57 countries that measured use nationally among youth, at least 5.0% of boys aged 13−15 years were reported to be either daily or occasional users; use among girls of the same ages equaled or exceeded 5% in 23 (40%) of the 57 countries (Table 2-2). In general, prevalence among boys was higher in countries in the South-East Asia and African Regions than in other regions. In all 11 countries in the African Region, the prevalence of use by gender was 5.0% or greater except for girls in Côte d'Ivoire (4.9%) and Togo (4.8%). In the South-East Asia Region, 5.0% or more of boys in 7 countries were reported to be users, but among girls the prevalence reached 5.0% in only 2 countries (Bhutan and India). The sex ratio (boys to girls) of ST use (Figure 2-8) among youth in the countries with available national data ranged from 0.9 to 4.3; girls' use of ST approximately equaled or exceeded that of boys in 10 countries (Botswana, Jamaica, Libya, Macau, Namibia, Peru, Seychelles, Trinidad and Tobago, Uganda, and Yemen).

Subnational estimates showed a similar pattern (Table 2-3). Of 46 locations in 18 countries, the prevalence was 5.0% or greater among boys in 40 locations (87%) and among girls in 29 locations (63%). In the African Region, prevalence was 5.0% or higher among boys in every location except Dar es Salaam, Tanzania (4.6%). Prevalence among girls fell short of this threshold in the Yaounde section of Cameroon (4.4%), where data on ST use prevalence were available for the first time, and in Dar es Salaam (4.3%), and Bulawayo (3.5%) in Zimbabwe. In the Eastern Mediterranean Region, prevalence reached 5.0% in every location for boys and in most locations for girls (the two exceptions were both in Pakistan: 3.1% in Lahore, and 2.6% in Peshawar).

Figure 2-8. Sex ratio (boys to girls) of smokeless tobacco use among youth, 2007–2010

Sources: Global Youth Tobacco Survey, 2007–2010 (14); National Youth Tobacco Survey, United States, 2009 (16); Youth Smoking Survey, Canada, 2008–2009 (15).

Gender Differences Among Adults

High prevalence rates among adults, as among youth, were found more often for males than females. For men, the available data reveal that ST use prevalence was above 10.0% in the following countries: Algeria (10.4%), Benin (12.7%), and Madagascar (22.6%), in the African Region; Yemen (15.1%) in the Eastern Mediterranean Region; Norway (17.0%), Sweden (26.0%), and Uzbekistan (22.5%) in the European Region; Bangladesh (26.4%), Bhutan (21.1%), India (32.9%), Myanmar (51.4%), Nepal (31.2%), and Sri Lanka (24.9%) in the South-East Asia Region; and Micronesia (22.4%) in the Western Pacific Region. Among women, prevalence exceeded 10.0% in 8 countries: Madagascar (19.6%), Mauritania (28.3%), and South Africa (10.9%) in the African Region; Bangladesh (27.9%), Bhutan (17.3%), India (18.4%), and Myanmar (16.1%) in the South-East Asia Region; and Cambodia (12.7%) in the Western Pacific Region. The estimate for men reached 5.0% in only 22 of the 70 countries with available national or subnational data; the estimate for women reached 5.0% in only 16 of the 67 countries with available data. The estimate was 1.0% or below for men in 22 countries (32%), and for women in 31 countries (47%).

The sex ratio (male to female) of ST use among adults (either national or subnational) ranges between 0 and 56.3 (Figure 2-9). In most of the countries with data available for both women and men, men were more likely to be current users of smokeless tobacco. However, ST use among females equals or exceeds that of males in 18 countries, and in 13 countries, women had an appreciably higher rate (prevalence for men shown first): Barbados (0.0%, 0.6%), Cape Verde (3.5%, 5.8%), Gambia (0.8%, 1.4%), Lesotho (1.3%, 9.1%), Malawi (1.9%, 5.0%), Mauritania (5.7%, 28.3%), Sierra Leone (1.3%, 4.7%), South Africa (2.4%, 10.9%), and Zambia (0.2%, 1.2%) in the African Region; Thailand (1.3%, 6.3%) in the South-East Asia Region; and Cambodia (0.7%, 12.7%), Malaysia (0.5%, 3.1%), and Vietnam (0.3%, 2.3%) in the Western Pacific Region. In three countries in the African Region, one country in the Americas Region, and one country in the South-East Asia Region, differences were quite modest, but women (shown second) had a slightly higher rate: Bangladesh (26.4%, 27.9%), Guinea (1.4%, 1.5%), Liberia (2.3%, 2.4%), Mexico (0.3%, 0.3%), and Namibia (1.8%, 2.3%).

Prevalence and Other Characteristics of Use

Examining several characteristics associated with the use of ST products could be informative in understanding public health impact, developing programs, and establishing policies. These characteristics include type of ST product used; pattern of use, including dual product use; age of initiation; and cessation rates.

Figure 2-9. Sex ratio (male to female) of smokeless tobacco use among adults, 2002–2011

Note: Ever use of smokeless tobacco was reported in South Africa, and daily use of smokeless tobacco was reported in Saudi Arabia.
Sources: Global Adult Tobacco Survey, 2008–2010 (23); Demographic and Health Surveys, 2005–2010 (24); WHO STEPS, 2002–2010, from: *WHO Report on the Global Tobacco Epidemic, 2011* (6); National Drug Strategy Household Survey, Australia, 2004 (20); Canadian Tobacco Use Monitoring Survey, 2010 (21); National Survey on Drug Use and Health, United States, 2012 (22); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (6).

Prevalence of Use, by Type of Smokeless Tobacco Product

Understanding the use of various ST products is essential for characterizing the level of ST use worldwide. A number of manufactured and locally produced ST products are used in India and Bangladesh.[3,4] In Bangladesh, betel quid with tobacco is chewed by more than 24% of adults (23.5% of men; 25.2% of women). Other products used in Bangladesh include gul (5.3% of adults) and khoini (1.5% of adults).[4] In India, only 6.2% of adults chew betel quid with tobacco (7.5% of men, 5.0% of women); 11.6% of adults use khaini, 8.2% use gutka, and 4.7% use tobacco products that are applied to teeth and gums, such as gul, mishri, or gudahku. Men and adults from rural areas use these products at a higher rate than women and urban residents.[3]

Daily Versus Occasional Use

In countries with high use of ST (Bangladesh, India, and Myanmar), more than 65% of current users (both men and women) were daily users.[3–5] In Bangladesh, prevalence of daily users among the general population was 23.7% (20.7% among men and 26.6% among women). In India, it was 21.4% (27.4% among men and 14.9% among women), and in Myanmar, it was 22% (37.7% among men and 12.2% among women). The prevalence of occasional users among the general population was 3.5% in Bangladesh (5.6% among men and 1.3% among women), 4.5% in India (5.4% among men and 3.5% among women), and 7.6% in Myanmar (13.7% among men and 3.9% among women). In both Bangladesh and India[3,4] 2.3% of the population were former (daily or occasional) users of ST (Bangladesh: 3.1% among men and 1.5% among women; India: 2.6% among men and 1.8% among women). In Myanmar,[5] the former daily ST use prevalence was 1.7% (3.9% among men and 0.3% among women).

Dual Product Use

Dual product use refers to the use of both smoked tobacco and ST products by the same person.[28,29] (These figures do not include use of more than one ST product.) Dual product use by adults was high in India (overall, 5.3%; among men, 9.3%; among women, 1.1%) and Bangladesh (overall, 6.8%; among men, 13.0%; among women, 0.7%).[3,4] In the United States, seven states that had the highest prevalence of cigarette smoking also had the highest prevalence of ST use: Alabama, Alaska, Arkansas, Kentucky, Mississippi, Oklahoma, and West Virginia. At least one of every nine men in these states who smoked cigarettes also used ST (range: 11.8% in Kentucky to 20.8% in Arkansas).[30]

Age at Initiation and Quit Ratio

The available data indicate that the mean age at initiation of ST use among adults aged 20–34 years is 25 years among Bangladeshi adults and 17.9 years among Indian adults. Bangladeshi men initiate use 2 years earlier than women; in India, men begin ST use about a year after women (18.2 years old for men and 17.1 years old for women). These data were obtained by reanalyzing data in the *WHO Report on the Global Tobacco Epidemic, 2011*[6] specifically to look at the ST indicator. The WHO data can also be used to calculate the quit ratio—the number of former ST users divided by the number of people who have ever used ST daily. Quit ratios among adults (aged 15 years and older) were low in both Bangladesh and India, although slightly higher in Bangladesh than in India (5.5% vs. 4.8%, respectively).[3,4,6]

Prevalence Data for Adults and Sociodemographic Variables in Four Countries

This section describes ST use prevalence in four countries in terms of demographic variables such as gender, age, location (rural/urban), and socioeconomic status, where data were available. These data demonstrate some similar patterns of use across countries and differences both within and across countries. Information in this section is derived from GATS data for Bangladesh and India because of their availability and because these two countries are home to more ST users than any other countries in the world. Additional information for the United States and Myanmar comes from the 2009 U.S. Behavioral Risk Factor Surveillance System (BRFSS),[30] the 2012 National Survey on Drug Use and Health,[22] and from WHO STEPS conducted in Myanmar in 2009.[5]

Bangladesh

Current prevalence of any ST use among adults in Bangladesh was 27.2% and was similar for men and women (26.4% and 27.9%, respectively).[4] Use increased steadily with age, rising from 6.6% in the 15−24 age group to 56.4% among those aged 65 and older. Prevalence was higher in rural areas (28.8%) than in urban areas (22.5%), and was more than four times as high among adults with no formal education (42.3%) as among adults with a secondary school education or more (10.2%). A similar pattern was observed with respect to the wealth index, a proxy for socioeconomic status: Adults with the lowest wealth index had the highest prevalence of use (36.1%), and adults with the highest wealth index had the lowest prevalence (17.3%).

India

Data from India[3] reveal a 25.9% prevalence of current ST use among adults, with use among men at 32.9%, compared with 18.4% among women. Although the absolute levels were different, the patterns in India were similar to those observed in Bangladesh. In India, prevalence was also lowest in the 15−24 age group (16.2%) and highest among those aged 65 years and older (33.7%). As in Bangladesh, prevalence in India was higher among adults in rural areas than in urban areas (29.3% vs. 17.7%), and more than twice as high among adults with no formal education as among adults with an education of secondary school or above (33.5% vs. 14.8%). Prevalence was 33.1% among retired and unemployed adults, 32.5% among employed adults, and 6.3% among students. By region of the country, prevalence was highest in the east (38.0%) and lowest in the north (7.0%). Among states in India, prevalence ranged from 49.0% in Bihar to only 5.0% in Goa.

Myanmar

Data from Myanmar[5] indicate that the prevalence of current ST use for men and women combined was similar across age groups between ages 25 and 65 years (28.4%–31.5%), whereas young adults (aged 15–24 years) had a somewhat lower prevalence of ST use (21.5%). The highest consumption was observed among men in the 25–34 age group (54.3%) and women in the 45–54 age group (21.1%).[5]

United States

In 2012, prevalence of past-month ST use in the United States was 3.6%, and it was higher among young adults (5.5% among those aged 18–25 years) than among youth (2.1% of those aged 12–17 years) and older adults (3.3% of those aged 26 and older).[22] Men also had a significantly higher prevalence of ST use (7.1%) than women (0.4%). In terms of education, the past-month prevalence of ST use was 4.0% among adults (age 18 and older) with less than a high school education: 4.4% among high school graduates, 3.9% among adults with some college education, and 2.3% among college graduates.

The 2009 BRFSS[30] was the first surveillance system to present U.S. data on current ST use by state. Prevalence rates varied significantly from state to state; prevalence was highest in Wyoming (9.1%), West Virginia (8.5%), and Mississippi (7.5%), and lowest in California (1.3%), the District of Columbia (1.5%), Massachusetts (1.5%), and Rhode Island (1.5%).

Gaps and Limitations of the Current Evidence Base

The data used in this report are based on self-reports and thus may be subject to misclassification of ST use. Secondly, the surveys from which the prevalence estimates of ST use are available vary in terms of their methodologies, timeframes, and approaches (for example, in design, purpose, year of survey, questions used, and indicators measured). Therefore, comparisons among estimates should be made cautiously. Thirdly, due to the lack of available data and differences in methodology (e.g., definitions or questions used for reporting ST use), it was not possible to report on ST use in some countries, particularly among adults; these deficiencies might have some influence on reporting patterns and generalization across countries. Finally, due to the differences in coverage (age groups, countries, representativeness), the reported numbers of ST users are approximations and should be considered as interim results until more accurately weighted calculations become available.

Summary and Conclusions

This chapter has presented data on overall prevalence of ST use in 114 of the 194 WHO member states (almost 58% of countries in the world), at national and subnational levels, for youth and adults. For many of these countries, data on ST use were reported for the first time.

From these data, it is clear that in the first decade of the 21st century, ST use occurs among youth and adults in almost every country of the world, but also that ST use is highly prevalent in some parts of the world and, in some cases, more prevalent than cigarette smoking. The GYTS and GATS, together with other surveys, document in detail the prevalence of ST use and reinforce the need for sustained monitoring of all forms of tobacco use.

From the data reported in this chapter, a few general patterns of ST use prevalence can be readily seen:

- Use rates appear to vary widely among youth and adults.
- Among youth, boys generally report more use than girls.
- Among adults, men generally have a higher prevalence than women, except in Bangladesh and Thailand in the South-East Asia Region; in a few African countries (such as South Africa and Sierra Leone); in Cambodia, Malaysia, and Vietnam in the Western Pacific Region; and in Barbados in the Americas Region.
- Among youth, there is evidence of high prevalence (≥10%) either overall or by gender in the South-East Asia Region (boys in Bhutan, India, and Myanmar), the Eastern Mediterranean Region (Djibouti), the Americas Region (boys in Barbados, Dominica, and Grenada), the African Region (Botswana, Congo, Lesotho, and Namibia), and the Western Pacific Region (Cook Island boys).
- Among adults, there is a high prevalence (≥10%) in the South-East Asia Region (Bangladesh, Bhutan, India, Myanmar, Nepal, and Sri Lanka), in the European Region (Norway, Sweden, Uzbekistan), the Eastern Mediterranean Region (Yemen), the African Region (in Madagascar overall; men in Algeria and Benin; and among women in Mauritania and South Africa), and the Western Pacific Region (in Micronesia overall and among men, and in Cambodia among women).

The significant impact of ST use, particularly in some countries, is illustrated by data showing that more than 300 million adults in 70 countries across all WHO regions use smokeless tobacco. The South-East Asia Region has the largest share (89%) of ST users. GATS data from 13 low- and middle-income countries included in this report account for more than 250 million users of smokeless tobacco.[27] In a few countries, most notably in Bangladesh and India, ST use is very high and surpasses tobacco smoking.

Longitudinal data and continuous monitoring of tobacco use, particularly ST use, are needed to refine understanding of the extent of the problem. More extensive data on patterns of use, ages and groups at highest risk, and cessation success are important to informing tobacco control actions that would effectively reduce morbidity and mortality attributable to tobacco[31] and prevent initiation of use by youth and young adults.

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Chapter 3

A Global View of Smokeless Tobacco Products

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Global Diversity of Smokeless Tobacco Products

Product Overview

Unlike smoked tobacco, which is burnt or heated and then inhaled in products such as cigarettes (both manufactured and roll-your-own) and cigars, or via hookahs, smokeless tobacco (ST) is predominantly used orally (chewed, sucked, dipped, held in the mouth, etc.) or nasally, which results in absorption of nicotine and other chemicals across mucus membranes.[1] Smokeless tobacco products are used worldwide[2–4] in forms that vary greatly in appearance and toxicant emissions and in their composition of tobacco and non-tobacco constituents (Figure 3-1).[2,5,6]

Worldwide, ST products range in complexity from simple cured tobacco to elaborate products with numerous chemical ingredients and, in some cases, non-tobacco plant material that may affect the attractiveness, addictiveness, and toxicity of the products[2,5,6] (see chapters 9–14). For certain products, preparation, ingredient selection (including non-tobacco plant materials), and mode of use (oral, nasal, etc.) can vary based on geographic locality, ingredient availability, cultural/societal norms, and personal preferences[1,2,5,6] (chapters 9–14).

Production and Preparation

In terms of production and preparation, ST can be broadly divided into premade and custom-made products (Table 3-1). Premade ST products, which are made for sale and generally consumed as purchased (i.e., "ready-to-use"), can be subdivided into: (1) commercial products (i.e., moist snuff, snus, khaini) that are made in traditional manufacturing settings such as factories or production facilities; and (2) cottage products (toombak, nasway, mainpuri, mawa) that are made in non-traditional production environments (market stalls, shops, houses, etc.) and often sold in non-commercial packaging (paper or plastic bags; wrapped in paper).[2,5,6]

Premade manufactured ST products are available in a wide variety of physical forms, including, but not limited to, twisted tobacco leaves, loose tobacco, ground tobacco, dry tobacco (dry snuff), tars (chimó), pastes (kiwam), dentifrices (creamy snuff, toothpowder), tobacco-containing chewing gums, and mixtures of tobacco and other materials (zarda, gutka).[2,5–7] Manufactured ST products, such as moist snuff and snus, are available as loose tobacco or tobacco sealed in porous teabag-like sachets (Figure 3-1), which are easily inserted and removed from the mouth. Release of nicotine and presumably other compounds is greater from loose tobacco than from sachets.[8]

Figure 3-1. Examples of global smokeless tobacco products

Note: Products by country or region are:
South-East Asia: kiwam, betel quid (paan), zarda, gutka
United States: moist snuff, dry snuff, moist snuff (caffeinated), plug, twist tobaccos, dissolvables (Orbs, Strips, Sticks, tobacco-coated toothpicks)
Sweden: snus (pouch)
Venezuela: chimó
Uzbekistan: nasway
Sudan: toombak
India: red toothpowder, mawa
Saudi Arabia: shammah
Brazil: rapé.

Sources: All images except for betel quid (paan) courtesy of Clifford Watson, Centers for Disease Control and Prevention. Image of betel quid (paan) courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinha.

Table 3-1. Characteristics and product examples of premade and custom-made smokeless tobacco products

Premade manufactured	Premade cottage industry	Custom-made vendor/individual
• Made in advance for sale • Made in a manufacturing environment • Sealed in labeled commercial packaging	• Made in advance for sale • Usually handmade in non-traditional environments • Often sold in non-commercial packaging	• Made by a vendor or individual according to user preferences, generally for immediate consumption • Involves mixing two or more components (including premade products) together by hand to form a final product
Product examples: • Chewing tobacco (plug/twist/loose leaf) • Creamy snuff • Dissolvables • Dry snuff • Gudahku/Gudahka • Gutka • Khaini • Moist snuff • Kiwam • Rapé • Red toothpowder	Product examples: • Dohra • Gutka • Mainpuri • Nass/Naswar • Nasway • Betel quid with tobacco (paan) • Rapé • Shammah • Toombak • Tuibur	Product examples: • Gudahku/Gudahka • Iqmik • Nass/Naswar • Nasway • Betel quid with tobacco (paan) • Rapé • Shammah • Tapkeer • Tobacco leaf • Tombol • Toombak Some premade ingredients are used to make custom-made products: twist, zarda, toombak, gudahku/gudahka, and kiwam.

Increasingly, new varieties of manufactured smokeless products appear in a discrete, spit-less form that can be used where smoking is prohibited or socially inappropriate.[9] Since 2001, several tobacco companies, including those that have traditionally marketed cigarettes, have been introducing dissolvable ST products, which are made from finely milled tobacco pressed into tablets, rods and sticks, or flat strips that fully dissolve in the mouth[10–12] (Figure 3-2). Novel products introduced after about 2010 include tobacco-coated toothpicks, which are sucked on to release nicotine,[13] and an "energy-enhanced" ST product called Revved Up, made by Southern Smokeless, which is essentially moist snuff augmented with energy drink constituents.[14] A nicotine disk product called Verve, introduced by Altria in Virginia in 2012, is a chewable disc made of cellulose fibers and a polymer and impregnated with flavor and nicotine. The disk does not dissolve, but is chewed for about 15 minutes and then discarded.[15]

Premade cottage products can be in the form of pressed cakes (mawa), pellets (nasway), or pulverized tobacco (toombak, shammah), among others. Some premade products are used as the tobacco ingredient in custom-made products; for example, manufactured products (zarda and kiwam) or cottage products (mainpuri and toombak) can be used as the tobacco ingredient in betel quid and tombol. The "tobacco ingredient" used to make a custom-made product (tombol, betel quid) may itself be a mixture of tobacco with other ingredients such as areca nut, alkaline agents, spices, and silver flakes.[2,5]

Figure 3-2. Dissolvable products and their packaging

Source: Images courtesy of Clifford Watson, Centers for Disease Control and Prevention.

Figure 3-3. Ingredients added to some smokeless products that may influence their addictiveness, carcinogenicity, or toxicity

Abbreviation: IARC = International Agency for Research in Cancer.
Notes: Samples taken from the Federal University of Paraiba (Brazil). Products may also contain chemical additives (sweeteners, moisteners, flavor chemicals, binders, whiteners, preservatives), plant extracts, essential oils, spices, and other plant materials.
Source: Images for tobacco, areca nut, tonka bean, and Peruvian cocoa courtesy of Clifford Watson, Centers for Disease Control and Prevention.

Custom-made products, handmade by the user, a relative, or a vendor according to user preferences, are characteristic of countries in South Asia, Africa, the Middle East, North America (Alaska), and South America (Brazil) (see chapters 9–14). Custom-made products such as tombol and betel quid (also known as paan) are made by combining cured tobacco or a premade tobacco product (e.g., zarda) with one or more ingredients, such as ashes, alkaline agents, areca nut, spices, catechu, or other plant materials[16] (Figure 3-3).

Product Packaging

Approaches to the packaging of ST products are nearly as diverse as their formulations. Many manufactured ST products are packaged in tins, cylinders, or containers made of cardboard, plastic, or metal (e.g., snus, moist snuff, dry snuff); sealable pouches (zarda, chewing tobacco); tear packs (snuff, gutka, khaini); and toothpaste-like tubes (creamy snuff).[2] Some novel dissolvable tobacco products are packaged in paper packs (tobacco rods and sticks) or foil press-out packs (tablets). Manufactured packaging serves not only to protect product integrity but also to display recognizable logos or images that can promote brand image and use. Alternatively, the hand-prepared cottage products (mawa, mainpuri, toombak) are often portioned into non-conventional packaging (unlabeled paper or plastic bags or cellophane paper wrapping). Custom-made products may not be stored in any packaging as they are frequently prepared at the time of use by the user, a family member (as in the case of iqmik),[16] or a vendor (e.g., betel quid seller). Thus, cottage and custom-made products are likely to show substantial variation in product size, packaging, and composition as compared to manufactured products, which tend to be more consistent because of standardized production methods and quality control measures.[2,17]

Smokeless Tobacco Product Ingredients

Tobacco

Tobacco Types

Worldwide, approximately 70 species of tobacco (*Nicotiana*) occur in nature, although few are regularly used for smoked or smokeless tobacco products.[2,18] The identity of different tobacco species in products can be determined by a chemical analysis of the levels of nicotine and other tobacco alkaloids[19] and confirmed using infrared analysis.[20] Most commercial tobacco products worldwide contain the species *Nicotiana tabacum* (cultivated tobacco), but *N. rustica* is also frequently grown and used in regions of South America, Africa, and Asia.[2,18] In India, smoking tobacco tends to be made with *N. tabacum*, but most ST contains *N. rustica*, which has higher concentrations of nicotine and other alkaloids than *N. tabacum*.[17,21,22] Some products, such as khaini and kiwam from South Asia, may contain both *N. rustica* and *N. tabacum*.[2] *N. rustica* is also contained in some forms of naswar, Bangladeshi tobacco leaf, Indian chewing tobacco, maras, zarda, and toombak.[2,17,20,23] Smokeless tobacco products such as toombak may contain *N. glauca* (tree tobacco),[2,24] which has high levels of the alkaloid anabasine; ingestion of this form of tobacco has been linked to accidental poisoning and fatality in a few cases.[24,25] (Figure 3-3 includes images of different *Nicotiana* species.)

Changes in Chemical Composition of Tobacco During Growth

As tobacco grows, it absorbs metals, metalloids,[26] and nitrate from the soil[27,28] and synthesizes alkaloids, including nicotine and minor alkaloids (e.g., nornicotine, anabasine, and anatabine) in various concentrations, depending on species and variety.[19] Alkaloids are key chemical precursors in the formation of tobacco-specific nitrosamines (TSNAs),[29–31] some of which are potent carcinogens.[2,32]

Tobacco nitrate content and the presence of certain microorganisms on tobacco leaves contribute to the formation of TSNAs from alkaloids.[33] During cultivation, microorganisms (yeast, mold, fungi, and bacteria) and agricultural chemicals can be deposited on tobacco plants. On growing tobacco, bacteria are present at approximately 10^5 to 10^6 organisms per gram of leaf material. At harvest, tobacco is not generally washed, thus leaves with deposited microorganisms and agricultural chemicals will be processed, and the contaminants will be present in the final product. During the subsequent curing step, the tobacco leaves dry, and bacteria, which proliferate to levels 10 to 20 times higher than on the growing leaf,[34] begin converting the nitrate (NO_3^-) present in the plant tissue to nitrite (NO_2^-), a process called nitrate reduction. Once nitrite is produced, a chemical process of nitrosation occurs in which nitrite reacts with tobacco alkaloids to generate TSNAs.[35] (Figure 3-7 illustrates this process.) Amine compounds other than tobacco alkaloids can also react with nitrite to form nonvolatile *N*-nitrosamines, volatile nitrosamines, and *N*-nitrosamino acids.[5,36] The International Agency for Research in Cancer (IARC) has classified various nitroso compounds as IARC Group 1 (carcinogenic to humans), 2A (probably carcinogenic to humans), or 2B (possible carcinogenic) agents.[37] The IARC has also classified nitrate and nitrite as Group 2A agents[38] because of their potential to form nitroso compounds in the human body after ingestion. There are indications that additional amounts of nitrosamines can be formed in the mouth during ST use.[39]

Curing

Prior to use in products, tobacco is dried using sun, air, flue, or fire curing (Figure 3-3). Any given ST product can be produced using various tobacco-curing methods, depending on the manufacturer. The simplest method of tobacco processing is sun curing, the process of drying tobacco leaves in the sun, which is often used in making toombak, gutka, maras, khaini, and nass/naswar. Some tobaccos used in betel quid are also sun-cured.[2] Air curing, which involves placing tobacco stalks on wooden staves that are hung in a well-ventilated barn, is usually used in loose leaf and twist chewing tobaccos and moist snuff.[2,40] Iqmik can contain air- or fire-cured tobacco.[41] Flue curing involves hanging tobacco in an enclosed structure connected to an external heat source without exposing the tobacco directly to smoke[33,40]; this method is often used in making chewing tobacco. During fire curing, tobacco is hung in a large enclosed barn and exposed to smoke from hardwood fires that are continuously burning or smoldering, in a process directly analogous to producing smoked meat.[42] Fire-cured tobacco is used in the production of plug chewing tobacco, moist and dry snuff, and iqmik.[2,40,41] Fire curing not only causes chemical changes in the tobacco leaf, it also contaminates the tobacco with smoke-related chemicals. As a result, the levels of polycyclic aromatic hydrocarbons (PAHs), phenols, and volatile aldehydes tend to be higher in fire-cured tobacco than air-cured tobacco.[21,22,41,43]

Fermentation and Aging

Fermentation and aging of tobacco are common in the production of tobacco used in cigars[44] and smokeless tobacco (e.g., moist and dry snuff, toombak, taaba).[2,33,45] During fermentation or aging, the tobacco takes on a more agreeable flavor.[45] For manufactured products, fermentation can occur in a partially insulated tank,[33] which, because of increased microbial activity, can reach high temperatures (up to 65°C).[44] Fermentation of toombak, a cottage industry product, occurs in a closed container at 30 to 45ºC for a few weeks, then the tobacco is aged for a year.[2]

Tobacco fermentation involves chemical and biochemical changes (bacteria-mediated reactions).[2,33,44] During fermentation, a portion of nitrate in fire-cured tobacco is converted to nitrite, which then reacts with alkaloids to produce TSNAs.[33,44]

Chemical markers indicative of bacterial and fungal growth have been identified in tobacco of various types and at various stages of production.[46,47] In tobacco or tobacco products, a number of bacteria including *Bacillus*, *Enterobacter*, *Staphylococcus*, *Corynebacterium*, *Clostridium*, *Serratia*, and *Escherichia* species have been identified that are capable of converting nitrate to nitrite (nitrate reduction).[33,44,48–52] Additionally, several genera of fungi, such as *Cladosporium*, *Alternaria*, *Candida*, *Fusarium*, *Aspergillus*, and *Acremonium* are capable of nitrate reduction.[44,47,52,53] Throughout production, the combined capacity of product microorganisms to generate nitrite is a key determinant of the levels of TSNAs and other nitrosamines in the final product.[37,54] During one fermentation study, nitrite levels generated by bacteria resulted in an almost threefold increase in TSNA levels.[44]

Pasteurization, or heat-treating of tobacco, is a very effective means of eliminating microorganisms during ST production, and thus preventing the reduction of nitrate to nitrite.[55] Indeed, Swedish snus, a pasteurized product, generally has lower nitrite and TSNA levels than nonpasteurized products, such as moist snuff and khaini.[56,57] It has been shown that a further increase in nitrite and TSNA levels can be prevented by cleaning fermentation equipment before use and "seeding" the fermentation process with non-nitrate-reducing bacteria.[33] Together, these observations provide additional support for the idea that the levels of some carcinogenic and toxic agents in tobacco products can be substantially reduced by changing tobacco processing methods.

Following fermentation, tobacco may still contain substantial amounts of nitrate, nitrite, and bacteria (including endospore-forming bacteria such as *Bacillus* spp.) that are active across a wide temperature and pH range.[33,44,58] Moreover, moist snuff products, including South African smokeless tobacco, contain nitrate, nitrite, and viable nitrite-producing bacteria (e.g., *Bacillus* spp.).[49,56,58] Bacteria capable of initiating various infections (*Pseudomonas* spp. and *Staphylococcus* spp.) and periodontal abscesses (*Atopobium* spp. and *Klebsiella oxytoca*) have also been isolated from tobacco used to make cigarettes.[48] Research on black South African nasal snuff users has found an association between the use of nasal snuff and chronic bronchitis, which can be caused by *Staphylococcus* spp.[49] Although conditions in ST products are favorable for the presence of bacteria, it is not known which strains of bacteria are most common in ST products.

Products from India, such as zarda, mishri, gutka, creamy snuff, and toothpowder, have elevated nitrate levels but lower levels of nitrite. In contrast, Indian khaini contains higher levels of nitrite and TSNAs.[57] Accumulated nitrite may contribute not only to the formation of TSNAs but also to other nitroso compounds, such as *N*–nitrosamino acids and volatile *N*–nitrosamines, in some ST products.[5] The high levels of nicotine and other alkaloids in *N. rustica*[19,21] may contribute to extreme levels of TSNAs such as are found in the Sudanese product toombak.[20,23]

Other Tobacco Processing Methods

Tobacco is processed differently during the manufacture of some forms of ST products. For example, Swedish snus, a snuff-like product, is made from pasteurized and air-cured tobacco that is not fermented. Pasteurization reduces or eliminates bacteria, including those that convert nitrate to nitrite, a key precursor for TSNAs.[55] Similar processing is used in most novel "spitless" U.S. products that are also called "snus" but are slightly different from the traditional Swedish snus. Because bacterial activity is very low in snus products, it is not surprising that snus contains much lower levels of nitrite and TSNAs than moist snuff made with fermented fire-cured tobacco that is not pasteurized,[56] and levels of nitrite and TSNAs do not increase during long-term storage of snus as they do with moist snuff.[33,59,60] Also, because snus does not contain fire-cured tobacco, the levels of total PAHs and volatile aldehydes are lower than those found in moist snuff.[56,61]

The Swedish snus industry voluntarily complies with the GothiaTek industry standard, which sets maximum levels for nitrite, TSNAs, NDMA (a volatile nitrosamine), benzo[*a*]pyrene (a representative carcinogenic PAH compound), five metals (cadmium, lead, arsenic, nickel, and chromium), and various agrichemicals.[55] The StarCured process, which may lower the levels of some carcinogens, was used to produce the dissolvables Stonewall and Ariva, which were discontinued by Star Scientific at the beginning of 2013. Although snus contains nicotine and toxicants at some level, maintenance of toxicants below certain thresholds demonstrates that the tobacco industry can use manufacturing controls to reduce the levels of certain toxicants in ST products.

Additives

After curing, aging, and fermentation, further steps for manufacturing smokeless products include cutting the tobacco to the proper width, adding other substances, and adjusting moisture and pH levels.[62] Manufactured ST products, particularly Western-style forms (e.g., moist snuff, snus) are known to contain flavoring agents, spices, fruit juices, sweeteners, salt, humectants, and alkaline agents.[5,63–67] Flavorings used include cocoa, licorice, rum, spice powders, extracts, oleoresins, individual flavor compounds (menthol, vanillin, etc.), and more than 60 different essential oils (such as wintergreen, cinnamon, ginger).[5,63] The most common flavor chemicals detected in 85 brands of ST, primarily moist snuff, were methyl salicylate, ethyl salicylate, benzaldehyde, citronellol, menthol, nerol, menthone, and caryopyllene.[68] Among many mint and wintergreen moist snuff brands, Chen and colleagues found high levels of methyl salicylate (18.5–29.7 milligrams per gram [mg/g]), ethyl salicylate (0.17–5.78 mg/g), and menthol (undetectable–5.25 mg/g).[69] Sweeteners added to ST include honey, molasses, saccharin, brown sugar, sugar, and xylitol. Humectants, which are added to maintain product moisture, include agents such as glycerol, glycerin, and propylene glycol.[5,63,64] Dissolvable tobacco products (Figure 3-2)

include ingredients such as flavorings, sweeteners, humectants, and alkaline agents, as well as fillers, coatings, binders, colorings, and preservatives.[65–67]

Cottage ST products made in the Middle East, Africa, and South-East Asia may contain ingredients such as edible oils, metallic silver, potassium nitrate, and soil (chapters 11–13).

Alkaline modifiers used in manufactured ST products are predominantly chemicals including sodium bicarbonate, ammonium bicarbonate, various metallic carbonates (calcium, sodium, and ammonium), and slaked lime (calcium hydroxide) (Figure 3-3).[5,63] Chemical alkaline agents (mostly slaked lime or sodium bicarbonate) are also used in the preparation of cottage products (e.g., toombak, nass, shammah) or custom-made ST (iqmik). In some rural or tribal areas, custom-made or cottage industry ST products are prepared with ashes from the burning of certain woods, plants, or fungi (for example, wood: willow, mamón, paricá; plants: *Aloe vera, Amaranthus,* grapevine; fungi: punk fungi *[Phellinus igniarius]*), which significantly increases product pH.[2,70,71] Unlike rapé products that are mildly acidic (lower pH), the type of rapé used by the Kaxinawás Indians, who live in eastern Peru and in the States of Amazonas and Acre in Brazil, includes ashes from the paricá tree (*Schizolobium amazonicum*).[72] Products that contain alkaline ashes, such as iqmik[41] and nass,[73] have extremely high pH levels (≥pH 11). The effects of pH on nicotine levels are discussed later in this chapter.

Non-Tobacco Plant Material

In several regions of the world, especially South Asia, the Middle East, and South America, tobacco is commonly combined with substantial amounts of non-tobacco plant material. In those regions, several premade ST products (gutka, mawa, mainpuri, and some zarda products) and custom-made products (betel quid, dohra, tombol) contain areca nut, the seeds of the Areca palm (*Areca catechu*) (Figure 3-3)[2,6,17,20] (see chapters 11–13). Products in South Asia often contain appreciable amounts of spices (cardamom, clove, camphor, mint, saffron, pepper) or other plant materials such as betel leaf (*Piper betle*) and catechu (*Acacia catechu*).[2,6,17] Alternatively, packets containing non-tobacco condiments, such as supari or pan masala (a mixture of spices, flavorings, and other ingredients) can be purchased separately and combined with tobacco prior to use. In South Asian and Mediterranean countries, custom-made ST products, such as betel quid, dohra, or tombol, are often handmade from tobacco or premade ST (kiwam, zarda, toombak) combined with other ingredients, such as alkaline agents, areca nut, spices, condiments, or other plant material (such as coconut), and rolled in a betel leaf.[2,5,6,17] Some forms of tombol, such as those used in Yemen, contain khat (*Catha edulis*) (Ghazi Zaatari, personal communication, 2012), a plant that has psychoactive properties.[74] In South America, rapé and other indigenous forms of nasal ST used in Brazil and Peru contain tobacco mixed with ingredients such as tonka bean (*Dipteryx odorata*), cinnamon powder, clove buds, camphor, sunflower, Peruvian cocoa, and possibly cassava (Figure 3-3)[75,76] (André Oliveira da Silva, personal communication, 2012).

Product Categorization Based on Constituents

Although ST products range from simple to highly complex mixtures of tobacco and other ingredients, all known products can be grouped by key product constituents (see Figure 3-4) into four broad categories:

- Category 1 products contain tobacco with little or no alkaline modifiers.
- Category 2 products contain tobacco and substantial amounts of alkaline agents.
- Category 3 products contain tobacco, one or more alkaline agents, and areca nut.
- Category 4 products contain tobacco mixed with other chemical or plant ingredients that exhibit additional bioactivity (such as stimulants).

(A similar scheme of categorizing ST products was first presented in *Smokeless Tobacco and Some Tobacco-specific* N-*Nitrosamines,* International Agency for Research on Cancer monograph 89.[2,p.34])

To extend this categorization, ST products can be grouped in categories based on ingredients listed on packaging, but further analysis using gas chromatography–mass spectrometry, infrared spectroscopy, and pH measurements can be used for confirmation or when product ingredient information is unavailable.[20]

Category 1 products can have a wide range of total nicotine, depending on the tobacco used, but because they have a pH of 7 or less, they generally have lower free nicotine. Category 2 products can have a wide range of total nicotine, depending on the tobacco used, but have an alkalinity greater than pH 7 and thus higher free nicotine values. Category 3 products generally contain an appreciable amount of areca nut, which decreases the tobacco content, thus the amounts of total nicotine are generally lower. These products also contain areca-related compounds, such as arecoline, and other compounds that can contribute to the formation of areca-specific nitrosamines; the pH of this category varies based on this composition.[6,20] Category 4 products contain nicotine as well as other compounds like stimulants, flavoring agents, or spices. Some of these additives are toxicants, or carcinogens—for example, coumarin (a liver toxicant), which is found in tonka bean, cinnamon, and other substances. Products in category 4 have also been found to contain camphor, a cardiac toxicant. Figure 3-4 shows key ingredients and chemical markers for the four categories as well as products in each category. This categorization can help illuminate the relationship between ST product ingredients and the resulting levels of addiction, toxicity, and carcinogenicity associated with their use.

Figure 3-4. Smokeless tobacco product categorization by key constituents

Notes: Tombol (Category 4) shown on betel leaf prior to addition of noura (alkaline agent), fofal (areca nut), and tobacco. This figure groups products with similar constituents for further investigation and research and highlights constituents of concern. This categorization, which is based on product knowledge at the time of publishing, does not reflect the safety or the addictive properties of a product or product type. The composition of products of a given type can vary such that seemingly similar products may fit into different categories. Detailed product information is given in Appendix A.
Sources: All images except tombol with khat courtesy of Clifford Watson, Centers for Disease Control and Prevention. Image of tombol with khat courtesy of Dr. Mazen Abood Bin Thabit, University of Aden.

Toxic and Carcinogenic Agents in Smokeless Tobacco Products

In general, tobacco, and thus ST products, contains roughly 4,000 chemical constituents,[77] including nicotine and other toxicants and carcinogens, which are believed to play a crucial role in causing the negative health effects associated with ST use.[78–80] The U.S. Food and Drug Administration has also established a list of 93 harmful and potentially harmful constituents for regulatory purposes in the United States.[81] Based on epidemiologic evidence and animal carcinogenicity data, the IARC has classified ST as a Group I carcinogen: carcinogenic to humans.[2] Moreover, the IARC has classified two TSNAs present in ST, namely *N'*-nitrosonornicotine (NNN) and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), as Group 1 carcinogens. A list of carcinogens present in ST products based on the 2012 IARC list[37] is shown in Table 3-2.

Among the carcinogens in ST, TSNAs are considered the most potent because of their concentration and carcinogenicity.[32,82,83] The two main carcinogenic compounds in this group, NNK and NNN, are believed to be involved in the induction of oral cancer in ST users.[32] Other carcinogens in ST include *N*–nitrosamino acids, volatile *N*–nitrosamines, PAHs, volatile aldehydes, inorganic compounds, metals, and metalloids.[5,36,84,85] In addition, areca nut, a constituent of products such as mawa, betel quid, tamol (fermented areca nut), and mainpuri, is also classified as an IARC Group 1 carcinogen.[6] Some ST products contain plant materials (tonka bean, cinnamon) that have high levels of coumarin, which is moderately toxic to the liver and kidneys.[86,87]

The following sections of this chapter discuss some of the most important groups of ST constituents in greater detail: their origin, factors affecting their formation, and their reported levels in ST products used globally.

Nicotine and Free Nicotine

Nicotine in tobacco products leads to addiction and persistent use of tobacco products, and thus continuous exposure to numerous toxic and carcinogenic agents, which results in devastating health consequences and premature deaths worldwide.[88] Additionally, nicotine is a major precursor of carcinogenic NNK and NNN.[2] Nicotine has also been associated with fetal toxicity and an increase in cardiovascular risk factors.[88]

In an ST product, the entire amount of nicotine present is referred to as total nicotine, which includes both free (also called un-ionized or un-protonated) and bound (also called ionized and mono-proponated or di-proponated) forms of nicotine (Table 3-3). Free nicotine is of importance because it is the uncharged form that crosses cell membranes most readily. The amount of free nicotine in a product can be calculated using the Henderson–Hasselbalch equation.[89] The fraction of nicotine present as free nicotine depends on the pH of the ST product: A higher pH results in a greater proportion of nicotine being present as free nicotine, which is the most biologically available form.[90–93]

Table 3-2. Substances identified in smokeless tobacco products and their categorization as carcinogens

Compound/substance	IARC group*	Source†
Tobacco-specific nitrosamines		
N'-nitrosonornicotine + 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone {NNN+NNK}	1	IARC 2007 (2)
Volatile *N*-nitrosamines		
N-Nitrosodimethylamine (NDMA)	2A	IARC 2007 (2)
N-Nitrosopyrrolidine (NPYR)	2B	IARC 2007 (2)
N-Nitrosopiperidine (NPIP)	2B	IARC 2007 (2)
N-Nitrosomorpholine (NMOR)	2B	IARC 2007 (2)
N-Nitrosodiethanolamine (NDELA)	2B	IARC 2007 (2)
Nitrosamino acids		
N-Nitrososarcosine (NSAR)	2B	IARC 2007 (2)
Inorganic compounds		
Nitrate (under conditions resulting in endogenous nitrosation)	2A	Stepanov et al. 2008 (56)
Nitrite (under conditions resulting in endogenous nitrosation)	2A	Stepanov et al. 2008 (56)
Volatile aldehydes		
Formaldehyde	1	Stepanov et al. 2008 (56)
Acetaldehyde	2B	Stepanov et al. 2008 (56)
Fermentation-related compound		
Ethyl carbamate (urethane)	2A	Faizi et al. 2010 (157)
Mycotoxins		
Aflatoxins (mixtures of)	1	Varma et al. 1991 (152)
Aflatoxin M1	2B	Varma et al. 1991 (152)
Ochratoxin A	2B	Varma et al. 1991 (152)
Polycyclic aromatic hydrocarbons		
Benzo[*a*]pyrene (BaP)	1	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
Dibenz[*a,h*]anthracene (DBahA)	2A	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
Benz[*a*]anthracene (BaA)	2B	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
Benzo[*b*]fluoranthene (BbF)	2B	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
Benzo[*j*]fluoranthene (BjF)	2B	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
Benzo[*k*]fluoranthene (BkF)	2B	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
Dibenzo[*a,i*]pyrene (DBaiP)	2B	Hearn et al. 2013 (41)
Indeno[*1,2,3-cd*]pyrene (IcdP)	2B	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
5-Methylchrysene (5MC)	2B	Hearn et al. 2013 (41)
Naphthalene (NAP)	2B	Hearn et al. 2013 (41), Stepanov et al. 2010 (61)
Plant material		
Areca nut	1	IARC 2004 (6)
Betel quid (with or without tobacco)	1	IARC 2004 (6)

Compound/substance	IARC group*	Source†
Metals/metalloids		
Arsenic	1	Pappas et al. 2011 (26)
Beryllium	1	Pappas et al. 2011 (26)
Cadmium	1	Pappas et al. 2011 (26)
Cobalt	2B	Pappas et al. 2011 (26)
Chromium VI	1	Pappas et al. 2011 (26)
Lead/Inorganic lead compounds	2B/2A	Pappas et al. 2011 (26)
Nickel compounds	1	Pappas et al. 2011 (26)
Polonium-210	1	Syed et al. 2009 (158)

*IARC = International Agency for Research in Cancer, 2012 (37).
†Numbers in parentheses correspond to full citations in the References at the end of this chapter.
Notes: All carcinogen designations are current as of October 2012 (IARC [37]). Includes agents that are added or that can be absorbed from the soil, result from microbial contamination, or form chemically. Some smokeless products contain nutmeg, which contains methyleugenol (IARC Group 2B) and safrole (IARC Group 2B). The concentration of these compounds would depend on the chemical composition of the nutmeg and the amount of nutmeg used in the product. The compound 3-(*N*-nitrosomethylamino) propionitrile (MNPN), which is an IARC 2B carcinogen, can be formed during the chewing of areca nut or products/preparations containing areca nut.

Table 3-3. Forms of nicotine: Chemical structures, ionic charge, alternative names, and health implications

Forms of nicotine (Ionic charge)	Di-protonated (++)	Mono-protonated (+)	Unprotonated (Neutral)
Chemical structure			
	Ionized	Ionized	Un-ionized
	Total nicotine is the combination of the ionic forms existing at a given pH.		
Alternative names	Not applicable*	Salt form Tobacco nicotine Protonated nicotine	Free nicotine Free-base nicotine Non-protonated nicotine
Health implications	Doubly charged nicotine is not prevalent at pH levels typically found in smokeless tobacco products (generally greater than pH 5.5).	For singly charged nicotine, absorption across cellular membranes is not efficient. This is the predominant form in unprocessed tobacco.	Uncharged nicotine rapidly crosses cellular membranes and diffuses into the bloodstream. Smokeless tobacco products with higher levels of this form of nicotine may be more addictive.

*A few smokeless tobacco products (plug, twist, zarda, and some forms of rapé) have a pH below pH 5.5 and would contain some di-protonated nicotine.
Note: The fraction of nicotine present in a particular ionic form is pH-dependent. Di-protonated and mono-protonated nicotine is present at acidic conditions below pH 5.5. In the majority of smokeless tobacco products, a combination of mono-protonated and unprotonated nicotine is present. The fraction of nicotine in the unprotonated (free) form increases as pH increases above pH 5.5.

The pH of unprocessed tobacco is generally slightly acidic (pH approximately 5–6.5)[43]; thus, generally less than 5% of the nicotine is present as free nicotine. During ST production, various alkaline agents are added that boost pH and increase the amount of free nicotine that can be delivered to the user. Some products, such as iqmik or nass,[41,73] are highly alkaline (pH 11–12; Figure 3-6); hence, greater than 99% of nicotine is present as free nicotine in these products.

The common practice of adding alkaline agents to ST products increases pH and thus free nicotine levels, which increases nicotine emissions and exposure, subsequently resulting in adverse health effects. Products with similar total nicotine concentrations can contain a wide range of free nicotine concentrations, depending on pH[2,94] (Figure 3-5).

Figure 3-5. The effect of pH on free nicotine amounts (in products produced by the same manufacturer, with equivalent amounts of total nicotine and product moisture)

Abbreviation: mg/g = milligram per gram.
Notes: An increase of 1.2 pH units increases free nicotine by 433%. Each square or diamond symbol represents a different product. Percent moisture = 51.9–53.9%; trends remain the same when expressed on a dry weight basis.
Source: Richter et al. 2008 (94).

Clinical studies indicate that absorption of nicotine through cell membranes is more rapid for products with higher pH than for products with lower pH.[90,92,95] Products with higher free nicotine concentrations generate faster spikes in blood nicotine concentrations and could cause such products to be more addictive.[96,97] Addition of alkaline agents and the resulting pH increase in some products may play a decisive role in the targeted delivery of nicotine (Figure 3-5). The availability of products spanning a

wide pH range may make it easier for ST users to move on to products with increasingly higher nicotine levels (i.e., the graduation strategy).[96,98]

The wide ranges of pH, total nicotine, and free nicotine levels in various products have been clearly demonstrated in numerous studies.[2,12,20,41,73,91,93,94,99–102] Combined, these studies include more than 20 product types (such as zarda, chimó, gutka) from 12 countries. Products with the lowest pH include chewing tobacco[2,73,101] and some forms of dry snuff, zarda, and snus[20,101] (Figure 3-6). Toombak, khaini, chimó, naswar, tuiber (tobacco water), and some varieties of African snuff and gutka have pH values generally between pH 8 to pH 10[2,20,41,73,99,100,102]; products such as iqmik and nass have the highest known values (pH 11.0 to pH 11.8).[41,73]

Figure 3-6. pH values and % free nicotine in selected smokeless tobacco products from 11 countries in 5 World Health Organization regions

Country abbreviations: B = Bangladesh; I = India; P = Pakistan; S = Sudan; N = Nigeria; SA = South Africa; SW = Sweden; UZ = Uzbekistan; VZ = Venezuela; BZ = Brazil; US = United States.
World Health Organization regions: SEAR = South-East Asia Region; EMR = Eastern Mediterranean Region; AFR = African Region; EUR = European Region; AMR = Region of the Americas.
Note: Each diamond represents the pH value for a single product; the rectangles are added to aid in visualization.
Sources: [a]Gupta and Sreevidya 2004 (100); [b]Brunnemann et al. 1985 (73); [c]Hearn et al. 2013 (41); [d]Stanfill et al. 2011 (20); [e]Stanfill, Oliveira da Silva, unpublished results, 2013: [f]Richter et al. 2008 (94); [g]Stepanov et al. 2005 (57); [h]Rainey et al. 2011 (11).

In a 2010 study of 30 naswar products, reported pH values ranged from pH 8.10 to pH 8.96.[102] Extensive surveys in the United States found pH values between pH 5.54 and pH 8.62 for moist snuff.[2,91,93,94] Among 74 brands of chewing tobacco sold in Massachusetts, the pH values ranged from pH 5.07 to

pH 6.91; for 33 brands of dry snuff the values ranged from pH 5.50 to pH 7.61. The pH for 106 brands of moist snuff ranged from pH 5.41 to pH 8.38,[2,103] and a study of 40 moist snuff brands reported a similar range (pH 5.54 to pH 8.62).[94] Several zarda products combined with supari mixes had pH values ranging from pH 8.56 to pH 8.90.[100]

The content of nicotine and other alkaloids in growing tobacco plants is affected by numerous factors, including genetics, geographic location, climate, fertilization rates, stalk and leaf position, and maturity of the leaf. The wide variation of nicotine levels in various ST products used worldwide depends on the method of tobacco curing (air-cured, fire-cured, or flue-cured), variety within the type of tobacco, curing processes, manufacturing techniques, and tobacco blending approaches used.[104,105] Because ST products differ in moisture content, which affects the amount of tobacco present in one gram of product, constituent levels are often reported per gram dry weight. This chapter presents nicotine values found in the product "as is" or per wet weight. While this approach could have limitations when applied to some products such as dry snuff, it makes it possible to compare the greatest number of values among published reports. All values are expressed on a wet weight basis unless noted otherwise.

Most ST products have a total nicotine content of 20 mg/g or less, but products such as nass, gul powder, chewing tobacco (India), iqmik, zarda, toombak, chimó, and twist tend to have the highest total nicotine concentrations, as high as 95 mg/g.[2,20,23,41,61,73,94,99,101] Products that contain a considerable amount of areca nut, such as gutka, mawa, and mainpuri, had the lowest total nicotine values due to tobacco dilution with other material based on weight (0.16–4.20 mg/g).[2,20,73,101] Moist snuff, the most popular form of ST in the United States, had values that ranged from 7.06 to 24.3 mg/g in one study as reported by IARC[2,103] and from 4.42 to 25.0 mg/g in another study.[94] A 2010 study of 30 brands of naswar from a Pakistani market found total nicotine values ranging from 7.35 to 26.7 mg/g.[102] The nicotine values for toombak varied widely (7.0–95 mg/g).[23] The high nicotine concentrations found in many samples of toombak may be due to the use of *N. rustica* tobacco, which has higher concentrations of nicotine than *N. tabacum*.[20,23] Other high total nicotine values were observed for dry snuff (U.S.) (4.70–24.8 mg/g), iqmik (38.3–38.9 mg/g), nass (11.8–28.7 mg/g), chimó (5.29–30.2 mg/g), gul powder (33.4–34.1 mg/g), twist tobacco (21.6–40.1 mg/g), and zarda (14.6–65.0 mg/g).[20,41,73,101,102]

One global survey investigated *N. rustica* tobacco and its higher nicotine content.[20] The presence of *N. rustica* was indicated by elevated nicotine concentrations and comparisons of infrared spectra of the product with known *N. rustica* samples. In one toombak sample containing *N. rustica,* nicotine concentrations were almost three times higher than in the toombak samples that contained *N. tabacum* (28.2 mg/g vs. 10.2 mg/g). Nicotine in several other *N. rustica* products, including gul, zarda, and tobacco leaf (Bangladesh), ranged between 19.7 and 33.4 mg/g. Some chimó samples had high nicotine values (27.5–30.1 mg/g), but the tobacco type could not be determined conclusively.[20] Products that have high pH values (due to alkaline agents) and contain the nicotine-enriched *N. rustica* can deliver extremely high levels of free nicotine.[20,23,41,73]

An analysis of ST products across several countries found that free nicotine amounts were generally less than 10 mg/g, with the exception of chimó (1.32–30.1 mg/g), gul powder (29.1–31.0 mg/g), and naswar (8.84–13.2 mg/g).[20] Free nicotine concentrations in moist snuff products sold in the United States ranged from 0.01 to 7.81 mg/g[91] (Table 3-4). Products that tended to have the lowest levels of free nicotine

included gutka (handmade, cottage-made, and manufactured: 0.12–3.33 mg/g), tobacco leaf (0.15 mg/g), zarda (0.05–0.63 mg/g), mawa (0.11 mg/g), mainpuri (0.38 mg/g), and South African and Swedish snus (0.29–2.03 mg/g).[20]

Table 3-4. Ranges of moisture content, pH, free nicotine, total nicotine, and 5 TSNAs in 39 top-selling brands of U.S. moist snuff

Constituent	Minimum value	Brand	Maximum value	Brand
Moisture, %	27.4	Hawken Rough Wintergreen	54.5	Rooster Long Cut Bold Wintergreen
pH	5.54	Hawken Rough Wintergreen	8.62	Kodiak Ice Long Cut Regular
Free nicotine, %	0.3	Hawken Rough Wintergreen	79.9	Kodiak Ice Long Cut Regular
Total nicotine (mg/g wet)	4.42	Hawken Rough Wintergreen	25.0	W.B. Cut Regular
Free nicotine (mg/g wet)	0.01	Hawken Rough Wintergreen	7.81	Kodiak Ice Long Cut Regular
NNK (μg/g wet)	0.382	Red Seal Long Cut Wintergreen	9.95	Skoal Key
NNN (μg/g wet)	2.20	Copenhagen LC Regular	42.6	Skoal Key
NAT (μg/g wet)	0.938	Hawken Rough Wintergreen	31.9	Skoal Key
NAB (μg/g wet)	0.123	Red Seal Fine Cut Wintergreen	4.24	Skoal Key
NNAL (μg/g wet)	0.021	Copenhagen LC Regular	1.41	Skoal Key
Total TSNAs (μg/g wet)	4.87	Red Seal Long Cut Wintergreen	90.0	Skoal Key

Abbreviations: For nicotine values, mg/g = milligram per gram, and μg/g = microgram per gram. For TSNAs (tobacco-specific nitrosamines): NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NAT = *N'*-nitrosoanatabine; NAB = *N'*-nitrosoanabasine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol.
Note: In the original report, one herbal brand (Oregon Mint Snuff) did not contain detectable levels of nicotine and was excluded from the data presented in this table.
Source: Richter et al. 2008 (94).

Several other reports published since 2000 have provided information on pH and nicotine content in ST products used in India, South Africa, and Pakistan. A report to the World Health Organization (WHO) South-East Asia Regional Office showed that 20 ST products used in India had pH values between pH 5.2 and pH 10.1, and the total nicotine content ranged from 1.24 to 10.2 mg/g product, with free nicotine values ranging from 0.03 to 4.06 mg/g.[100] A report on moist snuff products used in South Africa showed the pH of these products to range between pH 7.1 and pH 10.1, and total nicotine content to vary between 11.6 and 29.3 mg/g dry weight.[106] In the 30 brands of naswar from the Pakistani market, total nicotine ranged from 7.35 to 26.7 mg/g, and free nicotine levels ranged from 5.52 to 21.4 mg/g. The pH averaged 8.56,[102] resulting in an average 77% of total nicotine in these products being present in free form.

Of the ST products available on the U.S. market, moist snuff contains the highest level of free nicotine. According to 2003 data from the Massachusetts Department of Public Health (MDPH) as reported by IARC, the average pH of moist snuff was pH 7.43, compared to pH 6.36 for dry snuff and pH 5.82 for chewing tobacco.[2,103] The mean value for free nicotine in moist snuff was 3.52 mg/g, which is five times

higher than the proportion of free nicotine in dry snuff (0.71 mg/g) and 32 times higher than the free nicotine level in chewing tobacco (0.11 mg/g). In addition to the differences by the type of smokeless product, the MDPH report showed that pH and free nicotine in U.S. products vary by brand and over time. Thus, of the most popular brands of moist snuff, Kodiak has had the highest pH since 1999, and the free nicotine level in this brand has increased greatly, from 35.2% to 60.3% of total nicotine over a six-year period (1997–2003). In contrast, average nicotine levels in Copenhagen and Skoal decreased during this time.[2,103]

A 2008 survey of 39 top-selling brands of U.S. moist snuff showed a more than fivefold variation in total nicotine levels and a more than 500-fold range in free nicotine.[94] The ranges for moisture content, pH, total/free nicotine, and TSNA levels in this sample of U.S. moist snuff are summarized in Table 3-4. A 2003 study described nicotine levels for some of the brands that were later included in the 2008 study.[89] Comparing the data for the two time points shows the following ranking of differences in free nicotine content for the U.S. moist snuff brands: Hawken Wintergreen had the lowest free nicotine content in both studies (0.01 mg/g wet weight in 2003 and 2008), followed by Skoal Bandits Mint (0.97 mg/g in 2003 and 0.37 mg/g in 2008), Copenhagen Long Cut (2.04 mg/g in 2003 and 5.67 mg/g in 2008), and Kodiak Wintergreen (5.81 mg/g in 2003 and 7.14 mg/g in 2008). This observation supports the idea that moist snuff manufacturers target particular brands to specific consumers by controlling free nicotine levels in their products, most likely as a part of the continued use of the graduation strategy.[98]

In 2012, nicotine levels were reported for a large sample of novel oral spit-less and dissolvable ST products being marketed to U.S. smokers as an alternative to smoking.[12,107] A total of 117 samples were analyzed, including various flavors of Marlboro Snus (rich, mild, spearmint, peppermint) and Camel Snus (mellow, frost, robust, winterchill), as well as dissolvable products Camel Orbs (mellow, fresh), Camel Sticks (mellow), Camel Strips (fresh), Ariva (java, citrus, cinnamon, wintergreen), and Stonewall (java, wintergreen) (Table 3-5). Overall, the results of these analyses supported previous observations that, with the exception of Camel Snus, these products generally contain relatively low amounts of free nicotine compared with most traditional U.S. moist snuff brands.[12] Although the dissolvable Camel products have very low total nicotine levels, they have a higher pH and thus a larger portion of free nicotine, exceeding the amount of free nicotine in Marlboro Snus and the dissolvable brands Ariva and Stonewall.[12]

The varying levels of free nicotine across these novel products may affect how acceptable they are to current or new tobacco users. On one hand, smokeless products with higher nicotine content may be more effective at satisfying smokers' cravings than products with less nicotine,[108,109] and this may in part explain the greater popularity of Camel Snus compared to Marlboro Snus.[110] On the other hand, products that are low in free nicotine could be more easily accepted by young people initiating tobacco use.

Table 3-5. Moisture content, pH, total/free nicotine, and TSNA concentrations in novel U.S. smokeless tobacco products

Brands (number of samples)	Moisture content, %	pH	Total Nicotine mg/g wet	Free nicotine		NNN µg/g wet	NNK µg/g wet
				% of total	mg/g wet		
Marlboro Snus (71)	16.6	6.75	20.5	5.2	0.88	0.36	0.13
Camel Snus (36)	29.6	7.42	11.6	21.4	2.47	0.62	0.31
Camel Orbs (4)	13.0	8.10	3.0	54.5	1.65	0.21	0.28
Camel Sticks (3)	13.1	7.76	3.9	35.8	1.44	0.26	0.31
Camel Strips (3)	17.7	7.88	2.7	41.9	1.11	0.15	0.22
Ariva (4)	2.5	6.92	5.0	7.3	0.37	0.09	0.07
Stonewall (2)	3.8	7.10	6.9	10.6	0.73	0.12	0.06

Abbreviations: TSNA = tobacco-specific nitrosamines; NNN = *N'*-nitrosonornicotine; NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; mg/g = milligram per gram; µg/g = microgram per gram.
Note: The dissolvables Ariva and Stonewall were discontinued at the beginning of 2013 by Star Scientific, Inc.
Source: Stepanov et al. 2012 (12).

Tobacco-Specific Nitrosamines

TSNAs are commonly considered among the most potent carcinogens in ST products.[2,32] A total of five TSNAs have been identified in tobacco products: *N'*-nitrosonornicotine (NNN), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL), *N'*-nitrosoanatabine (NAT), and *N'*-nitrosoanabasine (NAB). NNN, NNK, and NNAL are among the more common TSNAs and are the most carcinogenic.[2,32,82] The carcinogenicity of NNN and NNK has been reviewed and established by the IARC,[2] and the pulmonary and pancreatic carcinogenicity of NNAL has been demonstrated in a few animal studies (reviewed in Hecht 1998[32]). NNN, NNK, and NAT generally occur in greater quantities than the other TSNAs.[20,32,56,57,59,85,94,111,112]

Because of NNAL's potential for carcinogenicity, the levels of NNAL present are also important, but these have been reported in smokeless products only occasionally.[20,94,113,114] However, regardless of the sparse reporting, NNAL carcinogenicity should always be taken into consideration because it is metabolically formed from NNK in ST users. Moreover, NNAL is commonly utilized as a biomarker of exposure to carcinogenic NNK.[115]

In the growing plant, TSNAs are not generally present at elevated levels,[21,22,35] but they can accumulate to extremely high levels in certain products (e.g., toombak).[23] The levels of TSNAs present in ST products are attributable to numerous factors, including plant genetics (tobacco species/varieties), growth factors (nitrate levels, climate), cultivation practices (fertilization rates, harvesting methods), processing (curing, fermentation), and storage conditions[2,27,114,116–121] (Figure 3-7). Many studies have investigated techniques for reducing TSNA levels in tobacco.[121–123] One study by Wiernik and colleagues proposed a method of quick-drying tobacco at 70°C for 24 hours to remove excess water and reduce growth of microorganisms, which resulted in decreased nitrite and TSNA levels.[34] Drying tobacco quickly at this stage of curing reduces the microbial activity but lowers tobacco leaf quality.

Figure 3-7. Plant-related absorption, microbiological, and chemical steps involved in the formation of tobacco-specific nitrosamines

Abbreviations: NO_3^- = nitrate; NO_2^- = nitrite; NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone.
Note: Nitrosation is the chemical reaction of nitrite with various secondary and tertiary amines. This reaction produces nitrosamines, including tobacco-specific nitrosamines, nitrosoamino acids, volatile nitrosamines, and areca-specific nitrosamines.

Nitrate, nitrite, and alkaloids are present in ST products at the time of purchase, and prolonged storage can lead to further accumulation of TSNAs, with larger amounts accumulating if storage occurs at elevated temperatures and humidity.[121,124] Adding nitrate-containing agents could contribute to increased levels of TSNAs in ST products. One product, Ghana traditional snuff, contains tobacco mixed with potassium nitrate (saltpeter)[125] (chapter 12).

Worldwide, the use of different tobacco types, processing techniques, and tobacco blending approaches leads to wide variation of TSNA levels in various ST products. Several comparative international reports[2,20,73,99] and individual studies on ST products used in different countries[12,23,57,94,112] provide an informative view of the variations in TSNA levels among countries and product types. Concentration data in this section are expressed as microgram per gram (µg/g) wet weight, which allows for comparison of a larger global dataset of ST products.

The highest levels of TSNAs ever observed in tobacco products have been found in Sudanese toombak. Calculations based on dry weight values and moisture content reported by Idris and colleagues[23] reveal that NNN content in some samples of this product were as high as 2,860 µg/g, and NNK content as high as 7,300 µg/g. Lower levels of TSNAs were reported in 1985 by Brunnemann and colleagues for moist snuff samples purchased in Canada; total TSNA was up to 115 µg per gram of product.[73] Some tobacco products sold in India also have very high TSNA levels, but Stepanov and colleagues[57] reported a large variation in TSNA levels among Indian products. The largest quantities of TSNAs were found in khaini; amounts were also relatively high in zarda products, but the levels of these carcinogens in gutka were

relatively low. Stepanov and colleagues found that, overall, total TSNA content varied from 0.04 to 127.93 µg/g product.[57] Such a wide range is not surprising given the variety of ST products and approaches to tobacco processing and product manufacturing used in India.

TSNA levels also vary widely in moist snuff products sold in the United States, although they do not reach the levels seen in Indian products. A comprehensive survey of moist snuff conducted by the Centers for Disease Control and Prevention (CDC)[94] showed an 18-fold variation in TSNA content among 39 top-selling U.S. brands of moist snuff (see Table 3-4 for a summary). The levels of NNN ranged from 2.2 to 42.6 µg/g; levels of NNK ranged from 0.38 to 9.9 µg/g. The survey also recorded information about NNAL levels in the studied brands, and an almost 70-fold difference was found in NNAL content among brands. Thus, even though TSNA levels had declined overall in some U.S. smokeless tobacco products since the 1980s,[116] some U.S. moist snuff brands still contained high levels of these carcinogens as of 2008.

TSNA levels in snus sold in Sweden are reported to have declined by about 85% over a 20-year period. In 2002, amounts of NNN in 27 samples of Swedish snus averaged 0.49 µg/g product, whereas the NNK amounts averaged 0.19 µg/g product.[112,126] These levels are among the lowest seen in commercial ST products. The oral spit-less and dissolvable ST products marketed in the United States after about 2008 also contain relatively low levels of TSNAs.[12,56] According to an analysis of 117 samples of these products reported in 2012, total TSNAs (the sum of NNN, NNK, NAT, and NAB) ranged from 0.53 µg/g in dissolvable Camel Strips to 1.19 µg/g in Camel Snus.[12] Thus, considerable variation of TSNA levels has been observed even in this low-TSNA category.

The most current and comprehensive analysis of international samples showed wide variation in TSNA levels in more than 53 products from 9 countries reported in 2011[20] (Table 3-6). The concentration of total TSNAs (that is, the sum of NNK, NNN, NAT, NAB, and NNAL) in the products ranged from 0.084 to 992 µg/g. As mentioned earlier, the highest NNK concentrations were found in Sudanese toombak and dry zarda (Bangladesh) (3.84 µg/g). The highest NNN concentrations were observed also in toombak (Sudan), dry zarda (Bangladesh), khaini (India), and handmade gutka (India). Handmade gutka and mawa from Pakistan had the lowest NNK concentrations. The study found that NNAL levels ranged from 0.004 to 6.77 µg/g, with the highest NNAL concentrations in toombak, dry zarda, and khaini.[20] Extremely high concentrations of TSNAs were found in saliva from toombak users.[23,127,128] Given the high carcinogenic potency of NNN and NNK, it is not surprising that over 50% of oral cancers in Sudanese men are attributed to the use of toombak or other oral products.[5,128–130]

Table 3-6. Ranges of pH, free nicotine, total nicotine, and 5 TSNAs in 53 international smokeless tobacco products

Constituent	Minimum value	Brand or type	Maximum value	Brand or type
pH	5.22	Baba Zarda120	10.1	Toombak, sample 2; Super Taxi Snuff
Free nicotine, %	0.16	Baba Zarda120	99.1	Toombak, sample 2
Total nicotine (mg/g wet)	0.16	Mawa	34.1	Mawa
Free nicotine (mg/g wet)	0.11	Mawa	31.0	Eagle Gul Powder
NNK (μg/g wet)	0.004	Mawa	516	Toombak, sample 5
NNN (μg/g wet)	0.045	Gutka (handmade, Karachi)	368	Toombak, sample 5
NAT (μg/g wet)	0.014	Gutka (handmade, Karachi)	59.6	Toombak, sample 5
NAB (μg/g wet)	0.005	Gutka (handmade, Karachi)	41.5	Toombak, sample 5
NNAL (μg/g wet)	0.004	Mawa	6.77	Toombak, sample 5
Total TSNAs (μg/g wet)	0.084	Gutka (handmade, Karachi)	992	Toombak, sample 5

Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NAT = *N'*-nitrosoanatabine; NAB = *N'*-nitrosoanabasine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol.
Notes: Values for nicotine (total and free), mg/g wet = milligrams per gram as received (wet weight). Values for TSNAs (tobacco-specific nitrosamines, NNN, NNK, NAT, NAB and NNAL), μg/g wet = micrograms per gram as received (wet weight).
Source: Stanfill et al. 2011 (20).

Metals and Metalloids

Metals and metalloids are naturally present in tobacco, and amounts of these substances in tobacco are influenced by soil pH, soil composition, and industrial contamination.[131,132] Smokeless tobacco products have been reported to contain detectable levels of several metals that are classified as IARC Group 1 carcinogens (arsenic, beryllium, chromium VI, cadmium, nickel compounds, polonium-210) or Group 2B carcinogens (e.g., cobalt, lead).[133] A review of studies of ST products from Ghana, Canada, India, and the United States found detectable concentrations of arsenic (0.1–3.5 μg/g), beryllium (0.01–0.038 μg/g), chromium (0.71–21.9 μg/g), cadmium (0.3–1.88 μg/g), nickel (0.84–13.1 μg/g), lead (0.23–13 μg/g), and cobalt (0.056–1.22 μg/g).[26] A report of metals values in Pakistani naswar showed detectable levels of arsenic (0.15–14.04 μg/g), chromium (0.8–54.05 μg/g), cadmium (0.25–9.2 μg/g), nickel (2.2–64.85 μg/g), lead (12.4–111.15 μg/g), and even higher levels of several other metals.[102]

Some ST products also contain mercury, a systemic toxicant, and barium, a dermal irritant,[26,125,134,135] and metals such as aluminum and chromium, which may cause biologic sensitization.[26,125,136] The potential for exposure to several of the toxic metals listed above (barium, beryllium, cadmium, cobalt, nickel, and lead) was demonstrated by determining how much of these metals transferred from tobacco to artificial saliva.[136]

The amount of copper in ST products is also of interest. The copper content of areca nuts is higher than that found in other nuts.[137] A study of seven ST product types from India (zarda, creamy snuff, khaini, etc.) revealed very high levels of copper in four gutka products (237–656 μg/g) compared with other gutka products or other types of ST products (0.012–36.1 μg/g).[135] Areca nut use has been linked to oral submucous fibrosis (OSF), a condition that affects the mouth, pharynx, and esophagus. It has been suggested that copper upregulates lysyl oxidase, resulting in the excessive cross-linking and accumulation of collagen that occurs in OSF.[137]

Among the previously mentioned GothiaTek standards set for the Swedish tobacco industry are guidelines for the allowable levels of metals in Swedish snus: cadmium (1.0 μg/g), lead (2.0 μg/g), arsenic (0.5 μg/g), nickel (4.5 μg/g), and chromium (3.0 μg/g). The average levels of metals in Swedish snus in 2009 were low: cadmium (0.6 μg/g), lead (0.3 μg/g), arsenic (0.1 μg/g), nickel (1.3 μg/g), and chromium (0.8 μg/g),[55] which demonstrates that the levels of metals in ST can be monitored and held below certain limits.

Polycyclic Aromatic Hydrocarbons

Compounds such as polycyclic aromatic hydrocarbons (PAHs), phenols, and volatile aldehydes are formed from burning wood and sawdust.[42,61] During fire curing, tobacco is exposed to this wood smoke, and these substances can be deposited on the curing leaf. Indeed, levels of PAHs and phenols tend to be higher in tobacco that is fire-cured rather than air-cured.[21,22,41,43] Products made with fire-cured tobacco (e.g., moist snuff) have higher levels of PAHs, including PAHs that are IARC Group 1 or 2 carcinogens, than products such as snus, which do not contain fire-cured tobacco.[56,61]

Ten PAH compounds have been designated as IARC carcinogens or potential carcinogens (see Table 3-2): in Group 1, benzo[*a*]pyrene (BaP); in Group 2A, dibenz[*a,h*]anthracene; and in Group 2B, benzo[*b*]fluoranthene, benzo[*j*]fluoranthene, benzo[*k*]fluoranthene, dibenzo[*a,i*]pyrene, indeno[*1,2,3-cd*]pyrene, 5-methylchrysene, naphthalene, and benz[*a*]anthracene.[37] All of these compounds have been found in smokeless tobacco.[61]

Among U.S. products, total PAH levels (that is, the sum concentration of 23 PAH compounds) in moist snuff that contained fire-cured tobacco ranged between 921 and 9,070 nanograms per gram of product (ng/g), which was generally higher than levels found in snus that did not contain fire-cured tobacco (660–1,100 ng/g).[61] Overall, among products with detectable levels of BaP, moist snuff had higher BaP levels (9.7–44.6 ng/g) than snus (3.0–12.3 ng/g); however, 41% of the snus brands had BaP levels below the detectable limit of 1.6 ng/g. The levels of naphthalene in moist snuff that contained fire-cured tobacco (409–1,110 ng/g) were comparable to naphthalene amounts in snus that was made with air-cured tobacco (636–1,065 ng/g). When naphthalene was excluded from the total PAH concentration, the remaining PAHs in moist snuff (145–8,120 ng/g) were higher than those found in snus (21–213 ng/g). One brand of moist snuff, Hawken Long Cut Wintergreen, which could be viewed as a starter brand, contained only 145 ng/g of PAHs other than naphthalene (776 ng/g).[61] It is clear that amounts of PAHs can be reduced by eliminating or reducing the use of fire-cured tobaccos.

Areca Nut

Areca nut, an ingredient in some ST products, is an IARC Group 1 carcinogen.[133] Areca nuts are seeds from the Areca palm (*Areca catechu*), which is native to South-East Asia and Eastern Africa (Figure 3-3). The seed can be used in the ripe or unripe form; can be dried, baked, or roasted; and then cut into slices, crushed, or consumed whole. Betel quid often contains areca nut, among other ingredients, such as tobacco, catechu (an extract of the *Acacia* plant), alkaline agents, and spices, wrapped in a piper betel leaf.[6]

Areca nut contains compounds such as arecoline and guvacoline that can react with nitrite to form areca-specific nitrosamine compounds (ASNAs).[6] These ASNAs are also formed in the mouth during use of products containing areca nut.[39] The areca-derived *N*-nitrosoguvacoline (NGL) has been shown to induce pancreatic tumors in lab animals, and a mixture of NG and NNK has been shown to induce lung tumors.[138] Another ASNA compound, 3-(*N*-nitrosomethylamino)propionaldehyde, is both highly cytotoxic and genotoxic to human buccal epithelial cells, a finding that is important to understanding tumor induction among users of areca nut–containing products.[139] Areca nut is a carcinogen and a very harmful substance that should not be included in tobacco products.[6]

Tonka Bean

Tonka (*Dipteryx odorata),* a flowering tree in the pea family (*Fabaceae*), is native to Brazil and is cultivated in Central and South America. The tree produces seed pods containing black wrinkled seeds with a fragrance reminiscent of vanilla, which are known as tonka beans.[140]

Coumarin, a benzopyrone compound, is present at high concentrations in tonka bean (35,000 µg/g), as well as in cassia (*Cinnamomum aromaticum*) (17,000–87,300 µg/g), cinnamon (900–40,600 µg/g), and Peru balsam (*Myroxylon balsamum*) (4000 µg/g).[141] In the mid-1950s, Hazelton and others identified coumarin as a liver toxin in dogs and rats following oral administration of coumarin.[142] Coumarin and tonka beans were banned as flavoring agents in the United States,[143] and because of this ban, daily human exposure is thought to occur at very low levels (60 ng/g), primarily resulting from use of fragrances and foodstuffs made with flavor substances (cinnamon) containing low levels of naturally occurring coumarin.[144] Detectable levels of coumarin have been found in the filler from several brands of Indonesian clove cigarettes[145] due to the use of flavor materials containing tonka bean.[146]

Tonka bean is widely used in a tobacco product called rapé (chapter 9).

Other Harmful Agents

Flavoring agents are added to ST products worldwide.[63,64,147]

Diphenyl ether, a flavor compound with a harsh metallic aroma,[148] and camphor have been identified as highly concentrated constituents of some tobacco products and certain spice condiment packs used to make betel quid.[149] Diphenyl ether irritates mucus membranes and can damage the liver, kidney, spleen, or thyroid after prolonged exposure.[149,150] Camphor can adversely affect the neurological, respiratory, cardiovascular, and gastrointestinal systems. Even small amounts of camphor have caused convulsions

followed by depression.[151] Ingestion of these substances is of note since betel quid can be swallowed during use.

Brazilian rapé, a nasal product, contains tobacco mixed with tonka bean, cinnamon powder, or clove buds, but usually lacks alkaline agents. Varieties of rapé produced in the Minas Gerais State of Brazil are known to contain extremely high levels of coumarin, a liver toxicant, which is derived from tonka bean and cinnamon (André Oliveira da Silva, personal communication, 2013).

Energy-enhanced smokeless products such as Revved Up contain stimulants (caffeine, ginseng), taurine, and vitamins B and C.

Some forms of tombol contain khat (*Catha edulis*), a plant that contains cathinone, an alkaloid with amphetamine-like stimulant properties, which purportedly causes euphoria, excitement, and loss of appetite.[74]

Gaps and Limitations of the Current Evidence Base

Further research is required to better characterize the chemical contents of a wider range of products. Research is also needed into the role of microorganisms (bacteria and mold) in altering product chemistry (i.e., generating nitrite and nitrosamines, producing mycotoxins). The effects of bacteria and mold on TSNA levels in products and the conditions that increase TSNA levels are also subjects in need of further study.

Because of the complexity of ST products—which can include a variety of tobacco types, chemical additives, non-tobacco plant ingredients, and microorganisms—ST products should not be viewed as a single homogenous product category for assessing composition or health effects. This wide variety of ST products worldwide differs in terms of addictiveness, toxicity, carcinogenicity, health effects, and impact on public health. Categorizing the products into groups with similar properties may provide a means of determining the health effects associated with particular product chemistries. However, drawing conclusions about the health consequences of different types of ST products (snuff, chimó, gutka) based on limited data from a small sample set from specific localities could be very misleading.

Summary and Conclusions

The widely diverse group of tobacco-containing products known as ST are distributed and used around the world. Smokeless tobacco products vary greatly in chemical composition and, in some cases, contain extremely high levels of total nicotine, free nicotine, and carcinogens. Most ST products contain tobacco and chemical/plant-derived additives, and may also contain microorganisms.

From the growing process to the final product, ST undergoes numerous chemical changes. Many constituents in ST products are present at very low levels in the growing tobacco plant. Chemicals are formed or introduced at one or more stages in the process of transforming the harvested tobacco into the final ST product. During curing, nitrite, TSNAs, *N*–nitrosamino acids, and volatile *N*–nitrosamines can be formed. Fire curing can also lead to the formation of PAHs, aldehydes, and phenols.[21,22,33,43,56,61] The fermentation stage may result in the formation of chemicals such as ethyl carbamate, nitrite, and

TSNAs.[2,33,44] During production or preparation, compounds from areca nut may be added, and storage conditions may increase TSNA levels in ST products.[114,121,124] Also, during use of products containing areca nut, areca-specific nitrosamines are formed endogenously in the mouth.[39]

A number of studies have begun to address the presence of bacteria, fungi, and mold in tobacco.[46,47] Especially important are (1) bacteria and mold that convert nitrate to nitrite, which contribute to the formation of TSNAs and other nitrosamines,[33,44,53] (2) bacteria and mold that are potentially pathogenic,[48] and (3) fungi that produce mycotoxins, including aflatoxins (i.e., *Aspergillus*).[152]

High nitrite concentrations in ST are a clear indication of past or ongoing conversion of nitrates to nitrites by microorganisms.[33,44] Nitrite concentrations should be monitored and controlled in all ST products as they are a key precursor in the formation of carcinogenic nitrosamines, including TSNAs.[2,38,54,133] Eliminating or decreasing the population size of nitrite-forming microorganisms (by pasteurization, cleaning fermentation equipment, seeding with non-nitrite-forming bacteria)[33,55] or lowering nitrite levels by other means (use of nitrite scavengers, modifying production processes, etc.) generally results in lower TSNA levels in smokeless tobacco.[33,44,53,55–57]

Among the means of controlling microorganism during ST production, pasteurization or heat-treating of tobacco is one of the most effective methods of preventing nitrate-to-nitrite conversion.[55] Indeed, snus, a pasteurized product, generally has lower nitrite and TSNA levels than non-pasteurized products such as moist snuff and khaini.[56,57] These observations suggest that changing tobacco processing methods shows promise as a means of reducing the levels of some carcinogenic and toxic agents in tobacco products.

The user's actual absorption of nicotine, toxicants, and carcinogens from a given ST product is affected by the product's characteristics (product design, pH, moisture, cut width, additives content, pouched/non-pouched, buffering capacity),[8,90,153] use parameters (dosage and frequency, duration, and intensity of use),[154,155] mode of use (oral: chewing, sucking, dental application, etc.; nasal),[1] and physiologic factors (salivary volume and pH).[85,153]

Areas of concern regarding manufacturing smokeless products include, but are not limited to, fire curing (introduction of PAHs and other smoke-related chemicals), bacterial contamination (potential pathogenicity), fermentation (formation of nitrite and carcinogenic nitrosamines), the addition of areca nut (an IARC Group 1 carcinogen), nicotine-enriched tobacco species (high total nicotine levels), alkaline agents (which boost free nicotine levels), and storage methods that allow continued formation of nitrosamines. Another matter of concern is the addition of stimulants to tobacco products, such as the addition of caffeine to moist snuff products (e.g., Revved Up energy dip[14]), and the mixing of khat, a plant with amphetamine-like properties, with tobacco to form tombol in Middle Eastern countries such as Yemen[74] (Ghazi Zaatari, personal communication, 2013). Maintenance of toxicants below certain feasible, but not necessarily safe, thresholds demonstrates that the tobacco industry has the ability to use manufacturing controls to reduce toxicants as recommended by the World Health Organization[156]; however, only one company has set its own voluntary toxicant reduction standards.

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Chapter 4

Health Consequences of Smokeless Tobacco Use

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Introduction

The health risks associated with smokeless tobacco (ST) can vary substantially by product characteristics and ingredients, manner of use, and potential interactions with other tobacco use behaviors, such as cigarette smoking. Based on epidemiologic studies of traditional ST products, such as snuff, chewing tobacco, and betel quid, the International Agency for Research on Cancer (IARC) concluded that these products are carcinogenic to humans[1] and, specifically, that there is sufficient evidence that ST products cause precancerous oral lesions and cancers of the oral cavity, esophagus, and pancreas. Additionally, there is sufficient evidence that ST products cause addiction as well as reproductive and developmental toxicity. (IARC defines evidence as sufficient when "a causal relationship has been established and chance, bias, and confounding could be ruled out with reasonable confidence."[2,p.24]) Given that over 300 million people use ST worldwide, the total burden of ST use is likely to be substantial. Moreover, ST use in some regions appears concurrently with cigarette smoking, thus contributing to the total health burden of tobacco use.

Assessing the global magnitude or severity of the health effects of ST is complex primarily because of the variability of the products' chemical composition and other characteristics and the different ways in which these products are used around the world. (See chapter 3 for descriptions of ST products.) Conclusions about a product's use and risks in one country may not be transferable to similar products in other countries. Smokeless tobacco products differ considerably in their concentrations of nicotine and volatile and nonvolatile nitrosamines including the tobacco-specific nitrosamines (TSNAs), as well as polycyclic aromatic hydrocarbons (PAHs), toxic metals, and other compounds.[3–5] For example, nitrosamines are formed when secondary and tertiary amines in tobacco, including the alkaloids (nicotine, nornicotine, anatabine, and anabasine), react with nitrosating agents such as sodium nitrite. TSNAs are carcinogenic to humans and are formed primarily during tobacco processing, curing, fermentation, and storage.[2] PAHs, which are also carcinogenic to humans,[6] are formed by incomplete combustion of organic matter such as wood; most PAHs in ST are formed during the fire-curing process.[7] Toxic metals that have been detected in ST products include arsenic, beryllium, cadmium, chromium, cobalt, lead, nickel, mercury, and the radioactive metals polonium-210 and uranium.[2,8] All ST products contain nicotine, and virtually all contain TSNAs.

Some products also contain added plant materials such as tonka bean or flavoring agents that may contribute to adverse health consequences (see chapter 3). For example, additives such as the areca nut, a known carcinogen, are commonly used in products in India and other South-East Asian countries.[9] Areca nut, often used with tobacco or used prior to initiating tobacco use,[9] is considered an IARC group 1 carcinogen.[1] It is estimated that 10–20% of the world's population use areca or areca nut–containing products/preparations[1] (in 2001, this was estimated at 600 million people[9]). Examples of these products are betel quid, tombol, mawa, and gutka, which often contain tobacco.[1] Some users may intermittently switch between areca nut and areca nut plus tobacco.[10] The health implications of using tobacco mixed with areca nut warrant consideration because areca nut has been linked to oral submucosal fibrosis (OSF) and oral squamous cell carcinomas.[11] Areca nut–containing products are commonly used in South-East Asia (paan, mawa, mainpuri, gutka, etc.), the Middle East (tombol), and more recently in the United Kingdom,[12] South Africa,[11] and United States.[10]

The aim of this chapter is to provide a science-based summary of the association between the use of ST and a range of adverse health consequences. This chapter does not present an exhaustive review of the literature. Evidence was drawn from comprehensive reviews by authoritative bodies, particularly the IARC, the Office of the U.S. Surgeon General, and the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), and supplemented by reviews and original research reports in the peer-reviewed literature. These sources should be consulted for additional in-depth information, including strengths and limitations of individual studies.

Adverse Health Consequences: Mechanisms

Evidence supports plausible mechanisms by which ST use can cause disease. Disease pathways and biologic mechanisms specific to ST (Table 4-1) may be similar in some respects to the pathways and mechanisms that underlie the pathogenicity of tobacco smoke and nicotine.[13] Higher concentrations of cotinine (a biomarker of exposure to nicotine uptake), nitrosamines, PAHs, and metals have been observed in the serum and urine of individuals who use ST products than in individuals who do not use tobacco.[8,14,15] Concentrations of some TSNAs are higher in ST users than in individuals who smoke cigarettes.[16] Constituents of ST cause local irritation and sensitization and are absorbed systemically through the oral or nasal mucosa and by swallowing saliva that contains tobacco particulates.[17] Smokeless tobacco carcinogens and other toxicants then circulate throughout the body and may damage multiple organs.

Adverse Health Consequences: Cancer

Conceptual Model

An adaptation by Boffetta and colleagues[18] of Hecht's conceptual model of carcinogenesis associated with tobacco smoke[19] is presented in Figure 4-1. The process begins with initiation of ST use and subsequent nicotine addiction (Box 1), leading to sustained use. Carcinogens present in ST are ingested and processed by the body (Box 2), which results in the metabolic activation of carcinogens and formation of DNA adducts, which are carcinogenic metabolites bound covalently to DNA (Box 3); and subsequent mutations (Box 4) which may ultimately lead to cancer (Box 5).

Figure 4-1. Conceptual model of carcinogenesis of smokeless tobacco use

Abbreviations: DNA = deoxyribonucleic acid; Hb = hemoglobin
Sources: Boffetta et al. 2008 (18); Hecht 1999 (19). Reproduced with permission.

Table 4-1. Smokeless tobacco products: Constituents, biologic mechanisms, and biomarkers

Product constituent	Biologic mechanism related to health consequences	Biomarker of human exposure (may not be specific to smokeless tobacco use)
Cancer		
Tobacco-specific nitrosamines (TSNA)*	Increase DNA adduct levels, cause oxidative DNA damage, cause gene mutations, disrupt mechanisms for cell growth control; systemic carcinogens	TSNAs and metabolites (NNAL) in urine TSNA–Hb adducts in red cells TSNA–DNA adducts in oral cells TSNAs in saliva
Volatile nitrosamines†	Form DNA adducts	N/A
Polycyclic aromatic hydrocarbons (PAH)‡	Form DNA adducts	PAH biomarkers in urine
Aldehydes§	Cause inflammation, increase cell proliferation	Aldehyde–DNA adducts in white blood cells
Metals¶	Cause inflammation and sensitization	Metal levels in urine, saliva, blood, and hair
Ethyl carbamate (urethane)	Form DNA adducts	N/A
Nicotine	Precursor to TSNAs	Nicotine and metabolites (cotinine) in urine
Arecoline	Inhibits cellular growth, depletes cellular glutathione	Arecoline in urine and blood
Areca-nut-specific nitrosamines (e.g., MNPN)	Form reactive oxygen species	MNPNs in saliva
Alkaline agents	Increases the absorption of carcinogens and contributes to chronic inflammation and tumor promotion	Sodium levels in urine
Cardiovascular disease		
Polycyclic aromatic hydrocarbons	Accelerate atherosclerosis	PAH biomarkers in urine
Aldehydes	Contribute to atherogenesis	Aldehyde–DNA adducts
Arsenic	Causes vasoconstriction	Arsenic levels in urine
Barium	Causes tachycardia, hypertension	Barium levels in urine and saliva
Cadmium	Disrupts endothelial function, increases blood pressure	Cadmium levels in urine, blood, and saliva
Nicotine	Acutely increases blood pressure and heart rate, may injure endothelial cells	Urine thromboxane A2 metabolites, atherosclerosis, elevated blood pressure
Arecoline	Acutely increases blood pressure and heart rate	Arecoline in urine and blood
Alkaline agents	Increase the fraction of nicotine and arecoline in free form that is most rapidly absorbed in the blood; increase blood pressure	Sodium levels in urine

Product constituent	Biologic mechanism related to health consequences	Biomarker of human exposure (may not be specific to smokeless tobacco use)
Addiction		
Nicotine	Elevates dopamine; releases endorphins	Nicotine and metabolites (cotinine) in urine
Arecoline	Elevates dopamine; releases endorphins	Arecoline in urine and blood
Acetaldehyde	Enhances reinforcing effects of nicotine	Aldehyde–DNA adducts in white blood cells
Reproductive health outcomes (neurodevelopmental toxicity, pregnancy complications)		
PAHs (e.g., BaP)	Causes anatomic and functional teratogenesis; prenatal, perinatal, and postnatal mortality; growth retardation; and developmental delay.	PAH–DNA adducts in umbilical cord blood
Cadmium	Causes oxidative stress, interferes with placental transfer of essential elements.	Placental cadmium levels
Nicotine	Binds nicotinic acetylcholine receptors in the developing lungs and impairs alveolar development and affects neurogenesis, migration, differentiation, and synaptogenesis in fetal developing neurites; also prune hippocampal and cortical neurons through effects of apoptosis.	Cord blood cotinine
Dental conditions		
Sugar	Causes dental caries	N/A
Arsenic, barium, mercury, nickel, cobalt	Cause dermal sensitization and irritation	Metal levels in urine, saliva, blood, and hair
Alkaline agents	Cause irritation	Sodium levels in urine
Silica	Wears down teeth	N/A

*Tobacco-specific nitrosamines (TSNAs): NNN (*N'*-nitrosonornicotine), NNK [4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone], NAB (*N'*-nitrosoanabasine), NAT (*N'*-nitrosoanatabine). NNK is a metabolite of NNAL [4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol].
†Volatile nitrosamines: NDELA (*N*-nitrosodiethanolamine), NDMA (*N*-nitrosodimethylamine), NMOR (*N*-nitrosomorpholine), NPIP (*N*-nitrosopiperidine), NPYR (*N*-nitrosopyrrolidine).
‡Polycyclic aromatic hydrocarbons (PAHs): Benz*[a]*anthracene, benzo*[a]*pyrene [BaP], benzo[*b*]fluoranthene benzo[*j*]fluoranthene, benzo[*k*]fluoranthene, 5-methylchrysene, dibenzo[*a,h]*anthracene, indeno[1,2,3-cd]pyrene, naphthalene.
§Aldehydes: Formaldehyde, crotonaldehyde, acetaldehyde.
¶Metals: Arsenic, beryllium, cadmium, cobalt, chromium, lead, mercury, nickel, polonium, uranium.
Abbreviations: N/A = information not available. DNA = deoxyribonucleic acid; Hb = hemoglobin; MNPN = 3-(methylnitrosamino)propionitrile.
Sources: U.S. Department of Health and Human Services 2010 (13); International Agency for Research on Cancer (IARC) 2004 (9); IARC 2007 (2); Pappas 2011 (8).

In this model, metabolic activation and DNA changes and subsequent mutations occur that may ultimately lead to cancer. During the metabolic activation stage, shown after Box 2, NNK and NNN are metabolically activated by cytochrome P450 enzymes. This activation induces primary DNA lesions including pyridyloxo-butylations and nucleotide methylations.[20] Permanent DNA mutations, such as in the RAS oncogene or the TP53 tumor suppressor gene, occur when DNA adducts persist unrepaired, leading to uncontrolled cell growth and cancer.[13] This model represents a simplified version of the complex process of carcinogenesis. Other mechanisms that may contribute to tumor promotion and co-carcinogenesis include chronic local inflammation and irritation, oxidative stress, and reactive oxygen species.[13]

Researchers have identified more than 30 carcinogens in various ST products, including volatile and nonvolatile nitrosamines, TSNAs, nitrosamino acids, PAHs, aldehydes, heavy metals, and radioactive metals (chapter 3, Table 3-2).

The most potent and abundant TSNAs in tobacco products include 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), the NNK metabolite 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL), *N'*-nitrosonornicotine (NNN), *N'*-nitrosoanabasine (NAB), and *N'*-nitrosoanatabine (NAT).[21,22] The level of TSNAs varies depending on the type of tobacco used (for example, *Nicotiana rustica* has more TSNAs than *N. tabacum*), the method of curing, fermentation, products added to the tobacco for processing or flavoring, and the method of storing the product.[4] The TSNAs most strongly linked to cancer are NNN and NNK.[21] Although some products such as Swedish snus contain relatively low levels of NNN and NNK, some U.S. brands of moist snuff contain very high concentrations, and toombak, a product used primarily in Sudan, has the highest concentration of TSNAs (NNN, NNK, and NAT) identified to date.[14]

Some ST products have been found to contain PAHs, such as: BaP, classified by IARC as a Group 1 agent (carcinogenic to humans); dibenz[*a,h*]anthracene, classified by IARC as Group 2A agent (probably carcinogenic to humans); as well as several PAHs classified by IARC as Group 2B agents (possibly carcinogenic to humans) including benz[*a*]anthracene, benzo[*b*]fluoranthene, benzo[*j*]fluoranthene, benzo[*k*]fluoranthene, 5-methylchrysene, indeno[*1,2,3-cd*]pyrene, dibenzo[a,i]pyrene, and naphthalene.[7,23] Smokeless tobacco is consumed without combustion, but some products contain fire-cured tobaccos; these products have higher concentrations of volatile aldehydes and PAHs, including BaP, than products that contain air-cured tobacco.[3,7] These PAHs may derive from the tobacco-curing process or from added ingredients such as punk ash.

Other ingredients that are added to ST products also may have cancer-causing properties. Products commonly used in India and other parts of Asia often contain areca nut, which contains arecoline, a nicotine-like alkaloid, and the areca nut–derived nitrosamines 3-(*N*-nitrosomethylamino) propionaldehyde, 3-methylnitrosamino propionitrile, *N*-nitrosoguvacine, and *N*-nitrosoguvacoline.[9] Areca nut use can lead to the production of reactive oxygen species and may cause precancerous lesions including oral submucous fibrosis and oral cancer, cancer of the pharynx, and esophageal cancer.[9] Salts such as sodium chloride, added to ST as a flavor enhancer and antimicrobial agent, may damage the gastric epithelium, increase the absorption of carcinogens, and contribute to chronic inflammation and tumor promotion.[3]

Biomarkers

Users' exposures to carcinogens in ST are most accurately measured by looking at biomarkers in the body. Biomarkers such as serum cotinine levels, total NNAL, total NNN, NNK–DNA adducts, or hemoglobin (Hb) adducts of nitroaromatic compounds may provide a realistic assessment of carcinogen and toxic dose in an individual.[24] For example, studies suggest a dose–response relationship between total NNAL and serum cotinine (not a carcinogen itself, but a marker of tobacco exposure) and lung cancer[24] and between total NNN and esophageal cancer risk[25] in smokers.

The metabolism of TSNAs can be measured in humans, as demonstrated by a study in which NNN, NAT, NAB, their pyridine-*N*-glucuronide metabolites, and NNAL were detected in the urine of ST users[26] (Figure 4-2). These metabolites can be used as biomarkers to provide realistic and direct assessments of a person's exposure to specific TSNAs.[24] The concentrations of total NNAL detected in urine parallel the level of NNK measured in these products.[14] A comparison of studies in the United States found that NNAL concentrations in the urine of users of moist snuff varied by brand used and, for some brands, were higher than levels seen in Marlboro cigarette smokers (Figure 4-3).[14]

Figure 4-2. Mean NNN, NAT, NAB, their pyridine-*N*-glucuronide metabolites (NNN-*N*-Gluc, NAT-*N*-Gluc, and NAB-*N*-Gluc), and NNAL in the urine of 11 smokeless tobacco users

Abbreviations: NNN = *N'*-nitrosonornicotine; NAT = *N'*-nitrosoanatabine; NAB = *N'*-nitrosoanabasine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; Gluc = glucuronide; pmol/mg = picomole per milligram.
Note: Total NNAL = NNAL + NNAL Glucs.
Source: Stepanov and Hecht 2005 (26).

Figure 4-3. Total NNAL concentrations in the urine of users of Marlboro cigarettes, different brands of smokeless tobacco products, and medicinal nicotine

Abbreviations: NNAL = [4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol]; pmol/mg = picomole per milligram.
Note: Total NNAL = NNAL + NNAL glucuronides.
Source: Adapted from Hatsukami et al. 2007 (14). Used with permission.

A study[15] using data from the U.S. National Health and Nutrition Examination Surveys from 1999 through 2008 to evaluate biomarkers of chemical exposure found that mean levels of PAHs (measured in urine) were higher among ST users than among people who did not use tobacco (Figure 4-4).

Figure 4-4. Polycyclic aromatic hydrocarbons in the urine of smokeless tobacco users compared to that of non-users, NHANES, 1999–2008

Abbreviations: NHANES = National Health and Nutrition Examination Survey; ng/g = nanogram per gram.
Note: 95% confidence interval.
Source: Naufal et al. 2011 (15).

Oral Cancer

Available evidence from multiple epidemiologic studies in the United States, Asia, and Africa supports a causal association between oral cancer and use of ST, including snuff, chewing tobacco, naswar, shammah, and toombak,[2,18,27] though observed relative risks (RR) vary substantially across products and regions, and with dosage and duration of use.[2] Summary RRs (adjusted for smoking) comparing ST users to non-users in the United States range from 1.65 (95% confidence interval [CI]: 1.22–2.25) for oropharyngeal cancer[27] to 2.6 (95% CI: 1.3–5.2) for oral cancer.[18] The RRs associated with some ST products may be especially high; for example, the RR associated with toombak is 3.9,[28] and relative risks ranged from 2 to as high as 14 for "tobacco chewers" (including users of pattiwala, naswar, khaini, and zarda) in India and Pakistan.[2] In contrast, although increased risks were observed in some studies of Scandinavian snus,[29] most evidence from Swedish studies does not support a causal association between snus use and oral cancer.[2,18,27]

Relative risk (RR): The likelihood of an event happening in one group/ country/region, etc., compared to another group.

RR = 1 (no difference between the groups)
RR >1 (increased risk in one group compared to the other)
RR <1 (decreased risk in one group compared to the other)

A relative risk of 1 indicates no difference between the groups, whereas a relative risk greater than 1 indicates an increased risk, and a relative risk less than 1 indicates a decreased risk.

Precancerous Lesions and Other Oral Conditions

Many studies from the United States, Scandinavia, and Asia provide conclusive evidence that ST products, including snus, snuff, shammah, and betel quid (paan), are strongly associated with the prevalence of oral mucosal lesions such as leukoplakia, erythroplakia, and verrucous hyperplasia.[2,18,30] These lesions are important because studies show a high risk of cancers arising from leukoplakia and oral submucous fibrosis.[9,31] Lesions tend to occur at the site of ST application and may vary depending on the product used. In comparison with use of chewing tobacco, use of snuff is associated with more frequent development of oral mucosal lesions and a greater variety of epithelial changes.[31] Chewing areca nut or betel quid with or without tobacco is also strongly associated with leukoplakia and oral submucous fibrosis.[9,32] Oral mucosal lesions are more severe in people who begin use at an earlier age, use ST for more hours per day, use greater dosages, or use on more days per month.[2] The lesions usually resolve when people stop using smokeless tobacco.[2]

Use of ST can lead to increased inflammation of the buccal and gingival mucosa.[33] The combination of ingredients in gutka—tobacco, areca nut, and slaked lime (calcium hydroxide)—may cause greater inflammation than one of these ingredients used alone.[34] Incidence of gingival recession, commonly adjacent to the area where the tobacco is held, is higher among individuals who use snus or snuff than among people who do not use smokeless tobacco.[30,33,35] Gingival recession can be observed within one year of beginning to use smokeless tobacco.[2] Prevalence of dental decay and caries is associated with the use of chewing tobacco.[33]

Esophageal Cancer

Available epidemiologic evidence from Scandinavia and Asia supports a causal association between esophageal cancer and use of ST, including snus, snuff, and chewing tobacco.[2,18,27] Summary RRs comparing ST users to non-users, based mainly on studies from Sweden, range from 1.13 (95% CI: 0.95–1.36; adjusted for smoking)[27] to 1.6 (95% CI: 1.1–2.3).[18] Evidence of a dose–response trend with amount and duration of use was reported in two studies.[2]

Pancreatic Cancer

The pancreas is one of the target sites of TSNAs.[2] Available epidemiologic evidence from Scandinavia and Asia supports a causal association between pancreatic cancer and use of ST, including snus and mishri.[2,18,36,37] Evidence of a dose–response trend with amount and duration of use was reported in two studies.[1]

Lung Cancer

Although the lungs are also a target site of TSNAs,[21] available evidence is inadequate to determine if ST use causes lung cancer.[2] Epidemiologic cohort studies comparing ST users to non-users from the United States (summary RR = 1.8; 95% CI: 0.9–3.5) and India (hazard ratio [HR] = 1.6; 95% CI: 0.9–2.9) reported an increased risk, but findings from cohort studies from Scandinavia have suggested no association (summary RR = 0.8; 95% CI: 0.6–1.0).[18,37]

Cervical Cancer

The evidence that ST use is associated with increased risk of cervical cancer is limited but plausible.[38] Although numerous epidemiologic studies have confirmed that smoking is an independent risk factor for cervical squamous cell carcinoma,[1] few epidemiologic studies have been conducted on the association between ST use and increased risk of cervical cancer. However, some research has shown that higher levels of carcinogen-DNA adducts have been measured in cervical cells of smokers than in those of non-smokers.[13] Both NNK and BaP have been detected in human cervical cells and are metabolically activated in cervical tissue.[2] Nicotine exposure alone can increase the expression of epidermal growth factor receptors (EGFRs) in cervical cancer cell lines; metabolites of BaP induce activation of EGFRs that promote cell proliferation.[13] Increased risk of cervical cancer with use of chewing tobacco and snuff was observed in a case-control study in the United States (RR for moderate use = 4.7, and heavy use = 3.6, compared to no use).[2] In a case-control study among non-smoking Indian women, women who had ever chewed tobacco (with or without areca nut) had a greater risk of cervical cancer mortality than women who did not chew tobacco; this association held true among women in both urban (OR 2.0, 95% CI: 1.5–2.7) and rural (OR 2.2, 95% CI: 1.5–3.2) areas.[38] Another case-control study in India observed a significant dose-response relationship between the number of betel quids with and without tobacco chewed per day and increased risk of invasive cervical cancer; ever use of betel quid was associated with a nonsignificant twofold increased risk.[9] In a study in Côte d'Ivoire, high-grade cervical squamous intraepithelial lesions were more common among women who chewed tobacco.[39]

Adverse Health Consequences: Cardiovascular Effects

Conceptual Model

Much of the work on the cardiovascular effects of tobacco and nicotine has focused on cigarette smoking[13]; some, but not all, of these mechanisms also may be applicable to ST use. Several of the constituents in cigarette smoke that are implicated in cardiovascular effects are also present in ST, although in differing amounts. These include nicotine, PAHs, and heavy metals such as cadmium.[40] PAHs have been shown to accelerate atherosclerosis in experimental animals.[13] Heavy metals such as cadmium catalyze the oxidation of cellular proteins, which may accumulate in the aortic wall and result in endothelial damage.[13] Additionally, some substances added to ST, such as punk ash or licorice, are reported to have adverse effects on the cardiovascular system.[13] Figure 4-5 presents a conceptual model of adverse cardiovascular effects associated with ST use (adapted from the conceptual model of adverse cardiovascular effects associated with cigarette smoking as described in Benowitz 2003[41]).

Figure 4-5. Conceptual model of adverse cardiovascular effects of smokeless tobacco

Source: Adapted from Benowitz 2003 (41). Used with permission.

As illustrated in the model, nicotine has a range of cardiovascular effects. Its effects mimic those of the body's sympathetic nervous system, acutely increasing blood pressure, heart rate, and the strength of the heart's contractions, all of which increase the heart's demand for oxygen and nutrients.[18] Nicotine also can contribute to inflammation, thus potentially contributing to atherogenesis.[41] Moreover, nicotine directly affects blood vessels and can contribute to the development of endothelial dysfunction.[41] In addition, nicotine in tobacco products may contribute to insulin resistance and hyperinsulinemia, both of which are linked to mitogenesis (cell proliferation), vasoconstriction, and inflammation, potentially contributing to the development of endothelial dysfunction and atherosclerosis.[42] Oral moist snuff users have shown decreased brachial artery flow–mediated dilation, a marker for endothelial dysfunction.[43] Because many of these studies have been conducted with individuals who use a range of tobacco products, the effects may be due to nicotine acting along with other tobacco constituents, rather than to nicotine alone. Additionally, safety studies have not shown any increased cardiovascular risk, even in people with existing cardiovascular disease who use nicotine replacement therapies.[13]

Hypertension

Several constituents of ST products, including nicotine, sodium, and licorice, can aggravate hypertension.[40,44] Although some ST products clearly cause acute, transient increases in blood pressure,[45] studies from the United States and Sweden do not provide evidence of increased prevalence of hypertension in ST users.[40] In a study in South Africa, women who used snuff had a higher prevalence of hypertension than women who did not use snuff, but this association was attenuated after controlling for other cardiovascular risk factors.[46] The prevalence of diastolic (but not systolic) hypertension was higher among Indian men who exclusively used ST products (mainly moist snuff, betel quid, and pan masala with tobacco) than among men who used no tobacco.[47] In another study, the prevalence of both diastolic and systolic hypertension was higher among Indian men who exclusively chewed tobacco (mainly gutka, paan, and khaini) than among men who used no tobacco.[48] One study from Sweden provides evidence that ST users may have a higher risk of developing hypertension.[40]

Heart Disease and Stroke

A substantial body of evidence from the United States, Sweden, and Asia indicates that ST use is associated with an increased risk of fatal ischemic heart disease and stroke, but is not associated with an increased risk of non-fatal myocardial infarction (MI) and non-fatal stroke.[2,40,49,50] This finding suggests that thrombosis is a major mechanism by which ST increases cardiovascular risk[44] and/or that ST use negatively affects survival after a cardiovascular event.[40] Some studies suggest an increased risk of non-fatal cardiovascular disease associated with use of ST including snuff, chewing tobacco, betel quid with tobacco, and mishri, but evidence is limited.[51–53] Data on dose–response trends are limited. Summary RRs for fatal ischemic heart disease range from 1.1 (95% CI: 1.04–1.19) in the United States and 1.1 (95% CI: 0.78–1.38) in Asia to 1.3 (95% CI: 1.07–1.52) in Sweden. Summary RRs for fatal stroke range from 1.3 (95% CI: 0.91–1.70) in Sweden and 1.3 in Asia (95% CI: 1.08–1.56) to 1.4 (95% CI: 1.22–1.60) in the United States.[49,50]

Adverse Health Consequences: Miscellaneous Other Diseases and Conditions

Diabetes and Insulin Resistance

Although nicotine increases circulating levels of insulin-antagonistic hormones and impairs insulin sensitivity,[13] the few studies that have examined the association between ST use and the development of insulin resistance, metabolic syndrome, and diabetes have yielded conflicting results.[2,40] Heavy use of Swedish snus appears to be associated with an increased risk of developing type 2 diabetes.[40]

Conditions of the Nasal Cavity

Some types of ST are inhaled nasally, including dry (powdered) snuff and Brazilian rapé[54] and products used in India and South Africa. Limited information is available about the effects of ST on the nasal cavity. Nasal use of snuff has been associated with edema of the mucosa and submucous conjunctive tissue of the turbinates, atrophy of the middle and inferior turbinates, inhibition of nasal mucociliary clearance, and chronic rhinitis.[54] Existing studies on nasal use of snuff have not provided conclusive evidence of a relationship with cancer.[2]

Reproductive Outcomes

Several constituents in ST have been shown to be reproductive or developmental toxicants, including nicotine, areca nut, PAHs, and several metals—particularly arsenic, cadmium, lead, and mercury.[9,13] Decreased perfusion from nicotine is not believed to be a major contributor to adverse fetal outcomes; rather, hypoxia is likely due to CO exposure. Metals may cause oxidative stress in cells and interfere with fetal nutrition.[13] Evidence suggests that infants born to women who use ST (including snus, betel quid, and mishri) during pregnancy have a higher risk of several adverse outcomes such as gestational age/pre-term birth and fetal growth restriction.[2,9,31,48,55–57]

Addiction

Research evidence shows that ST products initiate and sustain dependence and addiction.[2,58] Nicotine in tobacco causes addiction; other substances in ST products may reinforce nicotine's addictive effects.[13] Physiologic manifestations of ST addiction include tolerance with repeated use, symptoms of withdrawal upon cessation of regular use, and pleasurable psychoactive effects.[59] Smokeless tobacco users continue to crave and use ST despite harmful consequences, tend to switch to products with higher nicotine levels, and frequently relapse upon cessation.[2] Addiction to ST is related to age at initiation, amount of nicotine ingested per day, and years of use.[2]

Smokeless Tobacco Use as a Risk Factor for Cigarette Smoking

One important question is whether ST use promotes smoking initiation, particularly among youth. Smokeless tobacco products contain nicotine, and development of nicotine addiction may increase the risk of transitioning to smoking.[60] Some studies, but not others, have shown that young people in the United States who use ST are more likely to smoke cigarettes.[35,61] However, studies in Sweden have not observed that snus use among youth leads to cigarette use among adults.[31] Little evidence is available

about whether ST use precedes cigarette smoking in other countries, and transitioning from using ST to smoking is likely to depend heavily on social norms and tobacco industry marketing.

A second important question is whether cigarette smokers who may otherwise have quit using tobacco prolong tobacco use or engage in dual use by using smokeless tobacco.[1] For example, studies in the United States have found that smokers who may have otherwise quit using tobacco may switch to ST as a substitute for smoking or use both tobacco products concurrently (i.e., dual use).[13,62,63] A major concern about novel products like dissolvables—which have not been marketed long enough for epidemiologic data on health risks associated with them to become available—is that these products are marketed to provide smokers with an alternative source of nicotine in settings where smoking is prohibited.[64,65] People who both use ST and smoke cigarettes may have greater levels of toxicants, such as NNK, than people who use only one tobacco product, which suggests that a combination of ST use and smoking may have greater health risks than smoking alone.[13,51,60] Dual use of cigarettes and ST products may prolong rather than shorten the duration of smoking, thereby increasing the risks from continued smoking. It is also possible that some individuals substantially reduce cigarette smoking when they begin using ST, but the extent to which cigarette smoking would have to be reduced to result in lower health risks is unknown, especially when cigarettes are used in conjunction with smokeless tobacco. Additionally, evidence on the effectiveness of ST as a smoking cessation aid is insufficient.[66] Abstaining from all forms of tobacco use is the most effective way to prevent its morbidity and mortality.[13]

The Health Consequences and Disease Burden of Smokeless Tobacco Products

Understanding the global disease burden of ST use is important for informing tobacco prevention and control efforts. This impact is a function of the number of ST users multiplied by the magnitude of the risk. However, given the variety of products and conditions of use, in addition to limited product-specific data, estimating this total burden is not straightforward.

One way to measure the public health impact of an exposure to a risk factor is to calculate the *proportion* of cases of a given disease causally related to that risk factor, called the attributable fraction (AF). For example, the attributable fraction of lung cancer caused by cigarette smoking is over 90 percent.[67]

The AF due to ST use can be estimated using the RR associated with ST use and the percentage of people in the population who use ST (p) according to the formula[68]:

$$AF = \frac{p * (RR - 1)}{p * (RR - 1) + 1}$$

Then the attributable burden (AB), the number of cases (or deaths) attributed to ST use out of the *total* number of cases (or deaths) in the population, can be estimated by multiplying the AF by the total number of cases (or deaths) (D), according to the formula:

$$AB = AF * D$$

Because RR varies by type of ST and underlying disease prevalence varies by country, the attributable burden should be calculated for each country separately. As an example, this chapter includes estimates of the AB due to ST use in Sweden, the United States, and India. These countries were chosen as examples because much of the evidence on the associations between ST use and health consequences comes from studies conducted in these countries,[18,49] and because the ST products commonly used in these countries represent a wide range of products. (The prevalence of ST use was obtained from surveys reported between about 2008 and 2011; for descriptions of the ST products used and the prevalence of use in these three countries, see chapters 9, 10, and 13.) The RR estimates associated with ST use (Table 4-2) were obtained from reviews of studies in Scandinavia and the United States[18,49] and from studies in India and surrounding regions.[37,50] Cancer incidence data for 2008 were obtained from GLOBOCAN (http://globocan.iarc.fr/). These data were applied to the above formulas to estimate the attributable fraction and the annual attributable burden of disease due to ST use in Sweden, the United States, and India (Table 4-3). The estimated numbers of incident cancers of the oral cavity, esophagus, and pancreas attributed to ST use in 2008 ranged from about 130 in Sweden, to over 2,500 in the United States, and over 58,000 in India (Table 4-3). These estimates demonstrate the variability in public health impact caused by ST under different scenarios.

Table 4-2. Relative risks associated with smokeless tobacco use

Outcome	Country/region	Type of smokeless tobacco	Relative risk	Source*
Oral cancer	United States	Chew or snuff	2.6 (1.3–5.2)	Boffetta et al. 2008 (18)
	Scandinavia	Snus	1.0 (0.7–1.3)	Boffetta et al. 2008 (18)
	India	Smokeless tobacco†	5.1 (4.3–6.0)	Boffetta et al. 2008 (18)
Esophageal cancer	United States	Smokeless tobacco†	1.2 (0.1–2.3)	Boffetta et al. 2008 (18)
	Scandinavia	Snus	1.6 (1.1–2.4)	Boffetta et al. 2008 (18)
	India	Smokeless tobacco†	3.7 (1.6–8.4)	Pednekar et al. 2011 (37)
Pancreatic cancer	United States	Chew or snuff	1.4 (0.7–2.7)	Boffetta et al. 2008 (18)
	Scandinavia	Snus	1.8 (1.3–2.5)	Boffetta et al. 2008 (18)
	India	Mishri & other	2.0 (0.7–5.5)	Pednekar et al. 2011 (37)
Lung cancer	United States	Chew or snuff	1.8 (0.9–3.5)	Boffetta et al. 2008 (18)
	Scandinavia	Snus	0.8 (0.6–1.0)	Boffetta et al. 2008 (18)
	India	Mishri & other	1.6 (0.9–2.9)	Pednekar et al. 2011 (37)
Fatal ischemic heart disease	United States	Chew or snuff	1.1 (1.0–1.2)	Boffetta & Straif 2009 (49)
	Sweden	Snuff	1.3 (1.1–1.5)	Boffetta & Straif 2009 (49)
	Asia	Smokeless tobacco†	1.1 (0.8–1.4)	Zhang et al. 2010 (50)
Fatal stroke	United States	Chew or snuff	1.4 (1.2–1.6)	Boffetta & Straif 2009 (49)
	Sweden	Snuff	1.3 (0.9–1.7)	Boffetta & Straif 2009 (49)
	Asia	Smokeless tobacco†	1.3 (1.1–1.6)	Zhang et al. 2010 (50)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
†Type of smokeless tobacco not specified.
Note: Relative risks associated with smokeless tobacco use are provided for the purposes of illustration, as some uncertainty still surrounds some of the values provided. Nevertheless, this table and Table 4-3 demonstrate the variability in public health impact from smokeless tobacco under different scenarios.

Table 4-3. Annual burden of disease attributable to smokeless tobacco use in three countries: Sweden, United States, and India

Country/disease	Sex	Relative risk	Prevalence of smokeless tobacco use	Attributable fraction	Attributable burden of disease (new cases per year)
United States					
Oral cancer	Men	2.6	6.9%	9.9%	1,566
	Women	2.6	0.3%	0.48%	35
Esophageal cancer	Men	1.2	6.9%	1.4%	182
	Women	1.2	0.3%	0.06%	2
Pancreatic cancer	Men	1.4	6.9%	2.7%	507
	Women	1.4	0.3%	0.12%	23
Sweden					
Oral cancer	Men	1.0*	26%	0%	0
	Women	1.0*	7%	0%	0
Esophageal cancer	Men	1.6*	26%	13.5%	39
	Women	1.6*	7%	4.0%	4
Pancreatic cancer	Men	1.8*	26%	17.2%	67
	Women	1.8*	7%	5.3%	23
India					
Oral cancer	Men	5.1	33%	57.5%	26,131
	Women	5.1	18%	42.5%	10,359
Esophageal cancer	Men	3.7	33%	47.1%	13,569
	Women	3.7	18%	32.7%	6,308
Pancreatic cancer	Men	2.0	33%	24.8%	1,260
	Women	2.0	18%	15.3%	593

*Relative risks for Sweden in these cases are not country-specific, but represent relative risks calculated for Scandinavia (see Table 4-2).

Sources: Relative risk of disease associated with smokeless tobacco use from Table 4-2; Sweden: prevalence of ST use from the 2012 National Survey on Public Health (70), Table 2-3; United States: prevalence of ST use from the 2009 National Survey on Drug Use and Health (71); India: prevalence of ST use from the 2009–2010 Global Adult Tobacco Survey (72); Cancer incidence data for 2008 from GLOBOCAN (73).

The differences between attributable burden rates reflect both the different RRs seen in studies of ST use in these countries (likely due to differences in products and how they are used) as well as differences in the number of ST users, disease incidence, and the size of the overall country population. The attributable burden will be large if any of the factors is large (Figure 4-6). That is, the AB will be great if the RR is high, if the proportion of people who use ST is large, or if there is a high background risk of disease. For example, oral cancer is a relatively rare disease among men in the United States (15,800 cases annually), and the association between ST use and oral cancer is moderate (RR = 2.6). With 6.9% of men using ST, the fraction of oral cancers attributed to ST use in men is 9.9%, and the attributable burden is about 1,600 cases. If more men began using ST, both the number of oral cancers would increase and the proportion attributable to ST use would increase. If future research determines that ST use is a cause of common diseases such as ischemic heart disease or stroke, even the relatively small RR associated with these diseases would result in a large number of deaths attributable to ST use. For example, the number of deaths from ischemic heart disease and stroke in 2008 potentially attributable to ST use would be approximately 1,000 in Sweden, 4,600 in the United States, and 300,800 in India.

Figure 4-6. Attributable risk increases with relative risk and prevalence of exposure/use

The health impact and disease burden of ST use may be influenced by other forms of tobacco use, particularly cigarette smoking, in at least three ways. First, some smokers who would otherwise have quit smoking because of restrictions on smoking may instead use ST as a situational substitute and continue to smoke. In such cases, ST products may prolong rather than shorten the duration of smoking, thereby increasing the risks from continued smoking.[13] Second, some epidemiologic studies show that dual use of ST and cigarette smoking could have greater health risks than smoking alone.[13,51] Third, although cigarette smokers who permanently switch to exclusive ST use may reduce their risks for some diseases specifically associated with smoke exposure, the single study that examined this issue found that smokers who quit all tobacco use had lower mortality rates from lung cancer, coronary heart disease, and stroke than those who switched to ST use.[69]

Gaps and Limitations in the Current Evidence Base

Compared with the vast amount of information linking adverse health effects to cigarette smoking, studies on ST use are not comprehensive. Epidemiologic studies of ST use have less information about what levels of use are associated with particular outcomes, and, in some countries, fewer numbers of ST users on which to base conclusions. Some, but not all, studies attempt to control for factors such as consumption of other tobacco products and alcohol, which may confound or modify the association with ST use. Also, given that the median time between smoking initiation and death from lung cancer may be as long as 50 years,[67] data on novel products such as Swedish snus may not have accumulated for a long enough period of time to fully characterize the associated risk.

Estimates of the proportion of the population using ST may not be available in all countries or may not reflect current prevalence. Prevalence may be difficult to estimate because of the variety of ST products and the possibility of multiple product use. Therefore, it may be necessary for countries to include measures of ST use in surveys, and to ensure that the information is product specific. Generic data on ST use will not provide the type of specificity necessary for accurate information on disease burden. Also, while reliable data on cancer incidence and mortality are available in many countries, there may be fewer resources for reliable data on incidence and prevalence of other conditions such as reproductive toxicity, cardiovascular disease, precancerous oral lesions, and diabetes. Current estimates of disease burden are critical for diseases that have an increasing trend (pancreatic cancer) or decreasing trend (heart disease). Chapters 9 to 14 in this report will help to fill in some of these data gaps.

Summary and Conclusions

Smokeless tobacco is used in various forms throughout the world. All ST products contain nicotine, and ST users exhibit characteristics of nicotine addiction similar to cigarette smokers. Smokeless tobacco products contain numerous known carcinogens, although in varying levels depending on product characteristics such as type of tobacco, additives, alkalinity, and processing methods. Many products also contain other plant materials (areca nut or tonka bean) or additives that may be carcinogenic or have other adverse health effects. For this reason, the assessment of health risks associated with ST products should include not only tobacco but also the more complex mixture of ingredients that may further increase risk.

Based on information from large, comprehensive reviews,[1,2,9,31,40,58] the following conclusions can be reached:

- The associations between ST use and adverse health consequences differ by type of product.
- There is sufficient evidence that ST products cause addiction, precancerous oral lesions, and cancer of the oral cavity, esophagus, and pancreas, as well as adverse reproductive developmental effects including stillbirth, pre-term birth, and low birth weight.
- The evidence suggests that some, but not all, ST products are associated with increased risk of fatal ischemic heart disease, fatal stroke, and type 2 diabetes; more studies are needed to clarify any causal associations.
- There is insufficient evidence to assess whether ST products are associated with increased risks of lung cancer, cervical cancer, and hypertension.

The public health impact of ST use depends on the disease risk associated with a given ST product, the prevalence and manner of ST use, and the background burden of disease in the target population. These elements may be difficult to quantify because of the lack of data specific to particular products and regions. Sample calculations of the attributable disease burden suggest wide disparities in the impact of ST across countries. Additionally, the role of ST use in shaping other tobacco use behaviors (such as smoking cessation or initiation) should be considered. Currently available data are insufficient to provide a robust estimate of the global disease burden due to ST use. In the long run, comprehensive monitoring of ST use and related health outcomes is needed, especially in those countries where use is high. Nevertheless, evidence is sufficient to conclude that on a global scale, the negative health effects of ST use are substantial and completely preventable.

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Chapter 5

The Economics of Smokeless Tobacco

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Introduction

Economic analysis of the smokeless tobacco (ST) market is relatively undeveloped compared to analysis of the cigarette market. Understanding economics of the ST market, such as the demand, pricing, and taxation structure for ST, is important for understanding tobacco control. This chapter summarizes the literature (written in or translated into English) and available economic data on ST in the context of two separate and distinct marketplaces: the modern market and the traditional market (defined below). The chapter also provides the first systematic overview of ST excise tax rates and points out the vast gaps in both economic data and economic research related to ST use.

Smokeless Tobacco and Cigarette Markets

The ST market is different from the cigarette market in several key aspects.

First, the cigarette market offers, in most cases, a relatively homogenized and consistent product within and between countries. A pack of Marlboro cigarettes purchased in Cameroon is similar to a pack of Marlboro cigarettes purchased in Canada or Cambodia. On the other hand, ST purchased in Sweden is very different in terms of ingredients and types of products from ST purchased in India or Sudan.

Second, although cigarettes are a legal product in every nation of the world (except Bhutan), the sale of ST has been effectively banned in nearly 40 countries,[1] most of which are in Europe or the Western Pacific. As a result, and because ST is not widely used in many nations, the consumption of ST is largely concentrated in a few specific regions of the world. Cigarettes, in contrast, are consumed in almost all parts of the world.

Third, ST markets in low- and middle-income countries are not yet dominated by multinational tobacco corporations; the products consumed in those countries are often homemade or manufactured within a fragmented network of small, locally owned businesses. The ST market in many high-income countries, however, has become more highly concentrated, with multinational tobacco corporations owning the largest share. This concentration among multinationals has implications for tobacco surveillance, the regulatory environment, and economies of scale.

Fourth, ST markets are much less regulated than cigarette markets, particularly in low- and middle-income countries, and this lack of regulation affects tax levels and the effectiveness of collecting taxes on smokeless tobacco.

Given the diversity and complexity of the ST market, we define two separate, broad categories: modern markets and traditional markets. Modern markets, primarily located in Scandinavia and North America, are characterized by the presence of multinational corporations and the predominance of standardized, commercially manufactured ST products (defined in chapter 3 as one form of premade ST product). Traditional ST markets are much less concentrated, trading a large variety of products made under loosely defined standards (which would include cottage industry products, as defined in chapter 3, and custom-made products). These markets can be found in South Asia, Central Asia, South America, and Sub-Saharan Africa. The best available estimates indicate that, by volume, 91.3% (648.2 billion tons) of the ST products sold worldwide (710.2 billion tons) are sold in traditional markets.[2] In contrast, the

monetary value of ST sales in modern markets (US$7.882 billion) is higher than in traditional markets (US$6.548 billion).[2] Estimates of the size of traditional markets are conservative, however, as they do not include some important markets such as Bangladesh.

Overall, ST sales represent approximately 2.2% of the value of the global tobacco products market.[2] Although this figure is projected to grow considerably, cigarettes have the majority share of the tobacco market.[3]

Globalization of Smokeless Tobacco Markets

The business outlook for ST markets was positive as of 2012. Growth was expected in both the modern and traditional ST markets, making ST a profitable investment for multinational tobacco companies, which have increased their presence in modern markets. For example, the leading U.S. cigarette manufacturers decided to expand into the ST market and acquired the two largest U.S. smokeless tobacco manufacturers: U.S. Smokeless Tobacco (acquired by Philip Morris USA in 2009) and Conwood (acquired by Reynolds American in 2006). In addition, the largest Swedish ST corporation, Swedish Match, entered the U.S. smokeless tobacco market in the early 2000s. By 2010, Altria (the American parent company of Philip Morris USA, which sold Philip Morris International in 2008) owned 56% of the U.S. ST market by volume, whereas Reynolds had 30.3% of the market share.[4,5]

In addition to capturing most modern markets, the multinational corporations have attempted to enter traditional markets. For example, Swedish Match, Phillip Morris, and British American Tobacco (BAT) have tried (thus far unsuccessfully) to capture a portion of the massive Indian ST market, and Japan Tobacco International made inroads into the rapidly growing Nigerian ST market.[6] If these efforts continue, traditional markets can be expected to start selling more standardized ST products.

It is difficult to accurately track the extent of the global ST trade because the United Nation's commodities trade statistics database, Comtrade, does not disaggregate ST products from other tobacco products that are being traded.[7] Table 5-1 summarizes imports and exports for several important ST markets using data obtained from multiple sources. The major ST-exporting countries are India, Sweden, and the United States. The primary ST importers are Canada and Norway. Because the United States is not a Party to the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) and therefore does not have an obligation to provide an FCTC Party report, which is the primary source of these data, the United States is not included in this table.

Table 5-1. Global smokeless tobacco trade in selected countries

Country	Product	Export (kg)	Import (kg)	Year	Source*
Sweden	Chew and snuff	1,752,600	5,614	2009	Johansson 2010 (76)
Canada	Smokeless tobacco	—	27,377,139	2008	Sabiston 2010 (16)
Norway	Swedish snus	—	1,101,720	2009	Lindbak & Wilson 2010 (45)
Norway	Chew	—	12,800	2009	Lindbak & Wilson 2010 (45)
Italy	Snuff	—	10,000	2009	Galeone 2010 (77)
Iceland	Snuff	—	19,953	2008	Guðmundsdottir & Jensson 2009 (78)
Singapore	Snuff	—	90	2009	Taylor & Ling 2010 (79)
Singapore	Other smokeless tobacco products	—	10,400	2009	Taylor & Ling 2010 (79)
India	Chew	8,725,000	—	2007–2008	Tobacco Board 2011 (80)
India	Snuff	85,000	—	2007–2008	Tobacco Board 2011 (80)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
Abbreviation: kg = kilogram.

Smokeless tobacco may also be traded illegally across borders.[2] Such illicit trade of ST may circumvent policies that ban the import and sale of ST products in certain nations and could be the source of the ST used in those nations. Although there are no estimates of the size of the illicit ST trade, customs authorities in several countries have reported confiscating illicit ST products. Data on ST seizures are compared with cigarette seizures in Table 5-2. Cigarettes are confiscated much more frequently than ST products in the few modern market countries for which data are available. There are also reports of illicitly traded counterfeit ST products, but evidence of the practice is scarce.[8,9]

Although tax is most likely not collected on illicitly traded ST products, much larger tax leakage is assumed to occur in the domestic markets, primarily in traditional markets, due to weak tax administration and the challenges associated with collecting ST in a highly diversified market.[10]

Table 5-2. Seizures of illicit tobacco products in selected countries

Country	Smokeless tobacco seized	Cigarettes seized	Year	Source*
Modern markets				
Finland	54 kg	16,044 kg	2009	Hirvonen & Annala 2009 (81)
Malta	4 kg	25,197,477 units	2010	Kingswell & Vincenti 2011 (82)
Sweden	928 kg	56,900,000 units	2009	Euromonitor 2010 (2); Johansson 2010 (74)
Traditional markets				
Algeria	4,000,000 kg	—	2008	Euromonitor 2010 (2)
Bhutan	1,823 kg	472,600 units	2010	Norbu 2010 (83)
Brunei Darussalam	2 kg	58 kg	2009	Haji 2010 (84)
India	21,109,000 kg	214,205,000 kg	2009	Desiraju 2010 (85)
Nepal	147,504 kg	—	2005	Government of Nepal 2007 (86)
Oman	126,777 kg	17,743,000 units	2006	Al-Lawati 2007 (87)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
Abbreviation: kg = kilogram.

Modern Markets

Geography and Characteristics

Canada, the United States, and the Scandinavian countries of Northern Europe, represent the modern ST marketplace, each country having a sizeable, predominantly male population of ST users.

Although the rate of ST use is much lower in the United States (3.6% of the adult population in 2012) than in Sweden (17.0% of adults in 2010) (see chapter 2), the population of the United States is more than 300 times larger than Sweden's, thus the United States has significantly more ST users.[11,12]

In contrast, 18.1% of American adults were current cigarette smokers in 2012, representing a market of more than 42 million cigarette users.[13] However, ST is a growing segment of the U.S. tobacco market, for which marketing expenses more than doubled between 2005 and 2008.[4,14] The most commonly used ST product in the United States is moist snuff, known as "dip." Newer forms of ST, like snus and dissolvables are available in the United States, whereas sales of the oldest American ST product, chewing tobacco, continue to decline.[15] Two cigarette multinational corporations, Altria and Reynolds American, dominate the U.S. market, and the Swedish multinational ST corporation Swedish Match maintains a significant presence.

The Canadian ST market closely resembles the U.S. ST market in terms of its product selection and distribution system. About 2.4% of adult Canadian men aged 15–24 consumed some form of ST in 2008.[16] As in the United States, ST is consumed primarily in the form of moist snuff; chewing tobacco is much less popular. Canada does not manufacture ST products but imports most of them from the United States.[17] The leading distributor is the National Tobacco Company, which supplied 82% of Canada's ST

market in 2009; Imperial Tobacco Canada supplies the remainder of the market.[17] Because most ST imports come from the free-trade zone set up by the North American Free Trade Agreement, import duties are rarely levied.[16] Similar to the United States, Canada was classified by business analysts as a growth market for ST products.[18]

With few exceptions, ST is an illegal product in European Union (EU) countries. The EU's Tobacco Products Directive[19] on oral tobacco products prevents the marketing and sale of "oral tobacco," which they define as "all products for oral use, except those intended to be smoked or chewed, made wholly or partly of tobacco, in powder, … sachet portions, … or in a form resembling a food product."[19,p.4] This narrow definition of "oral tobacco" effectively bans snus and moist snuff, but chewing tobacco and nasally consumed ST (dry snuff) can be sold legally in all EU countries.[20]

Sweden, the only EU country exempt from the Directive on oral tobacco products, is an important and well-defined modern market for ST. Approximately 17% of Swedes consume ST (26% of males and 7% of females) (chapter 2). Swedish Match has a dominant share of the market (85.8% of retail volume) followed by Fiedler & Lundgren/British American Tobacco (9.2%) and Skruf Snus (2.8%).[21]

Norway, which is not an EU member, has about 10% ST use prevalence (17% of males and 5% of females use ST) (chapter 2). The Norwegian ST market is dominated by Swedish Match, which had an 80% share of the market value in 2009. Other multinationals with a market presence are British American Tobacco and Imperial Tobacco.[22]

Because the EU Directive does not ban chewing tobacco, there is still a market for chewing tobacco products in the United Kingdom, particularly "traditional" chewing tobacco products that are commonly used in South Asia.[23] The vast majority of Britons who consume ST products are South Asian immigrants, who produce and distribute ST in a way that closely resembles traditional markets in their countries of origin.[24–26] The general regulatory environment of the UK, however, is similar to that in other modern ST markets.

A mixed ST market exists in South Africa, where major multinational cigarette corporations control the manufacture and distribution of ST products usually sold in a manner that resembles traditional markets.

Corporate Influence

The multinational tobacco companies British American Tobacco, Phillip Morris International, and Swedish Match have begun to consolidate the modern ST market, a process reminiscent of the consolidation of the tobacco industry into the American Tobacco Company (also known as the "Tobacco Trust") at the turn of the 20th century.[27,28]

Figure 5-1 illustrates developments since 2005 in the ownership of modern ST markets.[29–33] Japan Tobacco International, British American Tobacco (a major stakeholder in Reynolds American), Imperial Tobacco, and Phillip Morris International have invested in both cigarette and ST markets, although cigarette sales are still their primary focus. Swedish Match has an international presence in the ST marketplace, but not in the cigarette marketplace. As a result of the consolidation process, the modern markets are dominated by five multinational tobacco corporations.[34]

Figure 5-1. Consolidation of the modern smokeless tobacco market, 2005–2010

*In 2008, Skandinavisk Tobakskompagni changed its name to Scandinavian Tobacco Group.

Figure 5-2 shows the change in these five multinational corporations' combined market shares in ST in the United States between 2001 and 2010, and contrasts them with the combined cigarette market shares of the four multinationals, that sell both cigarettes and smokeless tobacco. By 2010, ownership of the ST market was more concentrated than ownership of the cigarette market.[34] Consolidation accompanied by homogenization of ST products allows for economies of scale, improves efficiency, and reduces production costs.[35]

Entities operating in the modern ST marketplace are trying to market novel nicotine delivery products as distinct from tobacco products, both as a response to increasing regulation of the tobacco market and in an attempt to broaden the appeal and user base of ST.

Tobacco companies are also beginning to brand newly introduced ST products under the same names as popular cigarette brands.[36–40] This trend is most notable in the United States, where moist snuff and dissolvable tobacco products with names like Marlboro (Altria Group) and Camel (Reynolds American) have been introduced. In addition to stimulating sales of products bearing the Marlboro or Camel brand, this branding is apparently intended to encourage Marlboro/Camel cigarette smokers to substitute or supplement their use by using Marlboro or Camel ST products (see chapter 6).

Figure 5-2. Combined shares of the U.S. cigarette and smokeless tobacco markets held by multinational tobacco corporations, 2001–2010

Source: Authors' calculations based on data from Euromonitor International 2011 (15).

Tax

Several types of taxes are levied on ST products. An excise tax is the most important because it can be used by policymakers to achieve public health goals.[41] Excise taxes, similar to sales taxes, are internal taxes that can change the price of ST products relative to other consumer goods and make ST less affordable for the consumer, thereby reducing the quantity of ST demanded. There are two types of excise taxes: specific and ad valorem. A specific tax is charged as a fixed monetary value per physical unit of product. In the case of ST, the physical unit is usually a kilogram (e.g., in Iceland) or a smaller unit such as a sachet (in Madagascar). An ad valorem tax is charged as a percentage of the value of a product. The value of the product can be defined as the retail price, the manufacturer's price, or by some other measure. In addition to excise tax, most ST products also carry taxes that are levied on other consumer goods, such as sales, consumption, or value-added taxes, and customs duties, which are imposed on imports.

Table 5-3 presents ST tax rates in selected modern markets. These taxes are imposed on a national level and do not include any subnational taxes.

Table 5-3. Smokeless tobacco tax rates in modern market countries (per year)

Country	Specific excise (US$/kg)	Ad valorem tax	Type of product	Year	Source*
Albania	15.21		Snuff & chew	2011	Tobacco Merchants Association (TMA) 2011 (46); General Directorate of Tax (Albania) 2002 (88)
Armenia	4.01		Snuff & chew	2011	TMA 2011 (46); Tax Service (Armenia) 2000 (89)
Bulgaria	95.34		Chew	2011	TMA 2011 (46); National Revenue Agency (Bulgaria) 2011 (90)
Canada	60.17		Snuff & chew	2011	Sabiston 2010 (16); TMA 2011 (46)
Croatia	7.40		Snuff & chew	2011	TMA 2011 (46)
Czech Republic	73.55		Snuff & chew	2011	Czech Tax Administration 2011 (91)
Denmark	44.05		Chew	2011	TMA 2011 (46); Skatteministeriat 2010 (92)
Denmark	11.23		Chew, snuff	2010	Skatteministeriat 2010 (92); Falk 2010 (93)
Estonia	43.04		Chew	2011	Alcohol, Tobacco, Fuel and Electricity Excise Duty Act (Estonia) 2009 (94)
Finland		60.00%	All	2010	Hiroven & Annala 2009 (81); Colliander 2009 (95)
France		32.17%	Chew	2011	TMA 2011 (46)
Georgia	11.93		Snuff & chew	2011	TMA 2011 (46); Ministry of Finance (Georgia) 2009 (96)
Germany		None	Chew	2011	TMA 2011 (46)
Iceland	42.17		Snuff	2009	Ministry of Finance (Iceland) 2009 (97)
Ireland		22.00%	Chew	2011	TMA 2011 (46)
Italy		24.78%	Chew	2011	TMA 2011 (46); European Commission 2002 (98)
Macedonia	31.42		Snuff & chew	2011	TMA 2011 (46); Official Gazette of the Republic of Macedonia 2010 (99)
Malta	45.97		Chew	2011	Justice Services (Malta) 2010 (100)
Mexico		30.40%	Snuff & chew	2010	Secretaria de Hacienda (Mexico) 2010 (101); Avila & Ajenjo 2010 (102)
Netherlands	34.48		Chew	2011	TMA 2011 (46); Government of the Netherlands 2002 (103)
Norway	168.92		Snuff & chew	2011	TMA 2011 (46); Customs and Excise Special Taxes Department (Norway) 2011 (44)
Poland		60.00%	Chew	2011	TMA 2011 (46)
Romania	116.20		Chew	2011	TMA 2011 (46)

Country	Specific excise (US$/kg)	Ad valorem tax	Type of product	Year	Source*
Russian Federation	18.08		Snuff & chew	2011	TMA 2011 (46)
Serbia		35.00%	Snuff & chew	2011	TMA 2011 (46); Lazarevi & Stankovic 2011 (104)
Slovakia	96.06		Chew	2011	TMA 2011 (46); Ministry of Finance of the Slovak Republic 2009 (105)
Slovenia		0.00%		2008	Čakš et al. 2008 (106); Ministry of Finance (Slovenia) 2010 (107)
Spain		26.00%		2010	Hurtado & Férnandez 2010 (108)
Sweden	64.18		Chew	2011	Skatteverket 2008 (42); TMA 2011 (46)
Sweden	52.78		Snuff	2011	Skatteverket 2008 (42)
Switzerland		5.00%	Snuff & chew	2010	Les autorités fédérales de la Confédération (Switzerland) 2010 (109); Grundlagen 2011 (110)
Ukraine	2.51		Snuff & chew	2011	TMA 2011 (46); Schlesinger & Dye 2010 (111)
United Kingdom	137.35		Chew	2011	HM Revenue and Customs 2011 (112)
United States	1.11		Chew	2011	TMA 2011 (46); Internal Revenue Code 2009 (113)
United States	3.32		Snuff	2011	TMA 2011 (46); Internal Revenue Code 2009 (113)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
Abbreviations: kg = kilogram; TMA = Tobacco Merchants Association.

Smokeless tobacco is generally taxed at significantly lower rates than cigarettes (Table 5-4, Table 5-5). For example, the taxes on a standard pack of 20 cigarettes in Sweden was Swedish krona (SEK) 25.80 (US$3.57) in taxes in 2010, compared to SEK 11.42 (US$1.79) for a standard 34g pack of smokeless tobacco.[42] This difference in tax policy is clearly illustrated by the share of excise tax in the retail price of a product: The excise tax on the most popular brand of cigarettes in Sweden represents 52% of its retail price, whereas the excise tax levied on the most popular brand of Swedish snus represents only 22% of its retail price.[43] A similar situation exists in Norway, where the excise tax on cigarettes reaches 52% of the retail price, whereas the excise tax on Swedish snus represents only 33% of the retail snus price.[43–46] The lower level of ST taxes likely results from many factors, such as a lower priority on controlling ST consumption than cigarette consumption, or preferential treatment for domestically produced ST products over cigarettes sold by the multinationals. This contrasts sharply with the bans imposed by the EU, Australia, and New Zealand on the import and sale of ST products.

Table 5-4. Relative tax incidences of cigarettes and smokeless tobacco

Country	Tobacco type	Amount	Excise tax, LCU (US$)
Sweden	Cigarettes	20 sticks ~ 20g	25.80 ($3.57)
Sweden	Swedish snus	1 can ~ 34g	11.42 ($1.79)
Country	**Tobacco type**	**Amount**	**State tax (federal tax)**
U.S.–Washington	Cigarettes	20 sticks ~ 20g	3.02 ($4.03)
U.S.–Washington	Moist snuff, loose	1 can ~ 34g	3.03 ($3.14)
U.S.–New Jersey	Cigarettes	20 sticks ~ 20g	2.70 ($3.71)
U.S.–New Jersey	Moist snuff, loose	1 can ~ 34g	0.90 ($0.99)

Abbreviations: g = grams; LCU = Local Currency Unit.
Note: Tax rates for Sweden are for 2008, and for the United States, 2010.
Sources: World Health Organization 2011 (43); Skatteverket 2008 (42); Boonn 2011 (51).

Table 5-5. Tax burden comparison between cigarettes and smokeless tobacco

Country	Specific excise on cigarettes (US$/1,000)	Ad valorem tax on cigarettes (%)	Specific excise on smokeless tobacco (US$/kg)	Ad valorem tax on smokeless tobacco (%)	Smokeless tobacco type
Albania	23.83	0.0	15.21		Snuff & chew
Armenia	13.47	0.0	4.01		Snuff & chew
Bulgaria	67.17	23.0	95.34		Chew
Canada	227.33	0.0	60.17		Snuff & chew
Croatia	32.30	33.0	7.40		Snuff & chew
Czech Republic	56.22	28.0	73.55		Snuff & chew
Denmark	110.13	20.8	44.05		Chew
Denmark	110.13	20.8	11.23		Snuff
Estonia	43.76	33.0	43.04		Chew
Finland	22.79	52.0		60.00	All
France	22.01	58.0		32.17	Chew
Georgia	16.38	0.0	11.93		Snuff & chew
Germany	107.82	24.7		None	Chew
Iceland	134.93	0.0	42.17		Snuff
Ireland	238.98	18.3		22.00	Chew
Italy	9.05	54.7		24.78	Chew
Italy	9.05	54.7			Snuff
Macedonia	2.12	35.0	31.42		Snuff & chew
Malta	28.66	50.0	45.97		Chew

Country	Specific excise on cigarettes (US$/1,000)	Ad valorem tax on cigarettes (%)	Specific excise on smokeless tobacco (US$/kg)	Ad valorem tax on smokeless tobacco (%)	Smokeless tobacco type
Mexico	3.16	46.2		30.40	Snuff & chew
Netherlands	120.03	20.5	34.48		Chew
Norway	348.10	0.0	168.92		Snuff & chew
Poland	47.84	31.4		60.00	Chew
Romania	63.37	22.0	116.20		Chew
Russian Federation	6.81	6.5	18.08		Snuff & chew
Serbia	11.51	35.0		35.00	Snuff & chew
Slovakia	68.23	24.0	96.06		Chew
Slovenia	24.73	44.0		0.00	
Spain	13.29	57.0		26.00	
Sweden	42.84	39.2	64.18		Chew
Sweden	42.84	39.2	52.78		Snuff
Switzerland	105.32	25.0		5.00	Snuff & chew
Ukraine	11.45	20.8	2.51		Snuff & chew
United Kingdom	185.45	24.0	137.35		Chew
United States	114.00	0.0	1.11		Chew
United States	114.00	0.0	3.32		Snuff

Abbreviation: kg = kilogram.
Note: Compares cigarette and smokeless tobacco tax rates in all countries where a smokeless tobacco tax rate was available.
Source: Compiled and calculated by the authors from multiple sources.

Tax Revenue

Tax administration of ST products in a modern market is relatively efficient at raising revenue, as taxes are collected on most products, but much less revenue is raised on smokeless tobacco than on cigarettes, due to lower consumption and lower tax rates. The largest share of ST tax in total tobacco excise tax revenue is in Sweden, but even there it reaches only 12.8%.[47] In the United States, the federal ST excise tax revenue amounted to $165.5 million in 2010, or about 1% of the amount of federal excise tax revenue collected on cigarettes (based upon authors' calculations using the following sources: Ekonomistyrningsverket 2011,[47] Alcohol and Tobacco Tax and Trade Bureau 2012,[48] U.S. Department of the Treasury 2011[49]). Nevertheless, ST tax revenue in the United States is important, as it has been used to help fund the nationwide Children's Health Insurance Program.[50] In addition to the federal excise tax, each U.S. state (except Pennsylvania) also imposes a state-level excise tax on ST products.[51]

Price

The tobacco industry created tiered pricing schema in both the ST and the cigarette markets. In modern markets, premium-priced ST brands occupy a much larger market share than value-priced brands.[52]

Table 5-6 compares prices of major ST product categories with the price of the premium cigarette brand, Marlboro. Generally, ST products are less expensive than cigarettes, but the price differences between ST products and cigarettes are country-specific. It is important to note that many of the ST prices come from WHO FCTC Party reports, which do not require use of standardized methods of data collection and reporting.[53]

Table 5-6. Price in U.S. dollars of Marlboro cigarettes (per stick) and smokeless tobacco products (per gram) in the modern market in 2011

Country	Marlboro cigarettes	Moist snuff—portion	Moist snuff—loose	Dry snuff	Chew	Source*
Canada	0.53	1.65	0.45	—	0.96	Economist Intelligence Unit 2011 (114); Euromonitor (Canada) 2010 (17)
Denmark	0.35	—	0.09	—	0.78	Economist Intelligence Unit 2011 (114); Euromonitor (Denmark) 2011 (115)
Germany	0.34	—	—	0.59	0.30	Economist Intelligence Unit 2011 (114); Euromonitor (Germany) 2010 (116)
Mexico	0.09	—	0.29	—	—	Economist Intelligence Unit 2011 (114); Euromonitor (Mexico) 2011 (117)
Norway	0.71	0.47	0.26	0.63	1.06	Lindbak & Wilson 2010 (45); Economist Intelligence Unit 2011 (114)
Sweden	0.39	0.16	0.21	—	—	Euromonitor (Sweden) 2011 (21); Economist Intelligence Unit 2011 (114)
United States	0.32	0.18	0.18	0.40	0.07	Euromonitor 2010 (2); Economist Intelligence Unit 2011 (114)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.

Sensitivity of Smokeless Tobacco Demand

Data on the price and income sensitivity of ST demand are limited compared to that for cigarettes, and the vast majority of studies have used data from the United States. Research shows that the demand for ST, like the demand for cigarettes, responds to price and income changes.[54] Economists measure the degree of responsiveness to price and income changes by calculating price, tax, and income elasticities. Various studies have estimated changes in ST demand (measured by changes in expenditures on ST or by the prevalence of ST use) in response to changes in ST prices (own-price elasticity), ST taxes (own-tax elasticity), prices/taxes of other tobacco products (cross-price/cross-tax price elasticity), and income (income elasticity of ST demand). The magnitude of price elasticity will be greater than that of tax elasticity because taxes represent only a fraction of total price. For example, in order to achieve a 10% increase in price and a corresponding decline in demand, taxes must increase by substantially more than 10%, yielding a lower estimate of tax elasticity than price elasticity.

Price Elasticity – The proportional change in quantity consumed is larger than the proportional change in price. Absolute value of price elasticity is greater than 1.
Price Inelasticity – The proportional change in quantity consumed is smaller than the proportional change in price. Absolute value of price elasticity is less than 1.
Total Price Elasticity of Demand – A measurement of consumer price responsiveness; the change in quantity demanded or purchased in response to a change in price.
Price Elasticity of Prevalence – A change in the percentage of people using a product in response to a change in price (captures the number of those who quit or do not initiate use).
Price Elasticity of Conditional Demand – A change in the amount of product being used by those who continue to use after a price change (captures lower intensity or frequency of use).
Price/Tax Elasticity – The sensitivity of consumers to price/tax changes; for example, an own-price elasticity of –0.4 means that consumption of a good will decline by 4% if the price increases by 10%.
Cross-Price/Tax Elasticity – The sensitivity of consumers to price/tax changes of a related good (e.g., cigarettes, other smokeless tobacco products); for example, a 0.8 cross-price elasticity between cigarettes and ST means that a 10% increase in the price of cigarettes will yield an 8% increase in consumption of ST.
Price Elasticity of Prevalence + Price Elasticity of Conditional Demand = Total Price Elasticity of Demand

Most studies evaluate the impact of price and income on all ST products combined and do not distinguish between various ST types. The analytic methods used to study the ST market are similar to those applied to the cigarette market.[55] Estimates from these studies are summarized in Table 5-7.

Table 5-7. Studies of price and tax elasticity estimates of smokeless tobacco demand in the modern market

Country	Elasticity	Elasticity type	Dependent variable	Primary independent variable	Participants	Year(s)	Source*
United States	0.02†	Cross-price	Per capita cigarette consumption	ST tax, cigarette price		2004	Goel 2008 (58)
United States	–0.715‡	Cross-price	Participation in use of any smokeless product	ST tax, real cigarette price	High school males	1995–01	Tauras et al. 2007 (72)
United States	–0.413‡	Cross-price	Frequency of use of any smokeless product	ST tax, real cigarette price	High school males	1995–01	Tauras et al. 2007 (72)
Sweden	–1.58‡	Cross-price	Aggregate Swedish snus consumption	Real cigarette price, real snus price		1964–97	Bask & Melkersson 2003 (57)
United States	0.10	Cross-tax	Participation in use of any smokeless product	Cigarette tax, ST tax	Males ≥16 years	1985	Ohsfeldt et al. 1997 (59)
United States	0.98	Cross-tax	Participation in use of snuff	Cigarette tax, snuff tax	Males ≥16 years	1992–93	Ohsfeldt & Boyle 1999 (60)
United States	0.001†	Cross-tax	Participation in use of cigarettes	Snuff tax, cigarette tax	Males ≥16 years	1992–93	Ohsfeldt & Boyle 1999 (60)
United States	0.44	Cross-tax	Participation in use of any smokeless product	Cigarette tax, smokeless tax	Males ≥16 years	1985	Ohsfeldt & Boyle 1994 (73)
United States	–0.052	Own-tax	Participation in use of any smokeless product	Real snus price	Adolescent males	1992–94	Chaloupka et al. 1996 (71)
United States	–0.032	Own-tax	Frequency of use of any smokeless product	Real snus price	Adolescent males	1992–94	Chaloupka et al. 1996 (71)
United States	–0.402	Own-price	Participation in use of any smokeless product	Real snus price	Adolescent males	1992–94	Chaloupka et al. 1996 (71)
United States	–0.248	Own-price	Frequency of use of any smokeless product	Real snus price	Adolescent males	1992–94	Chaloupka et al. 1996 (71)

Country	Elasticity	Elasticity type	Dependent variable	Primary independent variable	Participants	Year(s)	Source*
Sweden	0.94	Own-price	Aggregate Swedish snus consumption	Real snus price		1964–97	Bask & Melkersson 2003 (57)
United States	–0.01	Own-tax	Participation in use of snuff	Snuff tax	Males ≥16 years	1992–93	Ohsfeldt & Boyle 1999 (60)
United States	–0.159	Own-tax	Participation in use of any smokeless product	ST tax	High school males	1995–01	Tauras et al. 2007 (72)
United States	–0.065	Own-tax	Frequency of use of any smokeless product	ST tax	High school males	1995–01	Tauras et al. 2007 (72)
United States	–0.15	Own-tax	Participation in use of any smokeless product	ST tax	Males ≥16 years	1985	Ohsfeldt et al.1997 (59)
United States	–0.55	Own-tax	Participation in use of any smokeless product	ST tax	Males ≥16 years	1985	Ohsfeldt & Boyle 1994 (73)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
†Not statistically significant.
‡Complements.
Abbreviation: ST = smokeless tobacco.

Generally, estimates of own-price elasticities of ST demand range between –0.25 and –0.5, similar to those for cigarettes.[41] This means that ST is price-inelastic because the absolute value of its price elasticity is smaller than 1. Estimates of cross-price elasticity measure the degree to which ST products are substitutes for or complements to other tobacco products, primarily cigarettes. There is strong evidence that higher taxes on cigarettes lead to an increase in the use of ST products, especially when the relative prices of ST and cigarettes are changing (i.e., when the prices of the two products have evolved at different speeds).[55] Despite this evidence that these products are substitutes, there is concern that tobacco company marketing efforts promoting dual use of ST and cigarettes may fundamentally change this relationship to a complementary one. The impact of higher ST taxes on cigarette use is less clear.[56–60] Observations from Finland have linked the country's 1995 ban of snus from the market to an 11% increase in cigarette consumption by 2001.[61]

Complementary products – Products that are consumed together, wherein increased consumption of one product increases consumption of the other (e.g., automobiles and gas).
Substitute products – Products that are consumed in an either/or fashion, wherein increased consumption of one product decreases consumption of the other (e.g., margarine and butter).

Demand for ST is also affected by income. Studies have tried to determine if ST is a normal good or an inferior good. The evidence from the modern marketplace suggests that ST is an inferior good, meaning that its consumption will decrease as the income of consumers rises (Table 5-8). However, the evidence that ST is an inferior good comes from the United States during the period of 1985 to 1994, which limits the generalizability of the findings to other places and periods of time.[59,60]

Normal Good – A good that is consumed in larger quantities as a consumer's income increases.
Inferior Good – A good that is consumed less as a consumer's income increases.

Table 5-8. Income elasticity of smokeless tobacco demand in the modern market (United States)

Income elasticity	Type of good	Dependent variable	Year	Source*
(–0.0068† to –0.0069†)	Inferior	Participation in use of snuff‡	1993	Ohsfeldt & Boyle 1999 (60)
(–0.0001 to –0.0009†)	Inferior	Participation in use of snuff§	1993	Ohsfeldt & Boyle 1999 (60)
0.004	—	Participation in use of any smokeless product	1992–1994	Chaloupka et al. 1996 (71)
0.004	—	Frequency of use of any smokeless product (ordinal dependent variable)	1992–1994	Chaloupka et al. 1996 (71)
0.003	—	Frequency of use of any smokeless product (continuous dependent variable)	1992–1994	Chaloupka et al. 1996 (71)
(–0.0015‡)	Inferior	Participation in use of snuff	1985	Ohsfeldt et al. 1997 (59)
(–0.0021‡)	Inferior	Participation in use of chew	1985	Ohsfeldt et al. 1997 (59)
(–0.0019‡)	Inferior	Participation in use of any smokeless product	1985	Ohsfeldt et al. 1997 (59)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
†Statistically significant (p <0.01).
‡Model controls for tobacco control policies by an index.
§Model controls for individual tobacco control policies.
Note: Income inelasticity measures the sensitivity of consumers to income changes. For example, –0.007 income elasticity means that the consumption of the good is going to decline by 0.007% if the income increases by 1%. An income elasticity value of 0.5 means that consumption of a good will increase by 5% if a consumer's income increases by 10%.

Traditional Markets

Geography and Characteristics

Traditional markets can be found primarily in South and Central Asia (Afghanistan, Bangladesh, Bhutan, India, Kyrgyzstan, Kazakhstan, Maldives, Nepal, Pakistan, Sri Lanka, Tajikistan, Turkmenistan, and Uzbekistan), Sub-Saharan Africa, the Western Pacific, and Latin America. The volume of ST products sold in these markets is much larger than in modern markets, as the vast majority of the world's ST users live in traditional market countries (chapter 2). Traditional markets are competitive markets characterized by a high degree of product diversity, a lack of product standardization, low levels of market concentration, low barriers to product entry into the market, lack of mass commercialization, and the absence of multinational tobacco corporations. These markets are organized primarily as cottage industries, with informal production, distribution, and retail chains. Because of these characteristics, economic analyses of traditional ST markets are much more challenging compared to modern markets.

Most of the data and research evidence on traditional ST markets come from India, the world's largest ST market.[62] However, researchers in this area struggle with severe data limitations because little is known about prevalence, intensity of use, product prices and taxes, product characteristics, distribution channels, labor practices, and tax collection.

Price, Tax, and Tax Revenue

Information on ST prices in traditional markets is scarce. Smokeless tobacco price data (Table 5-9) were obtained from WHO FCTC Party reports and Euromonitor International country reports. Because the methods used to calculate these prices are not known, prices should not be compared across products or countries.

Table 5-9. Smokeless tobacco prices in the traditional market

Country	Product	US$/gram	Year	Source*
Algeria	Chemma	0.014	2010	Youcef 2011 (118)
Bangladesh	Hakimpuri Zarda	0.017	2009	Senior Assistant Secretary 2010 (119)
Bangladesh	Suravi	0.006	2009	Senior Assistant Secretary 2010 (119)
Congo, Democratic Republic of	Chew	0.15/scoop	2008	Muteba 2009 (120)
Djibouti	Angadda/Bouri	0.011	2009	Ali-Higo & Djibouti 2009 (121)
Djibouti	Kourkoura	0.017	2009	Ali-Higo & Djibouti 2009 (121)
India	Rajnigandha Pan Masala	0.086	2008	Euromonitor 2010 (2)
India	Sathi Khaini	0.006	2008	Euromonitor 2010 (2)
India	Unbranded khaini	0.001	2008	Euromonitor 2010 (2)
India	RMD Gutkha Mini	0.046	2008	Euromonitor 2010 (2)
Lesotho	Babaton	0.373	2010	Mosala 2010 (122)
Marshall Islands	Copenhagen	0.146	2005	Edwards & Langdrik 2010 (123)
Panama	Masticable Picadora Wolf	0.020	2010	Roa 2010 (124)
Peru	Longhorn Snuff	0.312	2010	Euromonitor 2010 (125)
Peru	Lotzbeck Snuff	0.347	2010	Euromonitor 2010 (125)
South Africa	Taxi Snuff	0.036	2010	Moodley and Phaka 2010 (126)
Swaziland	Snuff	0.043	2009	Dlamini 2009 (127)
Tunisia	Neffa	0.005	2010	Euromonitor (Tunisia) 2011 (128)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.

Traditional market excise tax structures for ST are very similar to those in modern markets. Just as in modern markets, the excise tax accounts for a smaller share of the retail price of ST products compared to cigarettes. For example, the excise tax on cigarettes in Algeria represents 40% of the retail price, whereas the excise tax on ST products reaches about 35% of retail prices.[3,43,63]

Table 5-10 summarizes excise tax rates on ST products levied in various countries. The main difference between the traditional and modern markets is the efficiency and effectiveness of tax collection.

Table 5-10. Smokeless tobacco tax rates in traditional market countries (per year)

Country	Specific excise (US$/weight)	Ad valorem tax (%)	Type of product	Year	Source*
Algeria	9.86/kg		Snuff & chew	2011	Direction Generale des Impots (Algeria) 2011 (63); TMA 2011 (46)
Argentina		20.0	Snuff	2009	Fernandez 2009 (129); Ministerio de Economía y Produción (Argentina) 2011 (130)
Azerbaijan		12.5	Snuff & chew	2011	TMA 2011 (46); Ministry of Taxes, no date (131)
Bangladesh		30.0	Jarda, gul	2011	Barkat et al. 2012 (132)
Barbados	23.56/kg		Snuff	2011	TMA 2011 (46)
Benin		61.5		2011	Agossou et al. 2011 (133)
Bolivia		50.0	Snuff & chew	2011	TMA 2011 (46); Government of Bolivia 2001 (134)
Bosnia and Herzegovina	1.46/kg		Snuff & chew	2011	TMA 2011 (46)
Brazil		30.0	Snuff & chew	2011	TMA 2011 (46); Receita Federal do Brasil, no date (135)
Burkina Faso		17.0	Snuff & chew	2011	TMA 2011 (46); Théodore 2009 (136)
Burundi		41.0	Snuff & chew	2011	TMA 2011 (46)
Cambodia		10.0		2008	Pheang 2008 (137)
Cameroon		25.0		2009	Sibetchu 2008 (138)
Chile		59.7	Snuff & chew	2011	TMA 2011 (46); Servicio de Impuestos Internos (SII) (Chile) 2011 (139)
China		30.0	Snuff & chew	2011	TMA 2011 (46)
Costa Rica		60.0	Snuff & chew	2011	Sistema Costarricense 2011 (140)
Côte D'Ivoire	13.12/kg		Snuff & chew	2011	TMA 2011 (46)
Dominican Republic		65.0		2008	Direccion General de Impuestos Internales 2004 (141)
Ecuador		150.0		2008	Salazar 2008 (142); Servicio de Rentas Internas (SRI) (Ecuador) 2007 (143)
Egypt	1.35/kg			2010	Ministry of Finance (Egypt) 2008 (144)
El Salvador		39.0	Snuff & chew	2011	TMA 2011 (46); La Asamblea Legislativa de la Republica de El Salvador 2004 (145)
Ethiopia		75.0	Snuff	2011	Ethiopian Revenue & Customs 2008 (146)

Country	Specific excise (US$/weight)	Ad valorem tax (%)	Type of product	Year	Source*
Fiji	51.36/kg		Snuff & chew	2011	TMA 2011 (46)
Gabon		30.0	Snuff & chew	2011	TMA 2011 (46); Direction Generale des Impots (Gabon) 2006 (147)
Gambia				2009	Bah 2009 (147)
Ghana		0.0	Snuff & chew	2007	Ministry of Finance and Economic Planning (Ghana) 2007 (148)
Guatemala		100.0	Snuff & chew	2011	TMA 2011 (46)
Guyana		100.0	Snuff & chew	2011	TMA 2011 (46)
India		86.0	Snuff & chew	2011	John et al. 2010 (64); TMA 2011 (46)
Indonesia		30.0	Snuff & chew	2011	TMA 2011 (46)
Iran, Islamic Republic of		5.0	Snuff & chew	2011	TMA 2011 (46)
Jamaica		14.5	Snuff & chew	2011	TMA 2011 (46)
Kazakhstan	8.39/kg		Snuff & chew	2011	TMA 2011 (46)
Kenya		130.0	Snuff & chew	2011	TMA 2011 (46); Kenya Revenue Authority 2010 (149)
Korea, Republic of	15.08/kg		Snuff	2011	TMA 2011 (46)
Korea, Republic of	24.09/kg		Chew	2011	TMA 2011 (46)
Kuwait		0.0	Snuff & chew	2011	TMA 2011 (46)
Kyrgyzstan	0.03/kg		All	2008	Decree of the President 2006 (150)
Lebanon		108.0	Snuff & chew	2011	TMA 2011 (46)
Madagascar	0.0032/sachet	20.0	Chew	2011	TMA 2011 (46); Ministère des Finances 2010 (151)
Madagascar	0.0005/sachet	50.0	Snuff	2011	TMA 2011 (46); Ministère des Finances 2010 (151)
Malaysia	8.93/kg	5.0	Snuff & chew	2011	TMA 2011 (46); JKDM HS Explorer 2011 (152)
Mali		78.0	Snuff & chew	2011	TMA 2011 (46)
Marshall Islands	80.41/kg		Snuff	2010	Edwards & Langdrik 2010 (123)

Country	Specific excise (US$/weight)	Ad valorem tax (%)	Type of product	Year	Source*
Mauritania		20.0	Snuff & chew	2011	TMA 2011 (46)
Mauritius		230.0	Snuff & chew	2011	TMA 2011 (46); Mauritius Revenue Authority 2004 (153)
Micronesia		50.0		2010	Skilling 2010 (154)
Morocco		59.4	Snuff & chew	2011	TMA 2011 (46)
Mozambique		75.0	Snuff & chew	2011	TMA 2011 (46)
Myanmar		60.0	Chew	2011	TMA 2011 (46)
Myanmar		25.0	Betel	2007	Kyaing 2007 (155)
Nepal	2.32/kg		Chew	2011	TMA 2011 (46)
Nicaragua		0.0	Snuff & chew	2011	TMA 2011 (46)
Niger		10.0	Snuff & chew	2011	TMA 2011 (46)
Nigeria		50.0	Snuff & chew	2011	TMA 2011 (46)
Oman		0.0	Snuff & chew	2011	TMA 2011 (46)
Pakistan		15.0	Chew	2011	Ministry of Finance (Pakistan) 2011 (156)
Panama		50.0		2009	Roa & Vergara 2010 (124); Gaceta Oficial (Panama) 2009 (157)
Papua New Guinea	20.35/kg		Snuff & chew	2011	TMA 2011 (46)
Paraguay		10.0	Snuff & chew	2011	TMA 2011 (46); Subsecretaría de Estado de Tributación, no date (158)
Peru		50.0	Snuff & chew	2011	TMA 2011 (46); Alburqueque 2007 (159)
Philippines	0.02/kg		Chew	2011	TMA 2011 (46); Thirteenth Congress of the Philippines 2004 (160)
Rwanda		0.0		2009	Nzeyimana 2009 (161)
Saint Lucia		10.0	Snuff & chew	2011	TMA 2011 (46)
Saudi Arabia		0.0	Snuff & chew	2011	TMA 2011 (46)
Senegal		40.0	Snuff & chew	2011	TMA 2011 (46); Direction Général des Impôts et des Domaines (Senegal) 2011 (162)

Country	Specific excise (US$/weight)	Ad valorem tax (%)	Type of product	Year	Source*
Singapore	280.48/kg		Snuff	2011	TMA 2011 (46); Ministry of Finance (Singapore) 2011 (163)
Singapore	157.89/kg		Chew	2011	Ministry of Finance (Singapore) 2011 (163)
South Africa		0.0	Snuff	2011	TMA 2011 (46); South African Revenue Service 2012 (164)
Sri Lanka		0.0		2011	Sri Lanka Customs 2011 (165)
Swaziland	21.93/kg		Snuff	2009	Dlamini 2009 (127); Swaziland Revenue Authority 2010 (166)
Syria		15.0	Chew	2011	TMA 2011 (46); Syrian Ministry of Finance 2004 (167)
Tajikistan		10.0	Snuff & chew	2011	TMA 2011 (46)
Thailand	2.73/kg	0.1	Chew	2008	Kingdom of Thailand 2010 (168); Termsirikulchai et al. 2008 (169)
Tonga	75.10/kg			2009	Vivili 2009 (170)
Trinidad and Tobago			All	2010	Ministry of Health 2010 (171)
Tunisia		135.0	Snuff & chew	2011	TMA 2011 (46); Ministère des Finances (Tunisia) 2010 (172)
Turkey		63.0	Snuff	2010	Altan & Irmak 2011 (173); Council of Ministers (Turkey) 2011 (174)
Turkmenistan	10.00/kg		Snuff & chew	2011	TMA 2011 (46)
Uganda		150.0	All	2009	Uganda Revenue Authority 2009 (175); TMA 2011 (46)
Venezuela		70.0	Snuff & chew	2011	TMA 2011 (46)
Vietnam		65.0		2011	Ministry of Finance (Vietnam) 2011 (176)
Yemen		90.0	Snuff & chew	2011	Customs Authority (Yemen) 2010 (177); TMA 2011 (46)
Zambia	24.36/kg		Snuff & chew	2008	Zambia Revenue Authority 2008 (178)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
Abbreviations: kg = kilogram; TMA = Tobacco Merchants Association.

The scarcity of data on tax evasion and avoidance makes it extremely difficult to determine the effective tax rate in traditional markets. We know very little about the market penetration of custom-made, cottage-industry, or illicit ST products. However, it can be expected that the effectiveness of tax collection for less prominent ST products is worse than for more prominent products like cigarettes.[41]

Despite these challenges, some ST taxes in traditional markets are collected and can contribute significantly to a government's revenue. Table 5-11 shows that ST taxes in India contributed between 3.84% and 11.98% of the total tobacco excise tax revenue from 1999 to 2007. During this time, the ST tax rate increased from 33% to 50% of the retail price (Figure 5-3). This tax rate increase, combined with population growth, resulted in higher ST tax revenue in both real and nominal terms (Figure 5-3 and Table 5-12).[64]

Table 5-11. Percentage contribution of various tobacco products to total tobacco excise tax revenues in India, 1999–2007

Years	Cigarettes	Bidis	Chewing tobacco	Other tobacco products
1999–2000	86.18	5.70	6.22	1.89
2000–2001	84.75	5.79	6.96	2.50
2001–2002	78.52	5.54	9.79	6.15
2002–2003	80.00	5.61	9.84	4.55
2003–2004	82.82	5.07	9.25	2.87
2004–2005	83.60	4.86	8.05	3.49
2005–2006	84.76	4.39	3.84	7.01
2006–2007	76.95	4.64	11.98	6.43

Source: Calculated by the authors based on data from John et al. 2010 (64).

Figure 5-3. Excise tax and tax revenue from chewing tobacco in India

Source: John et al. 2010 (64).

Table 5-12. Tax revenue from chewing tobacco in India, adjusted and unadjusted for inflation, 1999–2007

Year	U.S. dollars in millions		Indian rupees in millions	
	Adjusted	Unadjusted	Adjusted	Unadjusted
1999–2000	83.734	78.141	3,763.2	3,511.8
2000–2001	90.228	90.228	4,257.5	4,257.5
2001–2002	125.242	129.747	6,088.0	6,307.0
2002–2003	126.641	135.670	5,899.3	6,319.9
2003–2004	119.838	135.385	5,430.6	6,135.1
2004–2005	108.819	130.905	4,798.9	5,772.9
2005–2006	56.681	71.170	2,568.1	3,224.5
2006–2007	201.589	266.843	8,335.5	11,033.7

Source: John et al. 2010 (64).

The volume of ST tax revenue collected by the Indian government contrasts with the ST tax revenue collected in Bangladesh, the second-largest ST market based on the number of ST users, where ST tax revenue represents only 0.4% of the total tobacco tax revenue.[65]

Sensitivity of Smokeless Tobacco Demand

Data on the responsiveness of ST demand to changes in price and income in traditional markets are even more limited than in modern markets. There are gaps in consumption and price data, and the absence of standard packaging makes it difficult to calculate unit prices. Some evidence indicates that ST users in traditional markets are price-sensitive and that higher prices on ST would lead to lower consumption.[66,67] No existing research appears to clarify the relationship between income and ST use in traditional markets.

The price elasticity of tobacco leaf demand in India has been estimated at –0.883, meaning that for every 10% increase in tobacco leaf prices, the consumption of tobacco leaf will decrease by 8.83%.[64,68] This suggests that, as higher prices for the raw tobacco used in ST products are passed on to consumers in the form of higher retail prices, overall tobacco use will be reduced, and most likely ST use as well. Another study from India used micro-level data to estimate that a 10% increase in the price of gutka would decrease consumption by 5.8% and prevalence of gutka use by 2.7%.[69]

One study used macro-level data to calculate the cross-tax elasticity between cigarettes and betel quid without tobacco (a product that can serve as a proxy for ST use because it is consumed in a similar way) and the own-price elasticity of the demand for betel nuts in Taiwan.[70] The cross-price elasticity between cigarettes and betel nuts ranged from –0.082 to –0.131, suggesting that these two products are complements.[70] This could be similar to the relationship between ST consumption and cigarette prices found in some studies using modern market data.[72] The own-price elasticity of betel use was –0.384, which was lower than the own-price elasticity of cigarette demand (–0.609 to –0.824) calculated in the same study,[70] but comparable to estimates from ST studies in modern markets.[59,60,71–73]

Economic theory predicts that ST products would be more price-elastic in traditional markets than in modern markets because many consumers can easily substitute custom-made tobacco products for manufactured ST products. However, more research is needed to support or reject this hypothesis.

Since about 2001, the economies of traditional markets have grown more rapidly than economies of modern markets, which has increased the affordability of all products, including ST products. In India, for example, chewing tobacco became much more affordable from 2001 to 2007 despite the higher ST tax and price increases, because these increases were not sufficient to offset the level of inflation and income growth (Table 5-13). Greater affordability may explain the growing consumption of chewing tobacco in India.[64]

Table 5-13. Chewing tobacco affordability in India, 2001–2007

Year	Affordability
2001	0.64
2002	0.58
2003	0.63
2004	0.56
2005	0.51
2006	0.49
2007	0.48

Note: The affordability of smokeless tobacco is measured as the percentage of per capita gross domestic product required to buy 100 packs of chewing tobacco. The higher value indicates less affordability.
Source: John et al. 2010 (64).

Gaps and Limitations

Very few data exist on ST prices, tax rates, and tax structures, which makes research into the impact of ST taxes and ST prices on ST use very difficult, if not impossible. Very little is known about the extent to which higher ST taxes translate into higher ST prices and how these prices affect the affordability of ST products. The affordability of ST should be studied in conjunction with the affordability of smoked tobacco (cigarettes) to determine how the population responds to changes in the relative prices of these two types of tobacco products.

Establishing a standardized unit of consumption and gaining a better understanding of the ST market structure will also be important for future studies on the price and income elasticities of ST demand. These future studies can help determine whether ST products are used as substitutes for or in combination with smoked tobacco, and if this relationship changes over time or according to pricing structure. Such findings will inform the development of public policies to control both smoked and ST use.

Summary and Conclusions

The tax system that best suits public health goals is likely to be country-specific. As a general rule, an excise tax system that effectively raises the prices of ST products and makes them less affordable over time is ideal because it would discourage consumption. Countries experiencing rapid economic growth may need to increase their ST taxes at a pace that ensures that prices for ST products increase faster than inflation and income growth. Another option would be to equalize tax at high rates across all tobacco products to limit substitution.

Best practice for cigarette taxation favors the use of a specific tax that is regularly adjusted for inflation because it reduces the price gap between the less expensive (most affordable) and more expensive products.[41] In some cases, a mixed excise tax system that contains both ad valorem and specific components can most efficiently deal with the tobacco industry's efforts to avoid taxes by manipulating the tobacco content of ST products. For example, reducing the content of tobacco in a product reduces

the tax burden if the specific excise tax depends on the tobacco weight of a product. On the other hand, lowering the declared value of a product reduces its tax burden if the tax is levied ad valorem. More studies are needed to clarify both the relationship between ST and smoked tobacco products, and how consumers respond to relative and absolute price changes of these products. Answers to these questions will have implications for the design of an efficient tobacco tax regime.

Smokeless tobacco tax revenue is expected to increase with higher ST tax rates because the demand for ST is price-inelastic. However, this revenue increase depends on the efficiency of a country's tax collection system. System improvements, such as switching from taxing producers based on production volume to taxing based on production capacity, can theoretically increase the efficiency of collecting taxes. (India levies tobacco excise taxes based on the production capacity of a facility, rather than the declared production volume generated by a facility. The production capacity is always greater than or equal to the production volume.)

The effectiveness of tax collection systems and the impact of higher taxes on ST use will also depend on the standardization of ST products.[74] Lack of standardization complicates not only tax collection but also scientific research, as it hinders the use of econometric methods.

A standard unit can be based on a dose, the weight of tobacco, or the weight of a product. The weight of a product includes its water content and the weight of any additives, which is especially important in smokeless tobacco. The weight of tobacco refers to the weight of dry leaf in the product, which will be smaller than the total weight of the product. These varying definitions of a standard unit have advantages and disadvantages. A dose is equal to the average amount of a product used in a single session, but not all products are sold in pre-portioned single servings. In addition, different ST products are used for different lengths of time. For example, a Camel Orb (a dissolvable tobacco product) dissolves in the mouth in under 20 minutes, whereas a betel quid can stay in a user's mouth for over 12 hours. Using the weight of tobacco as a standard measurement focuses on the primary concern of tobacco use. However, the tobacco content in an ST product would have to be determined or reported by ST manufacturers. For this reason, using the weight of an ST product as a base for calculating taxes would be easier than using the weight of tobacco in a product. Although information on total product weight is usually readily available in countries that have specific excise tax regimes, this standard would tax products with higher tobacco density (e.g., dry snuff) less than products with lower tobacco density per unit of weight (e.g., moist snuff). This discrepancy in taxation rates can be leveled by setting different tax rates for different types of tobacco products. Standardization methods can also be combined. For example, tax liability can be assessed based on the weight of the ST product, and a minimum tax amount can be set per dose.

Because the multinational tobacco corporations have recognized ST as the next frontier in expanding their business,[38] tobacco control research must adjust its resources in anticipation of the increased demand for these products.

Implementation of an appropriate surveillance system will be required to better understand the ST marketplace and the economic incentives linked to ST use. Systematic data collection on both the prevalence and the intensity of ST use by ST product type is necessary to assess the size of the ST marketplace, the level of substitution between various ST products and substitution with smoked

tobacco, and the introduction and uptake of novel ST products. To evaluate the opportunity costs associated with ST use, personal and/or household expenditures on ST products must also be tracked.

Data on ST prices, taxes, ST tax revenue, and ST trade (including illicit) are needed. This information could be collected by changing WHO FCTC reporting to require collection of data on all tobacco products, not just cigarettes. Designing an effective ST tax regime will require monitoring and regulation of the ST supply chain (i.e., manufacturing, trade, and distribution). Taxing tobacco leaves could help control the use of ST in the diverse and multilayered traditional markets.

In conclusion, the development of recommendations for the most appropriate ST tax structures must take into account the type of ST product and the tax structure applied to other tobacco products sold in a particular market. A WHO study group recommended that several economic and tax-related guidelines be followed in the formulation of ST control policy.[75] Namely, the study group recommended that (1) ST be taxed "at a level sufficient to act as a disincentive, and at least at the level at which cigarettes are taxed,"[75,p.64] (2) taxes should increase in real terms over time, and (3) a portion of ST tax revenue should be earmarked to support health promotion efforts.[75] Recent (2010) guidelines for tobacco taxation stipulate that equal tax rates should be imposed on all tobacco products.[41] The WHO technical manual recommends that the excise tax on cigarettes (either specific or ad valorem) make up at least 70% of the retail price, and it favors the use of the specific excise tax because of its administrative simplicity and effectiveness in reducing tobacco use. Smokeless tobacco products should meet an equivalent standard to shift discussions of smokeless tobacco and cigarette tax structures in the direction of tobacco tax structures.[41] This cohesive approach to tobacco control policy can produce more consistent, comprehensive, and effective tobacco control legislation over time.

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Chapter 6

Changing Smokeless Tobacco Products and Marketing Practices by Industry

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Introduction

Cigarette markets are declining in high-income economies such as North America and Europe due in large part to effective tobacco control policies. Implementation of demand-reduction policies called for in the World Health Organization Framework Convention on Tobacco Control (WHO FCTC)—such as smoking restrictions in public spaces, enhanced health warnings, increased taxes, and increased support for smoking cessation—are likely to further constrict these cigarette markets and slow the increase in smoking in low-income countries.[1] However, these changes also open opportunities for the tobacco industry to expand into new areas. Societal pressures discouraging cigarette use may impel smokers to use other forms of tobacco, for example. Such changes have precedent, as over time different forms of tobacco have seen changes in popularity among users (e.g., nasal snuff, pipes, cigars).[2,3] Econometric analyses[4] have examined the latent (i.e., untapped or potential) demand for smokeless tobacco (ST) in different world regions, concluding that demand would be highest in Asia and the Middle East (US$3.97 billion), followed by North America (US$2.82 billion) and Europe (US$2.78 billion). Thus, there is incentive for producers to bring new products to market and to expand into areas where ST products are not currently used.

Smokeless tobacco covers a wide range of products used orally or nasally. A number of other reports[5–11] and chapter 3 of this volume have examined the variety of ST products and their contents. This chapter will not address product variety and contents in depth, but will focus on data on marketing practices available mostly from high-income countries.

Since 2001, a number of manufacturers have introduced novel ST products that differ in numerous ways from traditional products (Table 6-1). Manufacturers have introduced products that are formulated differently (e.g., with reduced nitrosamines, in dissolvable form, spitless) and marketed differently (made available in new markets, targeted toward current smokers, contained in innovative packaging) relative to the traditional ST products in a given market. For example, introduction of snus products in the United States or South Africa would be considered novel, but emergence of new Swedish snus brands in Sweden probably would not fit this description.

Also since 2001, companies that historically had predominantly marketed cigarettes have entered the ST market. R.J. Reynolds purchased Conwood, manufacturer of Grizzly and other popular moist snuff products, in 2006. British American Tobacco began test marketing snus products in 2006. In 2009, Altria acquired U.S. Smokeless Tobacco (UST), thereby gaining control of UST's best-selling Skoal and Copenhagen brands. Philip Morris International (PMI) entered into an agreement with Swedish Match in 2009 to market ST outside the United States and Scandinavia (as of 2012, test-marketing in Canada and Russia). PMI also purchased the South African operations of Swedish Match in 2009. Consequently, a number of ST products co-branded with cigarettes have emerged, which represents an additional layer of novelty.

Table 6-1. Novel smokeless tobacco products introduced since 2001

Brand	Type	Company	Country	Year	Still sold?
Revel	Snus	UST	United States	2001	No
Exalt	Snus	Swedish Match	United States	2001	No
Catch	Snus	Swedish Match	South Africa	2001	No
Ariva*	Dissolvable	Star Scientific	United States	2001	No
Stonewall*	Dissolvable	Star Scientific	United States	2003	No
Interval	Dissolvable	Brown and Williamson	United States	2003	No
Magne*	Snus	Swedish Match	South Africa	2003	No
Tobaccorette	Snus	Swedish Match	South Africa	2003	No
Skoal Dry	Snus	UST	United States	2006	No
Taboka	Snus	Philip Morris U.S.A.	United States	2006	No
Camel Snus	Snus	Reynolds American/Japanese Tobacco International	United States, Sweden	2006	Yes
Peter Stuyvesant	Snus	BAT	South Africa	2006	No
Lucky Strike	Snus	BAT	South Africa, Sweden	2006	No
Triumph	Snus	Lorillard/Swedish Match	United States	2007	No
Grand Prix	Snus	Lorillard/Swedish Match	United States	2008	No
Tourney	Snus	Liggett Group/Snus AB	United States	2007	No
Marlboro Snus	Snus	Philip Morris U.S.A.	United States	2007	Yes
General	Snus	Swedish Match	South Africa, United States, Canada	2008	Yes
Catch Dry	Snus	Swedish Match	South Africa	2008	No
du Maurier	Snus	Imperial Tobacco (BAT)	Canada	2008	No
Pall Mall	Snus	BAT	Sweden	2009	No
Camel Orbs	Dissolvable	Reynolds American	United States	2009	Yes
Camel Sticks	Dissolvable	Reynolds American	United States	2009	Yes
Camel Strips	Dissolvable	Reynolds American	United States	2009	Yes
Skoal	Snus	UST	United States	2010	Yes
Zip	Snus	West African Tobacco	Nigeria	2010	Yes
Marlboro Sticks	Dissolvable	Philip Morris U.S.A	United States	2011	Yes
Skoal Sticks	Dissolvable	UST	United States	2011	Yes
Marlboro	Snus	Swedish Match	Sweden	2011	Yes
Ettan	Snus	Swedish Match	United States	2011	Yes

*Star Scientific discontinued its dissolvable products in early 2013.
Abbreviations: UST = U.S. Smokeless Tobacco Company; BAT = British American Tobacco.
Note: This table is intended as an overview of novel products introduced; it is not necessarily comprehensive as there is no formal mechanism on a global scale for reporting new smokeless tobacco products.

The tobacco market into which these novel products are being launched is influenced to a certain extent by the success of traditional tobacco control activities, such as smoke-free environments, high cigarette taxes, and increased awareness of the health effects of tobacco use.[12] Smokeless tobacco products have engendered controversy within the tobacco control community. Some public health advocates see ST as a substitute for cigarettes and a bridge to quitting, whereas others view it as a step toward smoking and a perpetuator of nicotine addiction through multiple product use.[13–16] These views are not necessarily mutually exclusive. Some models of the population impact of ST suggest that increased promotion of ST could draw smokers away from cigarettes with minimal offsetting use by non-smokers, former smokers, or youth.[17] Other models suggest that even aggressive ST promotion may have no public health benefits.[18]

In the United States, the Family Smoking Prevention and Tobacco Control Act gives the U.S. Food and Drug Administration (FDA) the authority to regulate the marketing of tobacco products to protect public health. The Act specifically prohibits "modified risk" claims for tobacco products in the absence of a marketing order from FDA. The Act also instructs that FDA only issue a marketing order if the applicant has met certain conditions, including a demonstration that the novel product will result in significantly reduced harm for tobacco users and will benefit the health of the population as a whole.[19,20] A recent Institute of Medicine report provides a broad framework for thinking about the evaluation of such claims, but there is not yet a scientific consensus about the specific methods to be used or the threshold of evidence that should be required.[21]

Understanding potential users of products is the realm of consumer psychology, which integrates behavioral and social sciences to understand the purchasing behaviors of specific segments of the population and methods to enhance these behaviors.[22,23] Marketing can be viewed in part, then, as the practical application of consumer psychology. Traditionally, marketing is conceived as a mix of "4 P's": product, price, placement, and promotion—that is, products are designed to meet consumer needs at a desirable price and are promoted effectively using multiple communication channels in places where consumers can interact with the product. This chapter explores the available research on the changing ST market, focusing primarily on the marketing of ST in new forms and in new ways, and how these influence the appeal of such products to consumers. The chapter is framed around these four primary aspects of marketing as they relate to the changing ST market: product, promotion, placement, and price.

Product

The characteristics and performance of a product can greatly influence its overall attractiveness. Smokeless tobacco products can be differentiated from one another most clearly in terms of product design, which may be tailored to achieve chemosensory effects and nicotine delivery targets and paired with marketing to appeal to varied subpopulations (women, youth, African Americans, people of low socioeconomic status). Over the past two or three decades, there has been substantial innovation in the ST market, particularly in North America and Sweden. In this section, we focus on three key areas that are likely to influence the attractiveness of novel ST products: product formulation, nicotine content and availability, and flavorings.

Product Formulation

An obvious difference among ST products is the form in which the products are presented for use. The tobacco in individual products can range from simply dried, cured tobacco leaves cut or torn in various ways, to moistened, fermented tobacco strips, to finely powdered dry tobacco. At present, most ST consumed in the United States is in the form of moist snuff, which is fermented, whereas in Sweden most ST is in the form of non-fermented, pasteurized Swedish snus. In both countries, loose product dominates, though portioned forms are growing in popularity. More novel ST formulations, available in the United States, include powdered tobacco compressed into different shapes, such as tablets, sticks, or thin strips.

Portioned pouch products were introduced in Sweden in the 1970s and in the United States with Skoal Bandits in 1983. These products were explicitly developed to be easier to use, neater, and more appealing to novice users.[24,25] In Sweden, pouches generally come in two forms: original, where the pouch is moistened and appears brown; and white, which is not premoistened and appears white. Three sizes (mini [0.5 g], normal [1 g], maxi [approximately 1.7 g]) are available. U.S. smokeless tobacco manufacturers began introducing products patterned after Swedish snus in the early 2000s, and as of 2011, Marlboro Snus, Skoal, General, and Camel Snus were in national distribution. In all cases, U.S. snus products have been introduced in portioned pouches, similar to the Swedish white portioned format. In 2012, Camel Snus was available in two portion sizes (approximately 0.5 g and 1.0 g). Swedish and U.S. snus products differ in nicotine levels and pH, and studies have even shown regional variation among U.S. snus products.[5,8,26] (Information on toxicant levels is provided in chapter 3.)

Compressed formulations of powdered tobacco specifically designed to dissolve in the mouth are among the ST products that have emerged in the United States during the 2000s. Two early examples, which are no longer available on the U.S. market, are Star Scientific's Ariva (introduced in 2001) and Stonewall (introduced in 2003). In 2009, Reynolds American introduced three dissolvable tobacco products, Camel Orbs (a lozenge), Camel Sticks (a thin, 4-inch stick), and Camel Strips (a thin, rectangular sheet). In 2011, Philip Morris U.S.A. and UST introduced Marlboro and Skoal Sticks, respectively, which consist of a small amount of finely milled tobacco applied to a toothpick-sized wooden dowel. Such products have attracted considerable concern because of their physical similarity to confectionary products and the ease with which use can be concealed, potentially making them attractive to youth.[27] An additional concern with such products is accidental ingestion by young children, which happens most commonly with cigarettes, followed by traditional smokeless tobacco.[28] To date, analyses of poison control center data find little evidence of specific problems with the ingestion of dissolvables,[29] although it is unclear how much of the apparently low rate of accidental ingestion of dissolvables can be attributed to their low prevalence of use or to the appeal and safety of their packaging for children.

Novel products typically weigh less (net weight of product, without packaging) than traditional snuff products, thus data tracking ST sales can only give hints about sales trends. For example, in the United States, moist snuff is typically packaged in approximately 1.2-ounce (oz) (34.0 g) cans. In contrast, a tin of Camel Snus weighs about 0.32 oz; a box of Ariva weighed about 0.34 oz. Data from 2002–2010 reported to the U.S. Federal Trade Commission (FTC) show changes in sales of ST by the size of package (Figure 6-1; package sizes up to 5 oz shown only, as these are the most common).[30] Sales of

ST products sold in units weighing less than 1 oz (which would include most novel ST products) grew more than sixfold between 2002 and 2010. In 2010, disclosures of product-level data for sales of snus and dissolvables were required. Snus sales in that year totaled 61.3 million units, 99.9% of which were less than 1 oz in size.[30] Among ST products weighing less than 1 oz, snus made up over one-third (37%) of ST sales in 2010.

Figure 6-1. Change in smokeless tobacco sales by weight class, 2002–2010, United States

Source: U.S. Federal Trade Commission 2012 (30).

Consumer Responses to Different Product Formats

Research comparing consumer responses to novel ST products with responses to conventional cigarettes or nicotine replacement products has yielded varying results. One study of Ariva found that it was preferred by smokers over a pure pharmaceutical nicotine lozenge.[31] A different study showed that novel ST products had drug effects, liking measures, and nicotine-withdrawal symptoms similar to those of pharmaceutical lozenges, and use of pharmaceutical lozenges resulted in lower craving scores than those observed with one of the novel tobacco products.[32] Examinations of biomarkers found evidence that users of the novel products had been exposed to as much nicotine as in the pharmaceutical lozenges, but there was little evidence of exposure to nitrosamines.[33] Carpenter and Gray[34] found that use of Ariva and Stonewall was associated with a reduction in cigarette consumption and an increase in intentions to quit among smokers who received these products compared to the smokers who didn't receive them.

An emerging theme from research on use of novel ST products is that sampling of different types of ST products may be important in assessing appeal to cigarette smokers.[35,36] Hatsukami and colleagues[35] showed that after 2 weeks of sampling oral products (General snus, Camel Snus, Marlboro Snus, Ariva,

Stonewall), smokers rejected General snus, and showed no significant preference for any of the other products (i.e., about 25% chose to use each of the products other than General). When the smokers quit smoking, those using Camel Snus reported greater relief of cravings and withdrawal symptoms compared to those using other oral products. O'Connor and colleagues[36] showed that when smokers not intending to quit were allowed to sample multiple products (Stonewall, Marlboro Snus, Camel Snus, Commit lozenges) simultaneously for 1 week followed by 1 week of preferred product use, the smokers most preferred the pharmaceutical nicotine lozenge and least preferred Stonewall. Interestingly, in the 2011 relaunch of Camel dissolvables, Reynolds American offered a variety pack containing all three versions of the product, presumably so consumers could try all three with less investment to find a type that suited them. This is also consistent with approaches used by UST to attract new users to Skoal Bandits: One-on-one sampling was identified as the "number one objective" for sales staff.[37]

Nicotine Content and Availability

Nicotine is the *sine qua non* for tobacco use in any form. The form of the product may have distinct effects on the form of nicotine (bound vs. free nicotine) and its delivery to the body. A prime example is the manipulation of acid/base chemistry to affect the proportion of free nicotine in the mixture, which impacts systemic absorption.[5,38] Specifically, free nicotine is readily absorbed across mucous membranes, leading to rapid uptake into the brain, thus enhancing centrally mediated nicotine reward. Manufacturers can use buffering agents and salts to raise pH and thereby raise the level of free nicotine in a product (or use these agents to lower pH and lower the amount of free nicotine). Lauterbach and colleagues[39] note that the measurement of free nicotine in ST may be complicated by other elements of the mixture (such as salts, pectins). Makers of custom-made products also manipulate the pH of their products when they add alkaline substances such as punk ash and slaked lime (calcium hydroxide) to products such as iqmik (used by Alaskan Natives), South African custom-made snuff, betel quid, and mawa. In manufactured products, there may be tiers of products at different pH levels.[37,40]

Variation of product pH (and thus free nicotine) was central to the "graduation" strategy pursued by UST in the 1980s.[37] Low-pH, low-nicotine products (e.g., Skoal Bandits) introduced novice users to product use, and as they developed tolerance to nicotine and experienced other effects, users would gravitate toward increasingly higher nicotine products, such as Skoal Fine Cut, and eventually to Copenhagen. One UST ad campaign explicitly stated: "Sooner or later, it's Copenhagen. It satisfies." UST was not alone in this approach of multiple product offerings: Pinkerton Tobacco and Conwood offered similar opportunities for graduation.[37]

Relatively few studies, however, have directly examined whether levels of free nicotine in ST influence how attractive a product is to consumers. Alpert and colleagues[41] linked reported free nicotine levels to ST prevalence and market sales data, and concluded that "changes in design, as reflected by variation in free nicotine associated with pH or tobacco leaf, or both, have enhanced the ease and uniformity of dosing,"[41,p.332] which likely contributes to growth in sales of moist snuff. Fant and colleagues[42] and Kotlyar and colleagues[32] showed that product pH appeared to relate to the level of nicotine absorbed. Subjective measures of product strength and satisfaction also followed a similar pattern. Kotlyar's study included Ariva, Revel, and Stonewall, all of which delivered less nicotine and had lower scores of subjective effects than Copenhagen moist snuff.

As novel ST products emerge and are promoted to smokers, there is concern that snus-type products sold in the United States and South Africa, having been shown to contain much lower free nicotine,[8,43] may not relieve nicotine craving and may promote dual use. Indeed, Hatsukami and colleagues[35] showed that among smokers who abstained from smoking and switched to ST, products with lower nicotine levels did not suppress smoking behavior as well as products with higher levels of nicotine. Yet a separate study shows that products with higher nicotine levels may be more likely to be misused or cause dependence.[44]

Flavorings

Smokeless tobacco preparations may range from simple unflavored tobacco to tobacco with added flavorants (such as wintergreen, apple, bourbon) to more complex mixtures of tobacco with additional plant materials (herbs, spices, leaves, nuts).

In North America, traditional chewing tobacco is either unflavored or incorporates some sweetener (e.g., molasses). Moist snuff traditionally was available unflavored or with the addition of wintergreen (methyl salicylate).[45] This began to change in the 1970s, however, as UST and others introduced moist snuff products with a far greater variety of flavors, including citrus, berry, apple, bourbon, and spice. In Sweden, common Swedish snus flavorants include mint/wintergreen, licorice, juniper berry, and eucalyptus. The flavors used in snus products in South Africa include coffee, tropical fruits, mint, and eucalyptus. Emerging dissolvable tobacco products have been marketed with flavors including mint and coffee. Chemical analysis of Camel dissolvables identified flavorants such as coumarin, vanillin, and cinnamaldehyde, along with sweeteners such as sorbitol and xylitol.[46] As of September 2009, FDA regulations banned the use of characterizing flavors other than menthol in cigarettes but not in other tobacco products, including smokeless tobacco.

The issue of flavors with oral ST products adds another dimension to exposure assessment because the flavorants themselves are ingested along with the tobacco. Chen and colleagues[45] measured the mint and wintergreen contents of leading U.S. moist snuff products and showed that these products contained far more of these flavorants than are found in hard candies; a typical ST user could ingest up to 12 times the acceptable daily level. Additionally, ST products may contain additives prohibited for use in food. For example, coumarin, identified in Camel Mellow Orbs,[46] is banned as a food additive due to its liver toxicity.

Promotion

Advertising and promotion are the most visible methods for fostering the growth of a market and attracting new customers, often through creating a specific brand image (i.e., glamour, sophistication, ruggedness, convenience, use of the latest technology).[47–49] Marketing messages can underscore desirable design features, such as flavorings, ease of use, and nicotine delivery, potentially increasing products' attractiveness.[50] New marketing approaches helped revive the snus market in Sweden beginning in the late 1960s. At the time, the median age of Swedish snus users was over 40 years, but new product development and intensive promotion by Swedish Match increased snus use among young Swedish men, so that by 1973 the median age of Swedish snus users had declined to 30 years.[51] In 1999, Swedish Match divested its cigarette business to focus on other tobacco products, primarily Swedish

snus and cigars.[52] In the United States, UST aggressively promoted moist snuff starting in the mid-1970s in an attempt to reach a younger market and combat declines in use over the course of the early 20th century.[37,53] This strategy was successful, as ST use among young men increased ninefold between 1970 and 1987.[54,55] In 2010, the major U.S. smokeless tobacco companies spent US$257,879,187 advertising and promoting moist snuff, and an additional US$57,394,000 advertising and promoting snus. In terms of return on investment, these companies spent $0.11 in advertising and promotion for every $1.00 in sales of moist snuff, and $0.70 for every $1.00 in snus sales.[30]

Evolving Target Markets

A key way for manufacturers to grow the ST market is to attract new groups of users. Mejia and Ling[56] have reviewed tobacco industry documents examining U.S. smokeless tobacco user characteristics dating back to the 1960s. They note that historically, ST use was concentrated in low-income, less-educated, white males, though an increase in use was observed in the 1990s among more active males engaged in outdoor activities such as hunting and fishing. Product marketing in the 2000s sought to expand beyond these traditional groups and attract more upscale, urban, and female users. Since about 2010, the ST industry has shifted its magazine advertising from men's sporting magazines to magazines with more general readership,[57] presumably in an attempt to broaden the appeal of ST beyond white males.

Smokers

One potential user group of interest is current cigarette smokers, who are already familiar with tobacco use (and addicted to nicotine). Smokeless tobacco manufacturers, at least in the United States, have been targeting smokers for the past few decades.[58] For example, advertising for Skoal Bandits in 1983 encouraged smokers to "Take a Pouch, Not a Puff." Marketing to smokers increased with the proliferation of workplace and public space smoking restrictions in the United States through the 1980s and 1990s.

Reviews of tobacco industry documents reveal the extent of the research the industry conducted on developing ST products that could attract smokers.[59] These reviews note that while manufacturers initially considered capturing those smokers who might otherwise quit smoking and converting them to ST alternatives, the manufacturers eventually refocused on promoting products designed to support temporary abstinence in situations where smoking was restricted. Some manufacturers accomplished this through the development of line extensions (e.g., Marlboro cigarettes, Marlboro Snus). In addition, the tobacco industry has advertised these products as alternatives to cigarettes in locations where they are otherwise prohibited and has also packaged these non-combustible and ST products in a manner that closely resembles the size and shape of cigarette packs. The potential effect of this approach, then, could be to undermine the impact of smoke-free laws on cigarette consumption by allowing for use of ST products in smoking-restricted environments. The original test markets for snus-like products (such as Camel Snus, Taboka) occurred in cities that had recently enacted smoke-free regulations.

Use of cigarette brand names to sell ST products is presumably aimed at smokers. In branding, the name carries with it a set of associations beyond the product characteristics, implying a certain level of quality and conveying a certain image.[60,61] Branding can communicate "a series of attachments and associations

that exist over and beyond the objective product."[61,p.745] That is, if someone self-identifies as a Marlboro cigarette user, then trying a Marlboro-branded snus product may seem more consistent with that identity than using another brand, such as Skoal.

Women

Historically, in the United States and in Scandinavia, ST has been used primarily by men. In Scandinavia, product developers have been explicitly targeting women with product innovations and attractive packaging since 2008, which may have contributed to an upward trajectory for Swedish snus use among women compared to stable levels among men.[62] In the United States, use of ST by women remains very low (<1%),[63] and studies show that men are far more interested in trying newer ST products (e.g., Taboka, Camel Snus) than women are.[64,65] Nonetheless, there are regional pockets with substantial use of ST by women (e.g., Alaska, Mississippi).[66] In some parts of South Asia[67] and Africa,[68] use of ST products is equally common among women and men, and in some cases ST use is more common than cigarette smoking among women, whereas smoking is much more common than ST use among men. The international experience demonstrates that, given the right context and product, ST products can appeal to women.

Youth

Although no tobacco manufacturer publicly acknowledges targeting youth, capturing this market is essential for the future sustainability of the ST enterprise, just as it is for cigarettes.[49,69,70] Morrison and colleagues[71] showed that ST advertising in U.S. magazines with substantial adolescent readership had increased over time, consistent with the observed shift away from men's sporting magazines to those with broader readership.

Adolescents can become dependent on ST just as they can on cigarettes. According to DiFranza and colleagues,[72] adolescent snuff users report levels of dependence similar to those of cigarette smokers with comparable histories of use; more than 50% of adolescents with less than 100 lifetime uses of either product reported at least one dependence symptom, whereas over 90% of those with more than 100 lifetime uses reported at least one symptom. Swedish youth report similar patterns, as well as particularly high dependence and withdrawal among dual users.[73] In the United States, UST aggressively promoted low-nicotine products to young people starting in the mid-1970s in an attempt to graduate these new users to higher nicotine products as they become more dependent on nicotine.[37]

A number of public health advocates have expressed concern about the appeal of novel ST products to youth. Regarding snus, attractive advertising and packaging have been a particular concern; for dissolvables, an additional issue has been their similarity to confections.[28,74] Studies examining youth awareness of, interest in, and use of novel ST products are few, however. Data from one survey indicate that 29% of young adult men (aged 18–25 years) living in test market cities had tried snus.[65] A study of 18- to 30-year-old smokers in Canada[75] showed that two-thirds would be willing to try ST (Marlboro Snus, du Maurier, Copenhagen, or Ariva), with du Maurier snus rated most appealing (du Maurier is a leading Canadian cigarette brand).

Of particular concern is whether novel products could initiate adolescents to nicotine use, leaving them more likely to try and eventually adopt cigarette smoking. Evidence for such "gateway" effects of ST is mixed, with Swedish studies consistently showing no significant effect.[76–79] Some U.S. studies[80–82] show increased likelihood of smoking subsequent to ST use, but others show no effect.[83–85] This inconsistency in patterns across countries points to the complexities of carrying evidence across national and cultural borders. As Rosendahl and colleagues note,[86] parental modeling of tobacco use can also be important. In Sweden, where more men use snus and more women smoke, adolescent smoking was predicted by parental smoking but not parental snus use, whereas adolescent snus use was predicted by parental snus use. The lack of "gateway" effects seen in Sweden may, in part, be a result of the greater adoption of ST use by adults, who are modeling this behavior for youth, in addition to other potential contributors such as Sweden's ban on tobacco advertising and increased taxation of tobacco products. In the United States, smoking is far more common and remains more socially accepted; however, snus use as a precursor of smoking is a potential concern.[87] Another possible contributor to the observed difference in gateway use patterns is the difference in product formulation (discussed earlier)—lower nicotine levels in "starter" brands may prime users for either higher nicotine ST products or for cigarettes.

Messaging

As target markets for ST products have evolved, so have the messages and themes used to promote them. Mejia and Ling[56] note that, whereas earlier messaging for traditional moist snuff was directed toward men and emphasized rugged masculinity, messaging for novel snus products centers on enjoyment of indoor activities where smoking is prohibited and is couched in imagery that emphasizes trendiness, urbanity, and sophistication for both men and women. Timberlake and colleagues[88] confirmed this in a content analysis of Camel Snus advertising during the years 2007 to 2010. They noted that in 2009, themes of temporary substitution were supplanted by the "Break Free" campaign, which provided more ambiguous messages tied to freedom, independence, and behavior change. Since that paper was published, Reynolds American appears to have married the two types of messaging, timing major campaigns to coincide with New Year's Day 2012 (New Year's is a peak time for quit attempts among smokers) and with the implementation of a May 2011 smoking ban in New York City public parks (Figure 6-2). In 2011, Reynolds American launched a 7-day switching challenge, suggesting that the company may begin to encourage full substitution of snus for cigarettes (Figure 6-3). Reynolds American and Star Scientific have employed similar themes for their dissolvable tobacco products.

Figure 6-2. Example of smokeless tobacco messaging emphasizing using smokeless tobacco when smoking is prohibited

Figure 6-3. Camel Snus ad promoting 7-Day Switch Challenge, 2011

Packaging as Marketing

Packages can serve as key aspects of tobacco marketing, both by reinforcing brand imagery communicated through other media, and by serving as a communication vehicle at the point of sale.[89] Packaging has become a more central marketing tool as other communication vehicles such as billboards, magazines, and mass media have been restricted or eliminated. Cigarette manufacturers use colors (e.g., dark versus light), images (healthy, sexy, serious) and words (full-flavored, light, mild, smooth, natural, low tar) to communicate specific product features to consumers.[69,90,91] Industry documents reveal that manufacturers pay careful attention to the messages conveyed by packaging.[60] As noted by a Philip Morris executive: "Our final communication vehicle with our smoker is the pack itself. In the absence of any other marketing messages, our packaging … is the sole communicator of our brand essence. Put another way—when you don't have anything else—our packaging is our marketing."[92,p.ii73]

Outside the United States, promotion of novel ST products in new markets (e.g., Tobaccorette and Lucky Strike snus in South Africa) has also tended to emphasize ability to use the novel product in place of cigarettes (Figure 6-2).

Packaging innovations can also play a role in the appeal of a product,[60] especially in high-income countries. In the United States, efforts to market ST to smokers have been accompanied by increased attention to attractive packaging. For example, Camel Snus has come in three different packaging configurations over time: originally a round tin, later an oblong tin, and finally an embossed metal tin with a design incorporating the newly required front-of-package health warning (Figure 6-4). Smokers may have been more explicitly considered in the design of Marlboro Snus, which comes in both round tins and cardboard sleeves (containing fewer sachets) that can be carried along with cigarettes (Figure 6-5). Reynolds American has also encouraged consumers to engage with the company in creating attractive packaging for both cigarettes and smokeless tobacco.[93,94] In low- and middle-income countries manufacturers have also introduced innovative packaging to make sale and use more convenient. In India, for example, the gutka industry promotes a packaged, ready-to-use product based on a traditional custom-made product.

Figure 6-4. Evolution of Camel Snus packaging, 2006–2011

Original tins, 2006

Redesigned tins, 2009

Redesigned tins, 2010

Source: Photos courtesy of Maansi Bansal-Travers, Roswell Park Cancer Institute.

Figure 6-5. Evolution of Marlboro Snus packaging, 2007–2011

Taboka
(test product), 2007

Brand changed to Marlboro and redesigned, 2007

Marlboro Snus redesign,
2011

Marlboro Snus redesign, 2009

Source: Photos courtesy of Maansi Bansal-Travers, Roswell Park Cancer Institute.

Camel's dissolvables line has been at the forefront of packaging innovation, using plastic shell cases with unique opening mechanisms on the initial release, designed to be child resistant.[28] The 2011 relaunched products have gone a step further, coming in distinctive matching containers and available in a variety pack. Also of note is the inclusion of Camel imagery on the package's Universal Product Code (UPC) (Figure 6-6). Embedding images in UPCs is an emerging trend in marketing,[95] which could increase in prominence on tobacco products as other avenues for communication are restricted or packaging of tobacco products becomes standardized.

Figure 6-6. Universal product code designs on Camel dissolvables, 2011

Source: Photo courtesy of Maansi Bansal-Travers, Roswell Park Cancer Institute.

Emerging Marketing Strategies

The evolution of technology has created opportunities for innovative forms of product marketing, and the ST industry has taken advantage of the Internet and other emerging marketing practices to increase interest in its products. In the last decade, stealth marketing has become an important strategy to increase product awareness.[96] Stealth marketing typically involves spreading information about a product among consumers who are not aware that they are being marketed to or do not know that the person spreading the information is an agent or employee of the company or a consumer compensated for their activity. Other emerging strategies include viral marketing (a marketing technique that uses pre-existing social networks and technologies to increase product sales and brand awareness through self-replicating, much like the spread of a virus), celebrity endorsements, product placements, and "brand pushers," all of which try to "catch people at their most vulnerable by identifying the weak spot in their defensive shields."[96,p.6] Some of these practices—particularly when the relationship with the company is not disclosed, or the practice is otherwise deceptive, intrusive, and/or exploitative of consumers—can be regarded as unethical.[97]

Freeman and Chapman[93] have noted that such activities have the potential to erode the impact of advertising restrictions on tobacco products. Accumulating evidence points to an increasing Web presence by tobacco companies, as well as consumers sharing user-generated content that is pro-tobacco (which may or may not be spurred on by the tobacco industry).[98–102] A formal analysis of message board content posted on the website for Camel Snus showed that the board helped create a community of users who could share use experiences, and that the message board also served a marketing function by gathering information on consumer responses in the test markets.[103] Reynolds American maintains websites for Camel Snus and Camel dissolvables, with evolving content that includes message boards, frequently asked questions, contests, and testimonials (Figure 6-7). In the past, website users have been asked to design new signature flavors and packages for Camel cigarettes,[93] and a 2011 website feature allows users to custom design a snus tin.[104]

Figure 6-7. Example of message board from Camel dissolvables website

Placement

Positioning as a Quit Aid

Some have argued that ST, particularly snus-type products and dissolvables, could play a role in smoking cessation.[15,105,106] In Sweden, some studies have found that men have used snus to quit smoking, although there is not enough evidence to demonstrate that snus would be an effective cessation aid.[78,107–110] In fact, the development of pharmaceutical nicotine gum was inspired in part by Swedish submariners who used snus to alleviate nicotine withdrawal when unable to smoke.[111] However, in the United States, evidence for smokers' use of ST as a means to successfully quit smoking is mixed.[112–114] Novel ST products have not been promoted directly as cessation aids. In many countries, including the United States, doing so would require manufacturers to go through a pharmaceutical approval process and provide strong evidence of their effectiveness for cessation. However, Ariva was packaged in pharmaceutical-type blister packaging and was sometimes shelved behind pharmacy counters near nicotine replacement products.

Increasing Availability and Access

Another marketing approach is to increase the availability of products, making access to them much easier. This is best illustrated by attempts by snus manufacturers to convince the European Union (EU) to lift its ban on the sale of moist snuff/snus (except in Sweden, which is exempt from the ban). Snuff sales are also banned in New Zealand, Australia, Turkey, Israel, Taiwan, Thailand, Singapore, Hong Kong, and the UAE,[11,115] but there have not been similarly strong public pushes to lift those restrictions. The EU ban, enacted in 1992, has been criticized by some for restricting access to a class of ST products that may be less toxic (that is, Swedish snus) while permitting sales of cigarettes and other forms of oral tobacco that have been associated with high toxicity and disease risks (e.g., gutka).[116] The European Commission (EC) directed its Scientific Committee on Emerging and Newly Identified Health Risks to review the health effects of ST products. The committee concluded that:

> STP [ST products] are addictive and their use is hazardous to health. Evidence on the effectiveness of STP as a smoking cessation aid is insufficient, and relative trends in progression from STP into and from smoking differ between countries. It is thus not possible to extrapolate the patterns of tobacco use from one country where oral tobacco is available to other countries.[117,p.5]

In the end, the committee did not recommend either relaxing or lifting the ban. On December 19, 2012, the EC adopted its proposal to revise the Tobacco Products Directive (see chapter 10).

Another approach to increasing ST use is to introduce ST products into markets where they have been used rarely or not at all. Manufacturers such as BAT, PMI, and Swedish Match have attempted to introduce snus products in such markets as South Africa and Canada. South Africa provides an interesting example of this process. South Africans, particularly black women, traditionally used handmade ST preparations (commonly nasally), although a few manufactured products were available.[118] In 2004, Ayo-Yusuf and colleagues[118] noted that a recently introduced snus-like product (Tobaccorette) had a low percentage of free nicotine available for absorption compared to more

traditional products. In 2006, BAT introduced snus products using familiar cigarette brand names, Peter Stuyvesant and Lucky Strike, into the South African market. Although there are no published data on consumer perceptions or snus usage estimates, a national survey in 2007 showed that only 1.6% of South African ST users surveyed reported using snus (Olalekan Ayo-Yusuf, personal communication, 2013). These few events and findings point to the need for greater monitoring and more research on marketing practices in low- and middle-income countries.

Price

Monetary Costs

Cost is often a significant factor in whether consumers will be interested in using a product. Depending on the jurisdiction, ST is taxed in various ways; tax authorities can apply a *specific* tax (per package or by weight) or an *ad valorem* tax (see chapter 5 for greater detail). In most cases, ST costs less per unit dose than cigarettes.

Tax is not the only driver of effective price paid by consumers; manufacturers can also influence product price. In the United States in 2008, according to the FTC, tobacco companies reported spending a record US$324.6 million on ST price discounts ("payments made to smokeless tobacco retailers or wholesalers in order to reduce the price of smokeless tobacco to consumers"[30,p.3]). Although companies spent less in 2010 (US$95 million), price discounts continued to be the single largest expenditure for ST advertising and promotion, amounting to more than one fifth (21.4%) of all ST advertising costs.[30] Tactics such as price discounts can soften the impact of tax increases at the retail level, blunting their effect on consumption.

Another way tobacco companies can alter the monetary cost to consumers is to offer tiers of products at different price points. This became an established practice in the cigarette market in the 1980s, primarily in response to increasing tobacco taxes,[119] and discount brands appear to be used most by more-dependent smokers of lower socioeconomic status.[120] U.S. smokeless tobacco companies also have pricing tiers: UST offers both premium (Skoal, Copenhagen) and discount (Red Seal) brands, as does American Snuff (Grizzly and Kodiak vs. Cougar). Premium brands tend to be most commonly used by adolescents, whereas discount brand users tend to be older.[121–124] Smokeless tobacco manufacturers have tended to introduce novel ST products at a premium price point.[125]

With novel ST products, a barrier to entry can be the cost of trying them, since consumers may be reluctant to spend money on a product they may not like. Thus, free trials and sampling are often important to fostering initial use of the product.[126] Free sampling, particularly on college campuses, was a key component of UST's product promotion strategies in the 1980s and 1990s.[37] U.S. data show dramatic increases in free samples of ST in the years 2002 to 2008—a 719% increase in free samples of units weighing less than 1 oz (which would include most snus and dissolvable products).[30] Free sampling was important to the initial launch of Camel Snus,[127] and a free variety sampler pack of Camel dissolvables was available with the purchase of a Reynolds American–branded tobacco product on initial launch.[104] Sampling and initial trial experiences can then diffuse through a user's social network, increasing sales (i.e., contagion).[128] Therefore, providing free samples can be viewed as an investment in future sales potential if a sufficient number of users adopt the product.

Other Conceptions of Cost

Price can be conceptualized as broader than simply monetary costs and may include social perception and perceived risks and benefits of use. Understanding consumers' knowledge, attitudes, and beliefs about ST, then, is important to projecting product appeal. Several studies have found that consumers incorrectly believe nicotine causes cancer[69,129,130] and that ST products are as dangerous as cigarettes, if not more dangerous.[130–133] Surveys have attempted to tap consumer interest in novel products, usually couched in terms of their risk relative to smoking. Timberlake noted that 13% of California smokers were receptive to substituting ST for cigarettes,[83] whereas similar studies in Australia and New Zealand show one-half and one-third of smokers in those countries, respectively, were receptive to substitution.[134,135] Shiffman and colleagues[136] described a smoking substitute as either a nicotine-based product or a tobacco-based product, finding that U.S. smokers generally preferred the former to the latter. Up to 75% of smokers in Edmonton, Canada, were willing to try a hypothetical oral tobacco product described as 99% less hazardous than smoking.[133]

Social norms can represent a powerful influence on behavior.[137] This concept underlies the tobacco control strategy of denormalization, which has resulted in significant gains in terms of reduced smoking prevalence (particularly among adolescents), increased support for smoke- and tobacco-free environments, greater voluntary adoption of smoke-free homes, and support for regulation of the tobacco industry. However, the denormalization of cigarette smoking also leads to greater stigmatization of smokers.[93,138–140] This may present a marketing opportunity for novel ST products: Because use of ST, particularly spitless forms, is less visible to others, it may carry less social stigma than smoking, thus making ST increasingly more attractive to smokers. Reynolds American's 2011 Camel Snus campaigns touch indirectly on this issue in their use of tag lines like "Smoke-Free. Spit-Free. *Drama-Free*" [emphasis added].

Summary and Conclusions

Tobacco manufacturers have begun to introduce ST products in new forms using new marketing techniques. Product innovations such as portion pouches, dissolvable tablets, unique flavorings, and varying nicotine levels may make novel products more attractive to potential consumers. Internet-based marketing appears to be increasingly important to the diffusion of novel ST products. Changing social norms and denormalization of smoking may contribute to increased attractiveness of ST products in markets where smoking prevalence is declining. In particular, ST products are being marketed toward smokers as substitutes to use in situations where they cannot smoke. On the one hand, such developments may be positive for public health if they draw substantial numbers of smokers away permanently from cigarettes. On the other hand, novel products and marketing approaches have the potential to undermine public health efforts to the extent that they attract non-users and youth to adopt use or deter smoking cessation by encouraging dual use.

Understanding consumer perceptions and responses to novel products is important to predicting their likely public health impact. Evolving regulatory frameworks under the FDA and the WHO FCTC may also help define the effects of these novel products at the population level. The FDA has authority to allow the entry of novel products, potentially allow claims of exposure or risk reduction for these products, evaluate substantial equivalence for product modifications, and set product standards.

Given these authorities, it is essential to develop the scientific evidence base to support regulatory decisionmaking. Effective regulation of product advertising and promotion must focus on consumer perceptions of messaging and take into account the emergence of Internet-based advertising and the role of product packaging. Increased and improved monitoring of marketing practices in low- and middle-income countries will benefit these countries by yielding an evidence base about regulating ST marketing in those countries. Finally, tobacco control efforts may need to evolve with the changing tobacco market to maintain progress in reducing morbidity and mortality.

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Chapter 7

Prevention and Cessation Interventions

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Interventions for Smokeless Tobacco Use

Public health efforts to reduce the overall prevalence of tobacco use must focus on both prevention and cessation of all tobacco products. Although cigarettes continue to be the primary tobacco products used, as of 2012, high prevalence rates of smokeless tobacco (ST) use are being reported among males and females, both youth and adults, in a significant number of countries, varying widely by region and area (see chapter 2). Even in countries that currently have low rates of ST use, vigilance is necessary because tobacco companies adapt their products and marketing approaches in response to greater tobacco control restrictions and reduced smoking prevalence. For example, tobacco companies promote ST as a way to adapt to concerns about the health effects of exposure to secondhand smoke in public places.[1] In addition, cigarette companies are introducing novel ST products, including "spit-free" forms, and the marketing of these products may increase use by young people and by smokers responding to environmental restrictions (chapter 6).

This chapter reviews a wide variety of available interventions to prevent and reduce the use of ST, ranging from intensive clinical interventions to high-reach, low-intensity public health programs. The chapter focuses first on prevention, emphasizing its importance especially among youth. Although by far the most research on youth tobacco use centers on smoking, there is an increasing awareness of the potential increased use of smokeless tobacco by youth and young adults. Because resources and cultures vary across countries, examples of interventions from a range of available countries are provided. Most of the current research, however, concentrates on high-income countries and school-based interventions. Several studies use the term *point prevalence* to mean self-report of abstinence from use of any tobacco product for the past 7 days or the past 30 days. Although some studies use *continuous abstinence,* most give the point prevalence estimate both at the end of the study and for follow-up periods. Two different measures of dependence have been used: the modified Fagerstrom scale and the Severson Smokeless Tobacco Dependence Scale (SSTDS).[2]

Interventions to Prevent Smokeless Tobacco Use Among Young People

To date, only limited efforts have been made to prevent ST use among children and adolescents in the United States and other countries. Compared to the extensive research on prevention of smoking, few publications have reported on empirical evaluations of ST prevention interventions. Considering the effects of ST, its health consequences, and its impact on public health, it is clear that more tobacco control efforts and interventions are necessary. Available prevention studies are described in Table 7-1, and community, school, and individualized (targeted to specific populations) interventions are reviewed.

Table 7-1. Smokeless tobacco prevention interventions

Study*	Intervention	Design	Outcomes
Community Level			
Arora, Stigler et al. 2010 (16)	Project ACTIVITY (2 years of intervention) Community intervention: Training workshops, community-based cessation camps, interactive activities, and enforcement of prohibition on sales to minors. Films, street plays, rallies, pamphlets, comic books, roleplaying, and stickers. Change agents were trained youth leaders and action groups.	Cluster–RCT 14 low socioeconomic status communities in Delhi, India Subjects: adolescents ages 10–19 Control group received no intervention	Not available. Qualitative results show community interventions denormalize ST use.
Arora, Tewari et al. 2010 (15)	Community intervention: Interactive activities, pretested posters, audio recordings, films, lectures, street plays, and knowledge enhancement using pictorial handouts, booklets, and pamphlets. Awareness rally to reach the masses and positively influence tobacco use norms in the community.	Cluster–RCT 2 low-income communities (Delhi, India); one treated as intervention and the other as control Subjects: adolescents ages 10–19 Saliva cotinine used for verification in 25% of sample	Significant difference in current tobacco use between study groups: intervention group—reduction in use, control—increase in use. After intervention, significantly lower uptake of tobacco use in intervention group compared with control group. No significant change found for quit rates across conditions.
Biglan et al. 2000 (4)	Project SixTeen Community intervention: Media advocacy, youth anti-tobacco module, family communication activities, and youth access campaigns. School-based intervention: curriculum titled Programs to Advance Teen Health (PATH).	Cluster–RCT 16 communities in Oregon Controls received school-based curriculum	Significant intervention effect on reducing ST use among 9th grade males at 1-year follow-up but not among 7th grade males. Prevalence of ST decreased significantly in community intervention.

Study*	Intervention	Design	Outcomes
School-Level Behavioral			
Dent et al. 1995 (23)	Project TNT The same treatment conditions as used in the report of 1-year outcome data (see Sussman et al.,1993): (1) Countering normative social influences (2) Countering informational social influences (3) Changing misperceptions about physical consequences of tobacco use (4) A combined condition to counteract both social influences and perceptions of physical consequences. A "booster session" related to the original curriculum was delivered to the 8th grade cohort.	Cluster–RCT Subjects: 7th grade students at 48 junior high schools (California) Assigned to one of four program conditions or to a control group which received usual care.	(2-year outcome data) Data suggested that: (1) Effects in the combined and physical-consequences conditions were maintained 2 years after the program (that is, physical-consequences curriculum was successful in attenuating increases in adolescent ST use). (2) A comprehensive program with all 3 components was necessary to attenuate increases in weekly use of both forms of tobacco.
Elder et al. 1993 (21)	Project SHOUT A psychosocial intervention combining refusal skills training, contingency management, and other tobacco use prevention methodologies such as telephone and mail boosters. College undergraduates served as change agents for both the classroom and booster interventions. A booster intervention was delivered in 9th grade.	Cluster–RCT Subjects: 7th grade students at 22 California middle schools; schools matched for size and tobacco use prevalence. Controls received no intervention	(3-year outcome data) Prevalence of tobacco use was significantly lower among intervention students compared to controls.

Study*	Intervention	Design	Outcomes
Perry et al. 2008 (24) Perry et al. 2009 (25)	Project MYTRI Purpose: To prevent and reduce many forms of tobacco use (ST, cigarettes, and bidis) among youth in India. Two-year, school-based, multicomponent, peer-led, tobacco intervention. Included classroom curriculum, school posters, parent postcards, and peer-led health activism. Underlying theory: social cognitive theory and other theories of youth health promotion.	Cluster–RCT Subjects: Students in grades 6–9 received the intervention (two cohorts studied: grade 6 and grade 8) in 32 private and government schools in Delhi and Chennai, India Schools stratified by city, gender (male, female, or coed), and type (government or private) and randomized into intervention and delayed-program control groups	(At 2-year follow-up) Students in the intervention group were significantly less likely than students in the control group to have increased their cigarette or bidi smoking over the 2-year study period. ST use was not reduced, but students were less likely to intend to smoke or chew tobacco in the future.
Severson et al. 1991 (20)	Multicomponent intervention delivered by classroom teachers and same-age peer leaders. Seven class sessions with emphasis on refusal skills. Two sessions on ST.	Cluster–RCT 13 middle schools and 9 high schools in Oregon matched, stratified, and randomly assigned Control group received only the usual 7th grade health education classes or 9th grade science classes, both including materials and lectures on tobacco All groups assessed before intervention and 1 year after intervention via questionnaires and collected expired carbon monoxide (CO) and saliva	Significant effects for reducing ST use by 7th grade boys but marginal effects on the rate of ST use for 9th grade boys.
Sussman et al. 1993 (22)	Project TNT Four curricula were developed, tested, and each was used in a treatment condition, which consisted of activities to counteract: (1) Normative social influences (2) Informational social influence (3) Misperceptions about physical consequences of tobacco use (4) A combined condition to counteract both social influences and perceptions of physical consequences.	RCT (a 5-group randomized block design) Subjects: Students at 48 middle schools from 27 southern California districts over a 5-year period Questionnaire at baseline and 1 and 2 years postintervention, along with a saliva or breath sample	(1-year outcome data) Combined intervention most effective overall in reducing initial and weekly use of cigarettes and ST. Each program component effectively decreased both the initial and weekly use of cigarettes (except for the social curriculum, in which refusal skills were taught) and initial use of ST (except for the curriculum for correcting social misperceptions).

Study*	Intervention	Design	Outcomes
Individual-Level Behavioral			
D'Onofrio et al. 2002 (32)	A set of five experience-based modules led by teams of trained adult volunteers and older 4-H youth delivered at monthly club meetings. Sessions plus activities to be completed between meetings. Subjects received illustrated, self-guided booklets reviewing the five club sessions, instructions and worksheets for activities. Other materials: leader's manual, pamphlets for parents identifying ways they could help, guides for clubs and members who wanted to form a Project 4-Health Action Team. Examples of Action Team projects: creating tobacco use policy for the 4-H club, conducting a tobacco survey at schools, and organizing a poster display and contest.	Cluster–RCT Subjects: 4-H club members aged 10–14 72 California 4-H clubs were matched and randomized, N = 1,438 Controls received no intervention	(At 1 year) Short-term effects were found on 7 of 24 outcome measures, indicating changes in knowledge, attitudes, and behavioral intention, but not changes in social influence variables or behaviors. None of the short-term program benefits were sustained 2 years after program completion.
Schinke et al. 2000 (31)	Two intervention conditions: Skills intervention alone: Cognitive and behavioral skills for substance abuse prevention. Skills plus community intervention: Local community residents were also engaged in community activities to raise awareness.	Cluster–RCT Subjects: 1,396 Native American 3rd–5th graders from 27 elementary schools 2 treatment groups and 1 control in North Dakota, South Dakota, Idaho, Montana, and Oklahoma	At 30- and 42-month follow-ups, ST use significantly lower for subjects assigned to the skills-based treatment condition, but community-based components did not demonstrate any added benefit.

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
Abbreviations: Project Activity = Advancing Cessation of Tobacco in Vulnerable Indian Tobacco Consuming Youth; Project MYTRI = Mobilizing Youth for Tobacco-Related Initiatives in India; Project TNT = Towards No Tobacco Use; Project SHOUT = Students Helping Others Understand Tobacco; RCT = randomized controlled trial; ST = smokeless tobacco.

Community- and Health Care–Based Prevention

Community-based efforts—which use a comprehensive approach that includes schools, media, family, advocacy, and public policy—may be effective in helping to prevent ST use by youth. The fact that community interventions can reach young people who may not be attending school is an advantage, because school dropouts and non-attending youth may have higher tobacco use rates than youth who are attending school.[3] Project SixTeen,[4] a randomized controlled trial (RCT) conducted in the United States (Oregon), tested whether a comprehensive communitywide effort to prevent teen tobacco use was a better deterrent than a school-based tobacco prevention program alone. The community intervention included media advocacy, a youth anti-tobacco module, family communication activities, and a youth-access campaign. The school-only intervention consisted of an evidence-based curriculum called Programs to Advance Teen Health. The study found that the community intervention had a significant effect on the prevalence of ST use by males after one intervention year, which suggests that a multicomponent community-based intervention can have stronger preventive effects than a school-based program alone, which was not as effective at preventing smoking initiation and future increases in smoking prevalence.

Despite a relative lack of specific ST prevention efforts in the United States, studies have documented an overall decline in adolescent ST use since the late 1990s and an increase in the percentage of 8th, 10th, and 12th graders who perceive regular ST use as harmful.[5] However, the most recent national survey data suggest that during the past 10 years, ST use among high school students has remained flat; perceptions of ST harm among 8th, 10th, and 12th graders also were constant through 2010, but as of 2012, perceived risk of ST use has decreased among 8th and 10th graders.[6,7] Temporary improvement of ST perceptions may have been the result of the extensive anti-tobacco efforts targeted toward young people throughout the United States in the 1990s, although these efforts focused primarily on cigarette smoking.[5] For example, in 1993, the Massachusetts Tobacco Control Program began a statewide comprehensive youth tobacco (ST and cigarette) prevention campaign in communities and schools and through the media. An analysis of school survey data between 1993 and 1996 found a greater decline in the state than had occurred nationally, suggesting the program was effective in preventing ST use.[8] This decline had continued as of 2005.[9]

Visits with oral health care providers offer a natural opportunity to deliver a brief ST intervention because these providers are in a unique position to identify the oral consequences of ST use. Although dental settings have been a venue for several cessation studies in the United States that have demonstrated efficacy in ST cessation,[10–12] they have not been evaluated for providing preventive interventions. Pediatricians might be in a similarly advantageous position to provide brief counseling to young people about avoiding tobacco use, as indicated in Indian health care settings,[13] but the only study evaluating this approach, which took place in the United States, did not find that counseling by pediatricians significantly prevented ST use.[14]

Few evaluations of U.S. programs to prevent young people from starting to use ST or preventing their continued use have been focused on interventions in communities, families, or health care settings. The results reported by Project SixTeen[4] are encouraging, but additional research is needed to determine effective ways to educate both children and parents about the health risks of ST use. The dental office setting offers a unique and timely opportunity to provide preventive education, but studies in this

setting to date have focused on cessation; there are no published evaluations of prevention efforts in dental settings.

In low- and middle-income countries, community-based interventions may have significant potential for reducing ST use. A study with 10- to 19-year-olds in two low-income communities in Delhi, India, compared a community that received the intervention with another community that served as the control. A significant difference in current tobacco use was observed between the study groups, with the intervention group showing a reduction in ST use and the control group showing an increase in use. Postintervention, there were significantly fewer new tobacco users in the intervention group compared with the control group. No significant differences were observed in tobacco quit rates between the two groups.[15]

Based on the success of this demonstration study, a group RCT called Project ACTIVITY (Advancing Cessation of Tobacco in Vulnerable Indian Tobacco Consuming Youth) was implemented to reduce tobacco use among disadvantaged youth (aged 10–19 years) in 14 low-income communities in Delhi. The study was conducted in collaboration with Health-Related Information Dissemination Amongst Youth (HRIDAY) and the University of Texas in the United States. In 2009, seven communities were randomly assigned to receive a 2-year intervention, and another seven served as controls.[16] The 2-year intervention targeted intrapersonal and socio-environmental risk factors to prevent initiation of smoking and ST use, and to promote tobacco cessation.[17] Four intervention strategies—training workshops, community-based cessation camps, interactive activities, and policy enforcement—were used, with an emphasis on leadership education and enforcement of tobacco control laws. Although final quantitative outcome data for this study are not available, preliminary qualitative results show that community-based interventions can be effective in preventing adolescents from starting tobacco use in a low-resource setting such as India, in changing community norms around tobacco use and denormalizing ST use among all community members.[18]

School Curriculum Interventions

Most interventions to prevent tobacco use have been school based because schools provide access to young people, and many interventions are designed to teach youth to resist peer pressure in relation to using tobacco products.[19] Some promising school-based programs are reviewed below and summarized in Table 7-1.

One study conducted in the United States evaluated a classroom-based social influences program delivered by teachers and peer leaders in randomly assigned schools. The goal of the intervention was to sensitize students to overt and covert pressures to use tobacco. Even though only two of the seven class periods focused on ST-specific content, the intervention resulted in diminished ST use among males (the predominant users of ST) in the 7th and 9th grades. The program had a significant effect on reducing ST use among the boys in the 7th grade.[20]

Another example of a successful school-based program, Project SHOUT, evaluated an intervention delivered to 7th grade students in 22 California middle schools. Directed toward grades 5 through 9, the Project SHOUT program combined education, social activism, behavioral strategies, and telephone support from an older peer. At the 3-year follow-up, results showed a significant decrease in cigarette

use (OR = 0.77), ST use (OR = 0.47), and combined cigarette and ST use (OR = 0.71) at the school level within the past month.[21]

A California school tobacco prevention curriculum, Project Towards No Tobacco Use,[22,23] also showed promising results for ST prevention. This program corrected misperceptions about ST use, taught about the physical consequences of use, and tested the effectiveness of refusal skills. Although the combined curriculum was effective in reducing initial and weekly use of ST, the results of a 2-year follow-up showed that only the physical consequences curriculum sustained its benefit over the long term, which suggests that teaching students about the physical consequences of ST use in personally relevant ways can be important to preventing ST use.

School- and community-based intervention and prevention efforts in high-income countries have shown promising results, but prevention programs that target both substance use and tobacco may not offer enough information to have a significant impact on ST initiation. Most tobacco prevention programs focus on smoking and give little attention to ST in their curricula or activities.

School curricula targeting prevention of tobacco use, including ST, in some low- to middle-income countries (such as India) have been tested and also show promising results. Project MYTRI (Mobilizing Youth for Tobacco-Related Initiatives) was a multicomponent intervention aimed at reducing tobacco use among adolescents in schools in Delhi and Chennai, India. Students from 32 schools in the two cities were randomly assigned to either an intervention group or a control group. Baseline, intermediate, and outcome data were collected from two cohorts of 6th and 8th graders beginning in 2004; from 2004 to 2006, 14,063 students completed surveys. The Project MYTRI intervention is based on social cognitive theory and existing evidence-based smoking prevention programs which were appropriately translated to match the needs of adolescents in India.[24,25] The intervention consisted of behavioral classroom curricula, school posters, a parental involvement component, and peer-led activism. Classroom activities were based on a graded curriculum, and multiple sessions were implemented each year. In both years of interventions, high participation rates were achieved for classroom interactive activities. The peer-led component involved training a large number of students as peer leaders, while training teachers to supervise and assist the peer leaders in conducting classroom activities.[25] The control group received only a diet and physical activity intervention.

Over the 2 years of the MYTRI intervention, significant differences were noted between the intervention and control groups in the trajectories of cigarette smoking and bidi smoking, but no significant between-group difference was seen in trends in ST use behavior.[26] However, there were significant differences between groups in students' intentions to use ST and their social susceptibility to ST, suggesting that the intervention had some positive impact.

Project MYTRI's baseline data indicated that the prevalence rate for ever-use of ST for girls and boys was 12% and 16%, respectively.[27] In the intervention schools, ST adoption for girls decreased marginally over time compared to initiation of ST use by girls in control schools, where there was no change.[25]

Individualized Preventive Interventions

Among youth in the United States and other high-income countries, ST use is considerably lower than cigarette smoking, although higher rates of ST use occur in certain subgroups. Smokeless tobacco use is much more common in boys than in girls,[28] and the highest rates of use in the United States are observed among Native Americans and Alaska Natives, in the Southern states, and in rural areas of low socioeconomic status.[29] Smokeless tobacco is also more common among young male players of certain sports, such as baseball.[30] Some prevention programs concentrate on these subgroups.

One study that focused on Native American youth[31] developed and tested a skills- and community-based approach to preventing substance abuse, including ST use. The program was carefully tailored to the cultural values and everyday realities of Native American youth in the targeted western reservations. The study found follow-up rates of ST use were lower for youths who received the skills intervention than for those in the control group, which did not receive an intervention.

Although not a special population of users, youth aged 10–14 years were targeted by a program that was implemented in 4-H clubs throughout California. This program focused on education about tobacco use in general, not specifically ST use. A youth development organization, 4-H is popular in rural areas and small towns in agricultural regions, and these voluntary clubs provided a unique opportunity to reach young people. Seventy-two 4-H clubs (with a total of 1,438 members) were matched and randomly assigned to an intervention (tobacco education delivered by volunteers in five successive monthly club meetings) or to a no-treatment control.[32] At a 1-year follow-up, club members in the intervention group showed significant effects in improved knowledge of the harmful effects of tobacco. Seven of 24 program effects were significant at 1 year in increasing knowledge, improving perceptions, and decreasing intentions to smoke, but no significant effect on reducing tobacco use was seen at the 2-year follow-up.

Studies conducted in the United States have documented that high school males frequently use ST when playing or watching a sport,[33–35] and the greater their athletic involvement, the more likely they are to use smokeless tobacco.[36] A behavioral intervention targeting male high school baseball athletes[37] was designed to discourage ST initiation and promote cessation. The intervention included an interactive peer-led component and a dental component with an oral cancer screening exam. Although the intervention was effective in promoting ST cessation, it was ineffective in preventing initiation. One predictor of ST initiation was that young people perceived that most of their teammates used ST (OR = 4.73), suggesting that correcting this overestimation would be an important component of an effective ST prevention program.

Smokeless Tobacco Prevention Among Youth—Summary

The studies conducted in India and the United States strongly suggest that communitywide programs can significantly reduce intentions to use smokeless tobacco. The cultural adaptations made in Project ACTIVITY also demonstrate that community interventions can succeed in challenging environments such as very poor neighborhoods of Delhi, but more studies are still needed in other countries.

Some well-designed school-based interventions tested in the United States have also shown positive results in preventing ST use, but the number of ST interventions is much lower than the number of

smoking prevention interventions conducted in the United States in recent years. School-based prevention programs that focus specifically on the negative health and physical effects of ST and combine educational strategies with social activism can significantly reduce the likelihood that young men will start to use smokeless tobacco. Since ST use is especially high in some special populations, it is encouraging that interventions have been targeted toward these groups. Recent comprehensive reviews and meta-analyses confirm that school-based drug interventions can be successful provided they: (1) are interactive, (2) engage peer facilitators, (3) involve parents and other segments of the community, (4) are theory based and follow the social influences model, (5) adequately train teachers and support health-promoting school policies, and (6) are provided in multiple years, starting with age of initiation.[3,38,39] School-based interventions in India did not successfully reduce ST rates, although they changed intentions, attitudes, and knowledge of health risks. In conclusion, although there is a need to address ST use through curricula and school-based programs that target ST use by adolescents, broad community-based interventions appear to have more effect than school-based programs alone. However, school-based programs containing the six components listed above can produce at least short-term effects and reduce the prevalence of tobacco use among school-aged youth, particularly when they are implemented in combination with other initiatives such as mass media campaigns and state and community programs.[40]

Smokeless Tobacco Cessation

Abstinence is the most effective way to prevent the morbidity and mortality associated with ST use. Evaluations of behavioral and pharmacologic interventions to treat ST use have shown that these interventions have had varying degrees of success, as measured by short- and long-term (≥6 months) tobacco abstinence rates. In addition to promoting ST cessation, these interventions can be effective in treating tobacco craving and nicotine withdrawal symptoms. Most published RCTs evaluating interventions for ST use were conducted in the United States and may have employed slightly different measures of cessation, making it difficult to generalize the findings to other nations with different types and patterns of ST use. However, results of these trials can form a foundation upon which to construct interventions specifically tailored to regionally or culturally driven patterns of ST use. Table 7-2 lists ST cessation interventions that have been conducted at the community, organizational, and individual levels.

Table 7-2. Smokeless tobacco cessation interventions

Study*	Intervention	Design	Outcomes
Community Level			
Anantha et al. 1995 (46)	A 2-year community-based health education program aimed at preventing people from initiating any form of tobacco use or helping them quit use. Components included films, exhibits, and display of photographs of ST's harmful effects.	Cohort study	Evaluated through changes in prevalence, quit and initiation rates. Follow-up surveys after 2 and 3 years. In intervention cohort, the quit rate for ST use = 30.2% in males and 36.7% in females. Significantly higher proportion of men quit tobacco chewing (30.2%) than quit smoking (20.4%).
Gupta et al. 1986 (44)	Baseline and annual exams to detect oral cancer or lesions over 5 years. Personal education and mass media communication promoting tobacco cessation. Five-year intervention.	Cohort study in Ernakulam District, Kerala state, India 12,212 intervention subjects Comparison group received no education	Intervention significantly increased abstinence from tobacco (9.4% in the intervention group vs. 3.2% in the control) and reduced incidence of leukoplakia lesions.
Kyaing et al. 2003 (43)	176 facilitators were trained in 11 communities. Program included roundtable community discussions; advocacy talks with community leaders; Information, Education, and Communication (IEC) materials; disseminating tobacco-control messages during festivals; monthly meetings between facilitators and quitters; billboard postings.	Community demonstration. 11 communities in Myanmar	Quit rate of betel quid users in one community was 11%.
Murthy and Saddichha 2010 (48)	Tobacco Cessation Clinics (TCCs) in cancer, surgical, and cardiology clinics, and in nongovernmental organization settings. TCCs provide behavioral therapy, education, tips to quit, motivation to change, and relapse prevention counseling.	Cohort study 23,320 cases from the first 5 years of operations of TCCs in India Comparison group received counseling only	Counseling and medication (bupropion) significantly increased tobacco abstinence rates compared to counseling alone.
Organization-Level Behavioral			
Youth Cessation			
Burton et al. 2009 (60)	Addiction group Psychosocial dependency group Groups met for 5 sessions in 1 month, where they watched video clips and discussed tobacco use, and ST users were encouraged to use oral substitutes.	Schools randomly selected 337 subjects from 16 schools in Illinois and California Controls received no intervention	Intervention significantly increased abstinence among ST users compared with smokers.

Study*	Intervention	Design	Outcomes
D'Onofrio et al. 2002 (32)	Tobacco education delivered by volunteers in 5 successive monthly club meetings.	Cluster–RCT Subjects: 1,438 4-H club members from 72 clubs in California Controls attended regular meetings	Intervention significantly improved knowledge but not abstinence (see Individual-Level Behavioral table for more information on study outcomes).
Gansky et al. 2005 (58)	Intervention consisted of: (1) 3-hour videoconference training for athletic trainers/dentists/hygienists; follow-up newsletter for athletic trainers (2) Oral cancer screening by dentists/hygienists (3) Athletic trainer follow-up and referral with follow-up by trainer on quit date, plus 3 booster sessions 1 week apart (4) Peer-led component with education meeting (50–60 minutes).	Cluster–RCT Subjects: 1,585 collegiate baseball players from 52 California schools Control group received anti-tobacco education	Intervention did not increase ST abstinence but significantly reduced initiation of use.
Walsh et al. 1999 (56)	Team-based program including oral exam with feedback, photos of ST effects, advice to quit, self-help manual, optional brief counseling (15–20 minutes, about quit date, triggers, tobacco withdrawal); optional nicotine gum, optional phone counseling.	Cluster–RCT Subjects: 360 athletes from 16 California colleges Controls received oral exam only	Intervention significantly increased ST abstinence.
Walsh et al. 2003 (37)	Peer-led component: Interactive, peer-led team directing education with videotape and brief discussion, slide show, and small-group discussion on tobacco industry advertising. Dental component with oral cancer screening exam by a dentist or hygienist. Included advice to quit, a self-help guide, tobacco cessation counseling in small groups, and a phone call on the quit date.	Cluster–RCT Subjects: baseball athletes from 44 rural California high schools (516 subjects in 22 intervention schools, and 568 subjects in 22 control schools) Control group received no intervention	Cessation prevalence for intervention group was significantly higher than for controls.

Study*	Intervention	Design	Outcomes
Walsh et al. 2010 (59)	Peer-led educational session, oral exam with feedback, and three nurse-led group cessation counseling sessions. Peer-led sessions included video/slide presentation and discussion about the presentations and how the tobacco industry targets young males. Oral exam included feedback about any tobacco-related lesions, advice to quit using ST, assessing of readiness to quit. The three nurse-led counseling sessions were non-compulsory.	Cluster–RCT Subjects: 4,731 male students at 41 schools in rural California counties Controls received no intervention	At 1-year follow-up, non-smoking ST users in the intervention group were significantly more likely to stop using ST (62%) than those in the no-intervention group (36%).
Adult Cessation			
Klesges et al. 2006 (63)	Discussion of positive changes since quitting ST use, information on negative consequences of ST use including visual depiction of health risks, encouragement to use oral substitutes (non-nicotine and non-tobacco herbal chew), and discussion of the progression from ST to other tobacco products.	RCT Subjects: 33,215 U.S. military recruits who quit using ST on entering basic training Controls received general health education	Intervention significantly increased abstinence from ST.
Severson et al. 1998 (12)	Usual dental care and office intervention with an oral exam, advice to quit, quit date setting; self-help materials including pamphlets, oral replacement, video; one phone support call.	Cluster–RCT with stratification 633 subjects from 75 dental clinics in Oregon Controls received usual dental care	Intervention significantly increased ST abstinence.
Individual-Level Behavioral			
Youth Cessation			
Fisher et al. 2001 (68)	Interactive computer program called Chewers Choice, which used a baseball interactive format.	Cohort study 50 subjects, mostly males	85% of users made a quit attempt, and 58% reported quitting.
Gala et al. 2008 (51)	Interactive, multiple-contact Internet ST cessation program.	Cohort study 18 collegiate baseball players from California (6 lost to follow-up)	As a result of this intervention there was a 26% self-reported reduction in ST use after 1 month, along with increases in motivation and confidence to quit.
Severson et al. 2011 (69)	An evaluation of Web-based cessation programs for ST users ages 14–25: one basic text-based website and one enhanced interactive site.	RCT 1,718 subjects	Intervention did not significantly increase ST abstinence.

Study*	Intervention	Design	Outcomes
Adult Cessation			
Boyle et al. 2008 (73)	A self-help manual plus proactive phone-based cessation counseling. Phone-based treatment included up to 4 calls in support of quitting and personalized cognitive and behavioral tobacco treatment strategies (e.g., setting a quit date, examining use patterns, developing stress-reduction skills, avoiding known triggers to use).	RCT 406 subjects from Minnesota Controls received usual care (i.e., self-help manual only)	Intervention significantly increased abstinence from tobacco. Significantly higher abstinence at 3 months in the intervention group (30.9%) than the control (6.8%), and at 6 months (intervention, 30.9%, vs. control, 9.8%).
Cigrang et al. 2002 (65)	Program using motivational interviewing consisted of a treatment manual, video, and two supportive phone calls from a cessation counselor.	RCT Subjects: 60 military personnel from Texas Controls received usual care	Intervention significantly increased abstinence from ST at 3 months but not at 6 months.
Severson et al. 2000 (72)	Assisted self-help including: (1) Phone support (two calls, 10–15 minutes, with quit date setting and tobacco withdrawal management) (2) Self-help manual (60 pages) (3) Self-help videos (20 minutes).	RCT 1,069 subjects in Oregon, Washington, Idaho, Montana, and Alaska Controls received a self-help manual	Intervention significantly increased tobacco abstinence.
Severson et al. 2008 (74)	Enhanced website including personal quitting assistant (guided, interactive program), printable resources, links to other sites, two Web forums, plan-to-quit module, staying-quit module.	RCT Subjects: 2,523 ST users from 49 U.S. states Controls received a static textual website	Intervention significantly increased abstinence from tobacco. At 3 months, quit rate for intervention subjects = 12.6; for controls = 7.9%.
Severson et al. 2009 (64)	Telephone counseling by a trained cessation counselor who offered assistance in quitting ST use; a mailed videotape and self-help guide tailored for the military.	RCT Subjects: 785 military personnel across the United States Controls received usual care	Intervention significantly increased abstinence from tobacco. Repeated point prevalence at 3 and 6 months showed abstinence from all tobacco: intervention subjects, 25% vs. controls, 7.6%. Abstinence from ST at 6 months: intervention subjects, 16.8% vs. controls, 6.4%.

Study*	Intervention	Design	Outcomes
Stevens et al. 1995 (66)	Oral exam with feedback, advice to quit from hygienist and dentist, self-help manual, quit kit, video, phone call from counselor, free helpline, six newsletters.	RCT Subjects: 518 ST users in the Pacific Northwest	Intervention significantly increased abstinence from ST. Abstinence among intervention subjects at both 3 months and 12 months = 18.4%, compared to 12.5% among controls.
Individual-Level Non-pharmacologic			
Chakravorty 1992 (76)	Interventions: (1) herbal mint snuff or (2) nicotine chewing gum	RCT Subjects: 70 male ST users ages 14–18 (Illinois area) Controls received lecture only	Herbal mint snuff users significantly decreased ST use compared to those who used gum or attended lectures.
Hatsukami et al. 2000 (75)	Herbal mint snuff. All subjects received a self-help treatment manual and 10 minutes of individual counseling at 8 clinic visits over 10 weeks.	RCT with a 2x2 design; active vs. placebo patch crossed with herbal mint snuff vs. none 402 subjects from Minnesota	Herbal mint snuff did not increase abstinence rates but significantly reduced tobacco craving and withdrawal.
Individual-Level Pharmacologic			
Nicotine Replacement Therapy: Nicotine Gum			
Hatsukami et al. 1996 (81)	2 mg nicotine gum for 8 weeks starting at 6 pieces per day then tapering, with an option for a third month.	RCT with 2x2 design; intensive counseling vs. minimal contact crossed with nicotine gum vs. placebo Subjects: 210 adult ST users from Minnesota	Gum significantly decreased tobacco withdrawal symptoms but did not increase abstinence from tobacco.
Nicotine Replacement Therapy: Nicotine Lozenge			
Ebbert et al. 2009 (78)	4 mg nicotine lozenge for 12 weeks including tapering period.	RCT 270 subjects from Minnesota and Oregon Controls received a placebo	Lozenge significantly increased self-reported abstinence from all tobacco at 3 months and significantly decreased tobacco craving and withdrawal.

Study*	Intervention	Design	Outcomes
Ebbert et al. 2010 (80)	4 mg nicotine lozenge for 12 weeks mailed to subjects, plus phone support.	RCT 60 subjects from Oregon and Minnesota Controls received a placebo	Nicotine lozenge did not increase abstinence from tobacco but significantly decreased tobacco withdrawal symptoms.
Nicotine Replacement Therapy: Nicotine Patch			
Croucher et al. 2003 (82)	15 mg patch for 4 weeks vs. brief counseling.	Non-randomized study, with pairs matched on age and amount of tobacco use; no placebo Subjects: 130 UK–resident Bangladeshi women who used paan	NRT and brief advice did not significantly increase tobacco abstinence rates compared to brief advice alone.
Ebbert, Dale et al. 2007 (85)	Conditions: (1) 63 mg nicotine patch, (2) 42 mg patch, (3) 21 mg patch, (4) placebo. Patches were given for 8 weeks. All subjects received behavioral counseling.	RCT Subjects: 42 ST users from Minnesota Multidose, placebo-controlled	Statistically significant dose–response relationship, with higher nicotine doses associated with less tobacco withdrawal.
Hatsukami et al. 2000 (75)	21 mg nicotine patch for 10 weeks, including tapering period.	RCT with a 2x2 design; active vs. placebo patch crossed with herbal mint snuff vs. none 402 subjects from Minnesota	Patches significantly increased abstinence from tobacco at 10 and 15 weeks and significantly decreased tobacco craving and tobacco withdrawal symptoms.
Howard-Pitney et al. 1999 (83)	15 mg nicotine patch for 6 weeks. Intervention subjects and controls received self-help materials and phone support.	RCT Subjects: 410 adult ST users in California Controls received a placebo	Patch significantly increased ST abstinence at 3 months.
Stotts et al. 2003 (84)	Conditions: (1) Nicotine patch tailored to baseline cotinine: >150 mg/ml received 21 mg initially, otherwise 14 mg with medication tapering for 6 weeks of treatment (2) Counseling only (6 behavioral intervention classes with NCI materials) (3) Counseling plus placebo patch and phone calls.	RCT Subjects: 303 users ages 14–19 in Arkansas Controls received a placebo	At 1 year, no differences between the placebo and active patch groups, but combined, the two patch groups had significantly higher cessation rate (32.8%) than the counseling-only group (22.9%).

Study*	Intervention	Design	Outcomes
Bupropion			
Dale et al. 2002 (87)	Bupropion SR 150 mg twice a day for 12 weeks.	RCT 68 subjects from Minnesota Controls received a placebo	Bupropion non-significantly increased short-term tobacco abstinence rates and significantly decreased tobacco withdrawal.
Dale et al. 2007 (86)	Bupropion SR 150 mg twice a day for 12 weeks.	RCT 225 subjects from West Virginia and Minnesota Controls received a placebo	Bupropion SR did not increase abstinence from ST but significantly attenuated weight gain and significantly decreased tobacco craving.
Varenicline			
Ebbert et al. 2011 (89)	Varenicline for 12 weeks.	RCT Subjects: 76 ST users in Wisconsin and Minnesota Controls received a placebo	Varenicline significantly decreased tobacco craving, but this study was underpowered to assess abstinence outcomes.
Fagerström et al. 2010 (88)	1 mg varenicline twice/day for 12 weeks.	RCT Subjects: 431 Scandinavian snus users Controls received a placebo	Varenicline significantly increased abstinence from ST at 6 months.

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.
Abbreviations: mg = milligram; ml = milliliter; RCT = randomized controlled trial; ST = smokeless tobacco.

Community-Level Interventions

Tobacco cessation efforts in low- to middle-income countries are primarily community-level interventions, reflecting, in part, limited resources and a scarcity of professional ST cessation training. For example, the Global Adult Tobacco Survey (GATS), conducted in India during 2009 and 2010, found that 47% of ST users had visited health care providers in the past 12 months, but only 34% of those users were asked about ST use, and only 27% of those who had visited health care providers in the past 12 months were advised to stop tobacco use.[41] These findings support implementing cessation efforts at the community level and offering more cessation training to health care providers.[41,42]

Myanmar and India are implementing tobacco control programs with legislation, community awareness, community mobilization, and/or health promotion activities as main components.

Myanmar piloted a community tobacco use cessation project.[43] In this pilot study, community facilitators in two regional divisions, Yangon and Bago, were selected and trained. Community-based cessation activities included roundtable discussions with the community; advocacy talks with community leaders; Information, Education, and Communication (IEC) materials; dissemination of tobacco control messages during festivals; monthly meetings between facilitators and quitters; and billboard postings. The impact of these cessation activities varied widely in different communities depending on the intensity of the interventions. Among smokers, 11% completely stopped smoking and 15.4% were in the process of quitting; among ST users, one community reported a quit rate of 11%.[43]

A large community-based cessation intervention was also tested in one state in India. The intervention included personal and mass media communications to motivate smokers and ST users to quit, which contributed to significantly more quit attempts among program participants in the intervention group (9.4%) than in the control group (3.2%) after 5 years of intervention.[44] This intervention was effective across all demographic groups but had a greater impact on men, ST users, older people, and those with a shorter duration of tobacco use.[45] The researchers also reported a reduced 5-year age-adjusted incidence rate of leukoplakia (oral lesions) after tobacco cessation.

Another community-based tobacco control education program was implemented in the Kolar district in Karnataka (India). In an effort to prevent individuals from initiating tobacco use in any form and to quit use if already using, this program used health education materials, consisting of films, exhibits, and displays of photographs of harmful effects. Program results were evaluated through changes in prevalence rates, quit rates, and initiation rates, and the effects of 2 years of intervention were assessed by follow-up surveys after the second and third years. In the intervention cohort, the quit rate for ST use was 30.2% among males (vs. approximately 1.15% in the control group). A higher proportion of men had quit ST use (30.2%) than had quit smoking (20.4%).[46]

In 2002, with support from the World Health Organization (WHO), the Government of India, through its Ministry of Health and Family Welfare (2009),[47] established 19 tobacco cessation clinics (TCCs) across the country, primarily in cancer, surgical, and cardiology clinics, and in some nongovernmental organization settings. The TCCs provide behavioral therapy, education, tips for quitting, motivation to change, and relapse prevention counseling.[47] Experiences from the TCCs were pooled, and baseline information was obtained on 23,320 individuals from the first 5 years of the TCCs' operations.

Sixty-nine percent of the individuals received behavioral therapy only, and 31% received both behavioral therapy and pharmacotherapy.[48] Younger men, ST users, and those receiving combination therapies had relatively better outcomes at 3-, 6-, and 9-month follow-ups. Continued follow-up was found to contribute to better outcomes in these clinics. However, more research is needed to determine whether these outcomes are sustainable over the long term. Barriers to ST cessation were low levels of awareness of the harms from ST use and lack of knowledge about the benefits of quitting and methods of quitting.

The tobacco cessation experience in India suggests that clinics have better outcomes with ST users than with smokers. Moreover, the "5 A's" approach for smoking cessation translates well into ST cessation: (1) Asking all treatment seekers about their tobacco use, (2) Advising them in clear terms about the risks of continuing use and the advantages of stopping, (3) Assessing their readiness to quit, (4) Assisting them in quitting, and (5) Arranging for referral or follow-up. Health professionals and community staff in existing health systems can be trained in using the 5 A's, which can easily be integrated into health initiatives in various health care settings.[49,50]

Organization-Level Behavioral Interventions

A variety of behavioral interventions for the treatment of ST use have been evaluated in a broad array of different populations of ST users at the organizational level (e.g., school, clinic, military unit). Successful interventions have used psychosocial education, social support, relapse prevention strategies, and an oral examination with feedback about changes in oral health caused by ST use. Interventions have been based on social influence theory,[32] the health belief model,[51] diffusion of innovation theory,[52] and cognitive social learning theory.[53]

Youth Cessation

Few researchers have focused on developing efficacious, practical cessation tools for young ST users. The small number of ST interventions designed for youth are usually incorporated as secondary elements of multicomponent ST tobacco use prevention programs. Although school- or community-based programs may help reduce initiation or early use, any effort to reduce prevalence must include a focus on helping young users quit. In the United States, most ST cessation programs for youth focus on high school or college athletes, groups that are known to have higher rates of ST use.[33,36,37] Some interventions designed to reduce the adoption of tobacco use by middle school and high school youth examine program effects on cessation among students who were already using tobacco products, but few programs have included ST-specific cessation components.

Cessation programs for youth often use multisession, multicomponent, cognitive behavioral interventions that include self-monitoring of ST use, education about health risks, and behavioral coping strategies for helping young people quit. These programs face challenges in motivating young users to quit and overcoming high drop-out rates and attrition levels.[29] These programs tend to be more successful for lower level users who use less ST and therefore are probably less dependent.

Group- or organization-level behavioral interventions have been effective in increasing rates of long-term tobacco abstinence among adolescent ST users. One large study,[37] involving 22 treatment schools

and 22 control schools, examined the impact of ST cessation efforts aimed at high school baseball players randomly assigned to treatment or to a control condition. Treatment consisted of discussion of the harmful effects of ST use, refusal skills training, encouragement of cessation by a strong peer opinion leader, a meeting with coaches, a self-help guide to quit, and a dental exam with cessation advice from a dentist. Sustained ST cessation was significantly higher in the treatment compared to the control group (27% vs. 14%, respectively). Results of this intervention were based on self-reports, but the researchers obtained saliva samples from participants to increase the accuracy of self-reports and used the "bogus-pipeline" procedure, in which participants were informed that the samples could be used to ascertain the veracity of the self-reports.[53,54] Using oral health screening exams, brief counseling, and peer-led educational sessions helped to double the quit rate compared to quit rates of students in control schools. Previous cessation research studies with adults have found that oral exams can be significant motivators for ST users to quit.[29,55]

A similar study found that a college-based ST cessation intervention targeting college athletes was more effective than no intervention for increasing long-term tobacco abstinence among these participants.[56] The study was an RCT involving baseball and football athletes at 16 California public colleges, both rural and urban, which were matched on prevalence of ST use. Players completed questionnaires assessing their tobacco use. The intervention was a team-based cessation program based on cognitive social learning theory[57] in which a dentist performed oral soft tissue exams with each team member, advised users to quit, pointed out ST-related tissue changes in their mouths, showed photographs of cancer-related facial disfigurement, provided a self-help cessation guide, and offered users a single 15- to 20-minute session of counseling. Individuals who wanted to quit received 2 mg nicotine gum to treat tobacco withdrawal symptoms. Dental hygienists met with non-users in small groups to discuss the quitting process and encouraged them to support the ST users in quitting. Those trying to quit received two support phone calls. Among the 360 ST users, the intervention significantly increased ST abstinence rates at 1 year compared to the rates for participants in the control groups. On average, the observed self-reported quit rates were 34.5% for intervention schools and 15.9% for control schools. Besides doubling the quit rate, the intervention led to significant reductions in reported tobacco use for those who did not quit.

Another study involved athletic trainers directing an ST cessation program with collegiate baseball players,[58] who are known to be high users of snuff. This study involved 52 California colleges in a stratified, cluster-RCT of an intervention intended to prevent initiation and promote cessation of ST use. Intervention components included videoconference training, newsletters, an oral cancer screening exam, a self-help guide for quitting, and a counseling session for interested players. Those wanting to quit received follow-up support from the athletic trainer on the quit date and three booster sessions 1 week apart. Athlete peer leaders conducted a single 60-minute educational team meeting that included video and slides. Although the program had the significantly positive effect of reducing initiation of ST use at 1-year follow-up, there was no significant difference in cessation between intervention and control groups (95% CI: 0.70–1.27). The authors attribute this lack of effect on cessation to the small number of dependent ST users enrolled in the study.

Walsh and colleagues[59] conducted a randomized study involving male students in 41 rural high schools. The students received an intervention consisting of a peer-led educational session plus an oral exam with

feedback and three nurse-led group cessation counseling sessions, or no intervention. In the peer-led educational session, student peers presented videos and slides and then led a discussion about the 2 videos and 10 slides related to ST use, and about the role of the tobacco industry in targeting young men. A school nurse conducted the oral exam and pointed out any tobacco-associated lesions to the students. The nurses also asked about tobacco use, advised users to quit, assessed users' readiness to quit in the next month, and assisted with the quitting process by offering a self-help guide. The nurse-led counseling consisted of three non-compulsory, 1-hour cessation sessions held after school approximately 1 week apart. Non-smoking ST users in the intervention group were significantly more likely to have stopped using ST at the 1-year follow-up than those in the no-intervention group (62% vs. 36%).

An ST cessation study involving younger users (aged 10–14 years) was conducted in California agricultural youth 4-H clubs (methods described in "Individualized Preventive Interventions" section above). Four months after the intervention, the intervention group showed significantly improved knowledge, attitudes, and behavioral intention; however, no differences in behavior (no increase in cessation or abstinence) were seen at either the 4-month or the 2-year follow-up.[32]

Burton and colleagues[60] reported a school-based study that compared two models of cessation for smokers and ST users in 16 high schools. Students were randomly assigned to an addiction group, a psychosocial dependency group, or a control group. The addiction model focused on psychological aspects of addiction and the effects of nicotine, whereas the psychosocial dependency model focused on social and psychological aspects of tobacco use and on stress management. The majority of the participants were smokers, but the treatment groups shared some components, and the sessions were divided between information presentations and group discussions. Smokeless tobacco users were significantly more likely than smokers to abstain from tobacco use at the 4-month follow-up, when the validated quit rates were 14.3% for ST users and 6.5% for cigarette smokers; the control groups had no subjects reporting ST abstinence and 3.2% reporting cigarette abstinence.

Adult Cessation

Both smoked and smokeless tobacco use rates in the U.S. military are higher than in the rest of the U.S. population.[61,62] Effective interventions focusing on the treatment of ST dependence are critical for reducing adverse health consequences among military personnel. In a study of U.S. military recruits entering basic military training (BMT), during which no tobacco use is allowed, 33,215 subjects were randomly assigned to either a tobacco use intervention, including an ST component, or a health education control group.[63] The ST component included a discussion of the positive changes since quitting (upon entering BMT), information about the negative consequences of ST use, a visual demonstration, encouragement to use oral substitutes (non-nicotine and non-tobacco herbal chews), and discussion of the progression from ST to other tobacco products. Smokeless tobacco users in the intervention group were significantly more likely than ST users in the control group to be continuously abstinent at follow-up.

Dental offices provide a unique and effective point of intervention for ST users. In a study involving 75 U.S. dental offices, 633 ST users were randomly assigned to a behavioral intervention consisting of usual dental care combined with advice to quit, setting a quit date, self-help materials (pamphlets; non-tobacco, non-nicotine oral replacement products; and a specialized video for smokers and ST users),

and phone support. The control group received usual dental care only.[11,12] The intervention was associated with significantly increased 3- and 12-month ST abstinence rates compared to usual dental care (10.2% vs. 3.3%).[11]

Dental setting interventions in both military and civilian populations have been effective in increasing tobacco abstinence rates among ST users. In a study of 24 U.S. military dental clinics, 785 ST users were randomly assigned to usual care or telephone counseling with a trained cessation counselor. Those in the phone counseling group received assistance in quitting ST use (if desired) along with a mailed videotape and military-specific self-help guide.[64] The first phone counseling call occurred about 1 week after a dental visit. Individuals accepting materials were offered two or more calls coinciding with receipt of the mailed materials and their ST quit date. Subjects in the ST cessation program were significantly more likely to be abstinent from all tobacco, as assessed by repeated point prevalence at both 3 and 6 months (25.0%), and were significantly more likely to be abstinent from ST for 6 months as assessed by prolonged abstinence (16.8%) compared with usual care (7.6%, repeated point prevalence; 6.4%, prolonged abstinence).

Another program identified active-duty military ST users during preventive health screenings and provided an intervention consisting of an ST treatment manual, a video, and several supportive phone calls from a cessation counselor.[65] At 3 months, tobacco abstinence rates in the intervention group were double those in the usual care group (41% vs. 17%), but the difference was not significant at 6 months (37% vs. 19%).[65]

The authors of another study cite feedback from oral exams as a key motivational factor for getting patients to try to quit. In a program conducted in 11 dental clinics, 518 ST users were randomly assigned to usual care or a behavioral intervention incorporating an oral exam with feedback, advice to quit from both a hygienist and a dentist, a self-help manual, a video, setting a quit date, telephone support from a counselor, a free helpline, and six newsletters.[66] The behavioral intervention significantly increased long-term abstinence rates; abstinence among the intervention subjects at both 3 and 12 months was 18.4% compared to a rate of 12.5% among those who received usual care.

A 2010 review of behavioral interventions for oral tobacco cessation offered in countries other than the United States suggested that behavioral interventions and components such as telephone counseling and oral examination may particularly enhance abstinence rates.[67]

Individual-Level Behavioral Interventions

Behavioral interventions for ST users conducted at the individual level are described in Table 7-2.

Youth Cessation

The high prevalence of Internet and computer use among young people suggests that technology-based interventions might offer an innovative opportunity to engage young users in the quitting process. Several studies of these interventions have been conducted in the United States. Fisher and colleagues[68] reported on the use of an interactive computer-mediated intervention designed to help individuals quit using ST, a mode of delivery that is an attractive alternative to school or clinical settings. A small pilot

study was conducted with 50 individuals who accessed a program called Chewer's Choice, which used a baseball field interface to appeal to users, most of whom were male. The authors reported that at the 6-week follow-up, 85% of all subjects had made a quit attempt, and 58% of all subjects reported having quit all tobacco for at least 24 hours.

Another pilot study evaluated an Internet ST cessation program with 18 baseball players at California colleges in 2008. The 26% self-reported reduction in ST use at 1-month follow-up indicates that this may be a feasible program acceptable to users.[51]

A Web-based program designed specifically for young users could be a low-cost alternative for promoting cessation. An RCT evaluating a Web-based cessation program[69] offered to ST users ages 14 to 25 years (described at http://ww.mylastdip.com) examined the efficacy of two websites designed for young ST users. The "basic" condition provided a text-based site offering an evidence-based cessation program plus information and resources on ST cessation. The "tailored" condition was a customized, interactive site providing video and other engaging activities plus the opportunity to post on "blogs" (Web-based message boards). A unique feature of this study was that no parental consent was required to participate, as previous research has shown that requiring active consent from parents can significantly deter enrollment in cessation or prevention studies.[70,71] Preliminary results showed relatively high self-reported quit rates at 3 months (38% for the basic condition; 41% for the tailored condition). Although there were no differences between conditions at either the 3-month or the 6-month follow-up, both groups had self-reported rates of abstinence comparable to rates for treatments involving more intense in-person interventions.[69]

Adult Cessation

Telephone support from trained counselors along with self-help materials can enhance tobacco abstinence rates among adult ST users. In a study that randomly assigned 1,069 ST users to a self-help manual only (MAN) condition or to assisted self-help (ASH), the ASH intervention resulted in significantly higher ST quit rates (23.4% vs. 18.4%) and rates for quitting all tobacco products (21.1% vs. 16.5%) at 6 months.[72] The ASH condition included an ST intervention manual, a video, and two support phone calls. Since this combination of assisted support, including the video and the phone calls, greatly increased quit rates, it can be considered a key ingredient for improving success in quitting.

In an RCT of a phone-based intervention, 406 adult ST users in the U.S. Midwest were randomly assigned to self-help alone (a manual only) or to a "QL" condition, consisting of a tobacco quit line with self-help combined with proactive phone counseling that emphasized support, problem-solving, use of cognitive-behavioral strategies (such as setting a quit date, examining use patterns, reducing stress, and avoiding known triggers).[73] Prolonged abstinence (after a 30-day grace period) from all tobacco was significantly higher at 3 months for the QL intervention group (QL intervention, 30.9% vs. manual only, 6.8%) and at 6 months for the QL intervention group (QL, 30.9% vs. manual only, 9.8%). Phone counseling again appears to be an important element in increasing quit rates.

Web-based interventions have increased abstinence rates among adult ST users. In a study of Web-based ST interventions, 2,523 U.S. smokeless tobacco users were randomly assigned to an "enhanced" or a "basic" website intervention.[74] The enhanced intervention included personal quitting aids with a guided,

interactive program; printable resources; and links to other websites, Web forums, and education modules. The basic intervention consisted of static text. On the basis of the repeated point prevalence of all tobacco use at 3 and 6 months, the enhanced intervention significantly increased tobacco abstinence rates compared to the basic intervention (12.6% vs. 7.9%, respectively).

Non-pharmacologic Therapy

Herbal chew is a nicotine-free, non-tobacco product available in U.S. convenience stores or on the Internet. A chopped mint or other plant blend product to be placed in the mouth, herbal chew is intended to replace the oral sensation of ST, which may help users achieve abstinence. One study evaluated the efficacy of an herbal chew product (herbal mint snuff) in a 2 x 2 design with 402 subjects randomly assigned to a nicotine patch or a placebo crossed with herbal mint snuff or no herbal mint snuff.[75] Herbal mint snuff did not increase abstinence rates but significantly reduced cravings and symptoms of withdrawal.

Several studies have noted that non-nicotine oral substitutes can help reduce withdrawal and aid in ST cessation. Smokeless tobacco cessation guides suggest a wide range of products, including chewing gum, nuts, sunflower seeds, beef jerky, or cinnamon sticks.[76,77] Chakravorty assigned 70 rural male ST users aged 14 to 18 years, who averaged 1.5 dips/day, to one of three conditions: use of a non-tobacco product (herbal mint snuff), use of nicotine chewing gum, or only attending a lecture (control condition). Subjects in the herbal mint snuff group were significantly more likely to report decreased use of ST than subjects in the other two conditions. Oral substitutes might be an important element in assisting users to quit ST, and a variety of substitutes exist for this purpose.

Pharmacotherapy

Pharmacotherapies evaluated for the treatment of ST users include nicotine replacement therapy (NRT patch, gum, and lozenge), bupropion sustained-release (SR), and varenicline (Table 7-2).

Nicotine Replacement Therapy

Limited evidence is available regarding the efficacy of NRT. Available evidence suggests that NRT does not seem to increase long-term (≥6 months) abstinence rates in ST users; however, it does appear to decrease nicotine withdrawal and craving, and some forms of NRT may increase short-term (10–12 weeks) abstinence rates.[78–80] Treating withdrawal is important because ST users experience a constellation of withdrawal symptoms upon cessation (craving, irritability, frustration, anger, difficulty concentrating, restlessness, impatience, increased appetite, and depressed mood).

***Nicotine Gum*—**In a study evaluating the efficacy of 2 mg nicotine gum for treatment of ST use, 210 adult users were randomly assigned to 8 weeks of 2 mg gum or a placebo along with either a group behavioral intervention or minimal contact.[81] Nicotine gum did not significantly increase tobacco abstinence rates. However, during the 8-week treatment, 2 mg gum use significantly decreased tobacco craving and nicotine withdrawal compared to placebo.

Nicotine Lozenge—In a study evaluating the efficacy of the 4 mg nicotine lozenge for treatment of ST use, 270 subjects were randomly assigned to a 12-week tapering regimen of lozenges or a placebo.[78] Compared to a placebo, at 12 weeks the 4 mg lozenge significantly increased self-reported all-tobacco abstinence (44.1% vs. 29.1%) and self-reported ST abstinence (50.7% vs. 34.32%), although biometrically confirmed tobacco abstinence rates were not significantly different between the placebo and NRT groups. The nicotine lozenge significantly decreased tobacco craving and nicotine withdrawal compared to the placebo. In a small randomized pilot study (N = 60) evaluating the efficacy of mailing the 4 mg lozenge to ST users combined with phone support, the lozenge significantly decreased withdrawal symptoms compared to the placebo.[80]

Nicotine Patch—Another study compared the 15 mg nicotine patch with brief counseling advice alone. The 130 subjects were UK–resident Bangladeshi women who volunteered in response to community outreach. These subjects chewed betel quid (i.e., betel leaf, areca nut, slaked lime [calcium hydroxide], and brown powder paste; also known as paan) with tobacco. They were matched on age and amount of ST use. Of the successful quitters at the end of the 4-week study, 22% had received NRT, and 17% had received brief advice and encouragement alone. This pilot study demonstrated that methods used to help smokers quit can be successfully adapted for use with Bangladeshi women who use betel quid.[82]

In a study evaluating the efficacy of the 15 mg/16-hour patch for ST users, 410 adult ST users were randomly assigned to the patch or a placebo plus a behavioral intervention for 6 weeks.[83] All participants received two sessions with a pharmacist at baseline and at 4 weeks, as well as self-help materials and phone support at 48 hours and 10 days after the target quit date. Use of the patch significantly increased abstinence rates at 3 months compared to placebo (31% vs. 25%, respectively); less craving was observed at 48 hours after the target quit date. This program demonstrated the potential of using pharmacists as interventionists; other professional groups could expand the reach of cessation programs.

Another patch study evaluating the 21 mg/day nicotine patch for 6 weeks with a 4-week taper compared to a placebo. Four hundred subjects were randomly assigned to active patch with and without herbal mint snuff or to a placebo patch with or without herbal mint snuff.[75] Compared to placebo, the nicotine patch significantly increased tobacco abstinence rates at 10 weeks (67% vs. 53%) and at 15 weeks (52% vs. 43%). The patch significantly decreased craving and withdrawal symptoms.

Stotts and associates[84] examined whether ST users aged 14 to 19 years were aided in their cessation attempts by using nicotine patches and receiving several follow-up counseling phone calls. Over 300 students were randomly assigned to one of three conditions: (1) counseling only (6 weeks of 50-minute, age-relevant behavioral intervention classes based on materials from the National Cancer Institute); (2) counseling plus an active nicotine patch and phone support; and (3) counseling plus a placebo patch and phone support. Participants in the two groups receiving the patch plus phone support also received seven 15-minute counseling phone calls. Analysis of 1-year follow-up results indicated no differences between the placebo and active patch groups, but when combined, these conditions were significantly more successful in encouraging cessation for ST (32.8%) than the counseling-only condition (22.9%). This study did not find that nicotine replacement was effective long term

(≥6 months), a finding that is consistent with other studies of the efficacy of nicotine replacement for ST cessation with adults.

In a study evaluating high-dose nicotine patch therapy, 42 ST users were randomly assigned to a 63 mg/day patch, a 42 mg/day patch, a 21 mg/day patch, or a placebo.[85] Patches were used for 8 weeks, and all subjects received behavioral counseling. No significant differences were observed in abstinence rates between the four groups at 6 months. However, a statistically significant relationship was observed between higher patch doses and a greater degree of withdrawal symptom relief.

Bupropion

Bupropion has not been demonstrated to increase short- or long-term abstinence rates among ST users, but two studies found that it may decrease tobacco craving and delay postcessation weight gain. In a study evaluating the efficacy of sustained release (SR) bupropion, 225 subjects were randomly assigned to medication or a placebo for 12 weeks.[86] Bupropion SR led to significantly less tobacco craving up to 14 days after the target quit date and less weight gain (1.7±2.9 kg increase for bupropion vs. 3.2±2.7 kg for the placebo). This weight gain attenuation was also observed in a smaller pilot study of bupropion SR for ST users,[87] in which the mean weight change from baseline to the end of treatment was 0.7±1.9 kg for bupropion and 4.4±2.4 kg for placebo ($p = .03$).

Varenicline

Varenicline, which came on the market in the United States and the European Union in 2006, has been demonstrated to be effective in treating nicotine dependence among cigarette smokers, yet few studies have assessed its effect on ST abstinence. In a study evaluating its efficacy for ST users, 431 Scandinavian snus users were randomly assigned to varenicline at a target dose of 1.0 mg by mouth twice daily for 12 weeks, or to a placebo. Compared to the placebo, varenicline significantly increased continuous tobacco abstinence rates at weeks 9 to 12 (59% vs. 39%; $p <.001$) and at weeks 9 to 26 (45% vs. 34%; $p = .012$).[88] A pilot study that randomly assigned 76 U.S. smokeless tobacco users to 12 weeks of varenicline or a placebo found that varenicline significantly decreased tobacco craving,[89] but the study was underpowered to assess abstinence outcomes.

Concerns have been raised about the possibility of adverse effects related to the use of varenicline. The U.S. Food and Drug Administration has required a boxed warning on the varenicline label to alert physicians and subjects to behavior change risks.[90] The labeling warns of the risk of behavioral changes such as depression, hostility, aggression, suicidal thoughts, suicide, and the risks of vehicular crashes. However, available research has not established a clear causal link between the drug and adverse psychiatric events.[91–93] Additional concerns about adverse cardiovascular effects[94] have been raised but remain controversial.[95] The U.S. Food and Drug Administration required the manufacturer of varenicline to conduct a meta-analysis on the cardiovascular effects of varenicline, which revealed a small increase in adverse cardiovascular effects, but the increase was not significant.[96] As with any pharmaceutical intervention, doctors are advised to weigh the benefits and risk of varenicline use and patients should be monitored for treatment responses and adverse effects.

Gaps and Limitations

While several studies have examined interventions for prevention and cessation among adults and youth, some of the studies reviewed here were conducted at least 10 years ago. Over that time period the types of ST products available and the marketing of those products have changed considerably. Therefore, the information on the interventions presented in this chapter should be examined in the current context to see if the findings can be replicated. In addition, standard definitions for cessation could be adopted or, at least, durations of abstinence should be consistently reported. When possible, biochemical validation of abstinence is also valuable. Finally, when evaluating interventions, additional consideration should be given to the applicability of these findings for low-income countries as well as the sustainability of the programs described.

Summary and Conclusions

Effective preventive and cessation interventions as well as public policy efforts can reduce ST use.

School-based and community prevention programs produce short-term effects such as reduced rates of prevalence, experimentation, and intention to use ST, as well as some reduction of use among those already using. Youth and parental involvement in planning and executing these programs may be an important component. Most prevention programs focus on younger adolescents (aged 12–15 years) and emphasize understanding social influences and developing the social skills needed to resist the social pressures to use smokeless tobacco. Many programs involve peer leaders rather than adult providers. School programs supplemented by effective family-based or mass media programs can produce larger effects than school-based programs alone. There is potential for young people to become involved in planning prevention programs for youth that are interactive, engage peer facilitators, and involve parents and other segments of the community. These programs may be more effective if they are theory based, continuous, provide adequate training for teachers, and are supported by school policies that promote health and by government tobacco control policies.

Most cessation programs have been evaluated with adult ST users; they show positive results for dental office interventions and clinical interventions involving multiple sessions and counselor support. Phone counseling and feedback on dental exams appear to be key elements in successful cessation programs. Oral health professionals can be further engaged as a “front line” in the prevention and treatment of ST dependence. To better support cessation interventions, oral health professionals can be trained to recognize oral disease caused by ST use and to deliver tobacco use interventions or refer patients who want treatment to physicians or counselors with the necessary training. Models such as “Ask-Advise-Refer” should be adopted and implemented in health care systems. A drawback of dental office interventions is that many high-risk youth and adults do not see a dentist, therefore considering other potential avenues for intervention is important.

The evidence suggests that pharmacologic aids such as nicotine replacement (e.g., patches, gum, or lozenges) can help reduce withdrawal symptoms and cravings in ST users, but so far they have been found to be ineffective for increasing long-term ST abstinence rates. At least one study has shown significant increases in short- and long-term abstinence rates with varenicline in ST users. So far, however, these medication aids have been approved by regulatory agencies for smoking cessation but

not for ST cessation or for reducing symptoms or cravings. Where available, medication may be helpful in reducing symptoms associated with quitting tobacco use and, in the case of varenicline, increasing short-term quit rates. More research is needed to support specific indications for cessation medications in ST users. Additionally, most of the evidence for medication aids comes from high-income countries, and more research is needed to develop and test interventions that can be effective in resource-constrained environments.

Some targeted interventions for youth have demonstrated efficacy, but available studies have shown varying success. A limitation of many of the studies reported is that they are based on self-reported data that is often school-based and concentrated in high-income areas. Additional research is needed on different types of interventions and programs among a diverse range of countries and groups for youth. Interventions for special populations of ST users (such as Native Americans and athletes) have been developed and evaluated and are available for implementation. Cultural adaptations are needed to provide interventions that are appropriate for both the context of ST use and the ST products being used in different regions, especially when translating a program to a region such as India, where a variety of different oral tobacco products are used.

In environments where resources are limited or clinics are inaccessible for ST users needing or wanting treatment (because of distance or lack of transportation) there may be ways to facilitate cessation, such as mailed self-help materials with follow-up telephone contact. Web-based programs may also be an effective alternative in countries that have widespread access to the Internet. Most evaluation studies to date have been carried out in the United States. Additional evaluation of self-help cessation programs is needed in other countries.

Evidence indicates that the detrimental health effects of ST use are not well known in low- and middle-income countries. Educating the populations in low- and middle-income countries about the harmful effects of ST through media and health care systems is essential.

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Chapter 8

Smokeless Tobacco Regulation and Policy

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Figure 8-1 Camel Snus advertisement 256

The Role of Regulation and Policy

Regulatory and policy actions on the part of governments and international organizations are vital to addressing the global tobacco epidemic and protecting human health. One of the principal requirements of the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) is to "adopt and implement effective legislative, executive, administrative, and/or other measures…at the appropriate governmental level to protect all persons from exposure to tobacco smoke."[1] Furthermore, according to the WHO FCTC, "the consumption of smokeless tobacco is a global concern and not limited to a few countries. During the negotiations leading to the WHO FCTC, Parties agreed to address concerns relating to all forms of tobacco, not only the smoking forms."[2,p.4] The need for regulation guided by effective policy can be seen in the measures the FCTC calls for: taxation and pricing, regulation of tobacco product contents, product packaging and labeling requirements, restricting marketing and advertising, as well as prohibiting sales to minors, preventing illicit trade, and others.

The key to successful use of regulatory tools is that they be grounded in scientific evidence. In recognition of this basic principle, the FCTC calls on the Parties to the Convention to develop and promote research in the field of tobacco control.[3] Through evidence-based regulation, governments can reduce their populations' exposure to harmful toxicants in smokeless tobacco (ST) products. Youth initiation of ST use can also be reduced through restrictions on advertising, marketing, and promotion, and through aggressive enforcement of restrictions on youth access to tobacco products.

The Global Community and Smokeless Tobacco Regulation

The global public health community has long focused primarily on cigarette smoking. Smokeless tobacco use has received less attention because it imposes a comparatively smaller burden on human health, and because it has been seen as confined to a few South Asian countries, Sweden, and the United States, and therefore not of worldwide concern. However, the reality is that ST use is not simply a local or regional problem but a major challenge facing a large percentage of the world's population. In addition, several factors suggest that the public health impact of ST use is likely to intensify. First, major cigarette companies have moved into the ST market by purchasing ST manufacturing companies, and have expanded their operations (see chapters 2 and 6). Second, the tobacco industry is promoting ST use as a short-term substitute for smoking in countries that have made good progress in ensuring smoke-free environments (Figure 8-1).[4] Third, ST use has been promoted by some as a cessation aid and a harm-reduction tool for cigarette smokers, although there is insufficient evidence for the effectiveness of ST as a cessation aid.[5]

Figure 8-1. Camel Snus advertisement

Note: This advertisement appeared after New York City amended its smoke-free law in 2003 to include all restaurants and bars. Caption says, "Smokers, switch to smoke-free Camel Snus and reclaim the world's greatest city. No matter where you go, or what you do, Camel Snus is the perfect tobacco pleasure to enjoy virtually anywhere. Camel Snus—the pleasure's all yours."

Key Provisions of the FCTC

The WHO FCTC was negotiated between 1999 and 2003 and came into force in 2005. During the negotiations, some WHO member states opposed including ST in the Framework Convention. It was argued that the body of evidence was insufficient for a concerted global action against ST, and that ST use was at most a regional concern in Asia that should be addressed by a regional policy. However, the majority view on the harms associated with ST use prevailed, and ST was incorporated into the FCTC.

Although the FCTC covers all tobacco products, many of the strategies developed under the Convention to date are focused on cigarettes only. However, in recognition of the emerging global threat from ST, the fourth session of the Conference of the Parties discussed the issue and requested a comprehensive report on the Parties' experience with smokeless tobacco.[6] The fifth session of the Conference of the Parties further discussed efforts to control smokeless tobacco and electronic cigarettes, and the Parties

will continue to review evidence on ST and the prevention and control of e-cigarette use, and report on this review during the sixth session of the Conference of the Parties,[7] which convenes as this report goes to press.

The following paragraphs describe measures called for by the FCTC (warning labels, toxicant testing, and illicit trade) as they relate to ST, and how these measures have been implemented by the Parties.

Warning Labels on Product Packaging

Parties to the treaty often apply WHO FCTC requirements differently to smokeless forms of tobacco as compared with cigarettes. For example, Article 11 sets standards for warning messages to be displayed on tobacco product packaging,[8] but many Parties have lower standards for ST packaging than for cigarette packages. Most European Union (EU) countries, the Russian Federation, and other countries allow health warnings to cover a smaller proportion of the principal display area of ST packages than of cigarette packages. Some countries (e.g., Thailand, Bangladesh, Venezuela, and Pakistan) have mandated that health warnings appear at the top of the principal display area for cigarettes but not for ST. In addition, many countries (e.g., the United Kingdom, Turkey, Sweden, and Vietnam) mandate alternating health warnings for cigarettes but not for ST products. Similarly, countries such as Australia, Canada, Malaysia, Switzerland, Jordan, and Djibouti require graphic/pictorial warnings for cigarettes but not for ST products.

The issue of package warnings also illustrates how evidence regarding ST use provided to governments and decisionmakers can lead to policy change. Data from the 2009–2010 Global Adult Tobacco Survey (GATS) for India showed an alarming increase in the prevalence of ST use in India. This evidence aroused great concern in the Indian government, which then formulated a requirement for pictorial health warnings for ST products.[9] (This requirement went into effect in December 2011.) The more current data on the prevalence of ST use that has been furnished by the GATS and other national surveys attracts greater policy attention to smokeless tobacco.

Toxicant Testing

Articles 9 and 10 of the FCTC stipulate the testing and measurement of contents and emissions of tobacco products. The numerous different ST products contain widely varying levels of toxicants and include some products with very high amounts of toxic substances. In view of this variability, the WHO Study Group for Tobacco Product Regulation (TobReg) has recommended mandating upper limits for toxicants in ST products.[10,11] The TobReg Study Group produced a review, published in two technical reports, of the available global data on toxicant levels in ST products, with emphasis on two carcinogens, tobacco-specific nitrosamines (TSNAs) and benzo(*a*)pyrene (BaP). The Study Group recommended setting an upper limit for both *N'*-nitrosonornicotine (NNN) and 4(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) at 2 micrograms per gram of dry weight tobacco, and an upper limit for BaP at 5 nanograms per gram of dry weight tobacco. These recommendations were based upon extensive review of the evidence on methods to reduce these carcinogens and the feasible limits to which they can be reduced in available products. Although not formally adopted by the Conference of the Parties, the Study Group's recommendations can serve as a basis for future regulations or can be adopted by countries where ST use is highly prevalent and constitutes a major public health problem.[12]

Importantly, TobReg emphasized that "regulators must assume responsibility to ensure that consumers are not told directly or indirectly or led to believe that ST products that meet the carcinogen limits established pursuant to this proposal are less hazardous than similar products, have been approved by the government or meet government-established health or safety standards."[11,p.34–35]

The WHO established the Tobacco Laboratory Network (TobLabNet), an international collaborative network of testing laboratories, to validate testing methods for selected ingredients in tobacco products and emissions in smoked tobacco products. The experience gained in testing smoked products is clearly important in informing future regulatory efforts aimed at ST and other tobacco products.[13] As of September 2014, TobLabNet has successfully completed the validation of testing for nicotine and humectants in cigarettes, and BaP, TSNAs, and carbon monoxide in mainstream cigarette smoke. Validation of ammonia in cigarette tobacco filler, and volatile organic compounds (VOCs) and aldehydes in mainstream cigarette smoke is currently under way.

Illicit Trade

To further develop the provisions of Article 15 of World Health Assembly Resolution 56.1 on preventing illicit trade, the second WHO FCTC Conference of the Parties established the Intergovernmental Negotiating Body (INB) on a Protocol to Eliminate Illicit Trade in Tobacco Products, which met five times between 2008 and 2012. Despite an INB consensus that strong supply chain measures are critical to eliminating illicit trade in tobacco products, some Parties cited domestic or regional/legal constraints and opposed stringent measures, such as unique identification markings and tracking and tracing (T&T) of ST products.[14] After extensive negotiation, the Parties agreed to put a T&T mechanism in place for cigarettes within 5 years of the Protocol's entry into force and within 10 years for all other tobacco products.[14]

The decision to delay T&T for ST highlights the need to expand the ST evidence base not only for health and economic implications, but also for trade and financial transactions. In some regions not much is known about the nature and volume of ST trade transactions within countries and across borders. Sharing trade information as well as trend analysis data on illicit trade detected by governmental enforcement authorities would do much to reduce this lack of information. It is equally important to engage with other relevant intergovernmental organizations, such as the World Customs Organization and World Trade Organization, and intelligence organizations such as the European Commission Anti-Fraud Office and others.

During the fifth session of the Conference of the Parties, the Protocol to Eliminate Illicit Trade in Tobacco Products, the first of its kind for the Convention, was developed. The Protocol states that the Parties "shall adopt and implement effective measures to control or regulate the supply chain covered by this Protocol in order to prevent, deter, detect, investigate and prosecute illicit trade."[15,p.7] The Protocol also calls for control of tobacco licensure for tobacco retailing, manufacture, and growth; for Parties to track and trace tobacco manufacture, sale, and shipments; and for ensuring legislative action on unlawful or illicit activities.

Description and Analysis of Key Tobacco Control Policy Interventions

Changing trends in the use of ST products make it even more important for countries to develop comprehensive tobacco control programs that address the use of smokeless tobacco. Intervention strategies must fit the context of the local society, its tobacco use rates, and trends in consumption of tobacco products including smokeless tobacco. Interventions may include: health warnings on product packaging; comprehensive bans on advertising, promotions, and sponsorships as well as bans on ST product sales, trade, and use; restrictions on sale to minors; training and capacity building; tax and pricing policies that discourage ST use; and information, education, and communication strategies and campaigns to increase awareness of the harmful health effects of ST use. Social, cultural, and economic factors are central to how individuals perceive the health risks of smokeless tobacco. This section highlights several measures that have successfully addressed these considerations.

Education and Awareness Efforts

The effectiveness of health warnings and comprehensive bans on cigarette advertising, promotions, and sponsorships[16–18] strongly suggests these steps will be successful in curbing the demand for smokeless tobacco. Given the lack of awareness of the hazards of ST, some countries have launched mass media and other awareness-building campaigns. A long-term investment by governments in sustained mass media campaigns will bring a high degree of awareness and create change in social norms.

An example of this kind of effort was the "Mukesh campaign" conducted by the Ministry of Health in India in 2009–2010, acting in concert with Tata Memorial Hospital in Mumbai and the World Lung Foundation (WLF). The campaign consisted of media spots that followed a 24-year-old male ST user, Mukesh Harane, from his diagnosis with throat cancer caused by ST use, through his treatment and eventual death. An evaluation by the WLF in 2010 showed that viewers had a high degree of recall of the media spots, as well as a significantly enhanced appreciation for the devastating effects of smokeless tobacco use.[19,20] Another positive result of the campaign was that an advertisement that included pictures of the damage oral cancer wreaks on the human body was aired nationwide in 12 vernacular languages. At that time, the country did not have pictorial warnings on ST labels. This campaign served as a useful tool to communicate the harmful effects of smokeless tobacco to a large audience.

The availability of accurate data has been instrumental in initiating policy change. For example, the 2009 Bangladesh GATS report indicated a very high level of ST use among women in rural Bangladesh.[21] This finding prompted the government to request the WHO Tobacco Free Initiative (TFI) to provide technical assistance on developing a strategy for tackling the problem. Likewise, following India's release of its 2009–2010 GATS report,[9] the government of India increased funding for media campaigns against ST use in 2010–2012 and announced a stronger set of health warnings.[22] Smokeless tobacco cessation has been included in the Indian government's national guidelines on tobacco dependence treatment as well as in training modules for doctors and health workers.

In some cultures, ST is mistakenly believed to have beneficial effects—for example, that oral tobacco cures toothache (India) or that ST cures morning sickness during pregnancy (Bangladesh). The high prevalence of ST use among women in South-East Asian countries is associated with low levels of awareness regarding its harmful effects, which include addiction, especially when such products are

promoted as a dentifrice. Use of ST to clean the teeth is common in some countries, especially among women, and it is important not only to raise public awareness, but also to target and educate women, schoolteachers, dentists, health workers, and others on the risks associated with use of ST products.

Excise Taxes and Pricing Policies

Because ST products are cheaper and easier to access than cigarettes in some countries, with high social acceptance rather than stigma attached to their consumption, the young and the poor may predominantly consume ST instead of smoked tobacco. Given the price sensitivity of these groups, raising prices by raising excise and other taxes on ST is, therefore, one of the most effective measures to reduce demand. However, any efforts to levy taxes must also be fully supported by well-managed tax administration and compliance systems.

Administering taxation on ST products is especially challenging because of the high likelihood of illicit trade and tax evasion with these products. Smokeless tobacco products are easy to manufacture with small machines in limited spaces, and it is easy to trade these products illegally and avoid paying taxes on them. In addition, because products in some countries are made in traditional markets and by individuals for their own use, it is difficult to determine how taxation systems would be implemented and enforced in these countries. To better regulate ST products, securing the supply chain is essential in order to guarantee taxes are paid. For example, in response to rampant tax evasion, the Indian government changed the excise tax collection on gutka and other ST to a system of presumptive tax (compounded levy per manufacturing machine). The resulting fourfold increase in excise collection since 2009 indicates ST's tax potential if proper taxation systems are put in place.

Bans on Smokeless Tobacco

The sale of several types of oral tobacco is banned in all EU countries except Sweden.[23] Smokeless tobacco has also been banned at various levels in New Zealand, Australia, Turkey, Israel, Taiwan, Thailand, Singapore, Hong Kong, and the United Arab Emirates (UAE).[24] Specifically, the UAE bans the importation of ST, and Israel, Taiwan, Thailand, Singapore, and Hong Kong ban the manufacture, sale, and import of ST products. Turkey, Australia, and New Zealand limit ST sales and supply. By law, the government of Bhutan has banned the cultivation, sale, and purchase of all tobacco products, including ST, making it the first country to introduce such a comprehensive ban.

In India, a national-level group of experts convened by the Ministry of Health in April 2011 strongly recommended that the government ban the sale of gutka and all other smokeless forms of tobacco nationwide, based on India's current laws. Many Indian states, territories, and subregions have subsequently banned the sale, manufacture, distribution, and storage of these products.

A ban on ST tobacco products, however, is difficult to implement if it is the sole tobacco control measure in place in a given country. If a ban is accompanied by a comprehensive tobacco control program that includes tobacco dependence treatment and education on the danger of using ST, it may further enable existing users to quit. Setting up a comprehensive program requires strong will among decisionmakers and a consensus among the majority of the population, as well as an environment amenable to legislation and the administrative capacity to fully implement the ban.

Not only is it difficult to implement ST bans in isolation from a comprehensive program of tobacco control measures within a country, it may be also difficult to enforce a ban on ST in only one country, given the trend toward elimination of non-tariff barriers to trade between countries. In the case of Bhutan, illicit trade and smuggling of tobacco products from neighboring countries reportedly have increased, thereby keeping up the supplies of tobacco products, including ST products, which Bhutan has banned. The example of Bhutan clearly exemplifies the difficulties in enforcing bans and illustrates the need to take cross-border issues and international policies into consideration before implementing these types of measures.

A further concern related to banning ST, particularly in countries with substantial ST use, is whether or not such a ban would result in ST users switching to cigarettes or initiating cigarette smoking, which would result in higher tobacco-related mortality and morbidity.

Regulatory Experience of Countries and WHO Regions

The South-East Asia and Western Pacific Regions

Some Asian countries have begun regulating and banning ST products to keep pace with industry developments and to take steps to preempt the entry and spread of products in local markets. For example, under the Tobacco (Control of Advertisements and Sale) Act, Singapore has banned chewing tobacco since 1993.[25] In July 2010, an amendment was passed that expanded the scope of this act. Novel and emerging forms of tobacco products, such as tobacco derivatives (dissolvable tobacco) and nicotine-based products, are now subject to the same regulatory control as existing ST products, and the Minister for Health is empowered to ban a wider array of products, including more types of smokeless tobacco. Singapore has a lab for testing contents and emissions of cigarettes and measuring nicotine content in ST products such as chewable tobacco, betel quid, and khaini. However, other Asian economies including the countries where the ST burden is extremely high—India, Bangladesh, and Myanmar—generally lack laboratory capacity to test ST products.[25]

The European Region

Regulations governing the use of ST vary widely within Europe. In EU member countries, ST is regulated under EU Tobacco Products Directive 2001/37/EC, which prohibits the sale of tobacco for oral use. The EU Directive defines "tobacco for oral use" as "all products for oral use, except those intended to be smoked or chewed, made wholly or partly of tobacco…particularly those presented in sachet portions or porous sachets, or in a form resembling a food product" (Directive 2001/37/EC, Article 2: Definitions[23]).

As a result of negotiations at the time Sweden entered the EU, Sweden was exempted from this regulation, and the manufacturing, sale, and marketing of snus are legal within its borders. This form of tobacco is traditional in Sweden and represents a major proportion of the tobacco consumed in that country.[26]

In many Eastern European countries, ST use is rare.[27] In many of these countries, ST is subjected to regulations regarding advertising and health warnings similar to those of smoked tobacco products. Because of the high prevalence of use of smoked tobacco products in the region, many Eastern

European countries have undertaken aggressive tobacco control measures. The Russian Federation has set a timetable to put into effect all FCTC articles by 2015. Such measures will also restrict the use of smokeless tobacco. Moreover, several Eastern European countries have joined the EU (or are in the process of joining) and consequently must observe the existing EU directive regarding ST use.

The Americas Region

United States

The Family Smoking Prevention and Tobacco Control Act, enacted in 2009, set in motion a new regulatory regime for tobacco products in the United States. This law enables the U.S. Food and Drug Administration (FDA) to regulate the manufacture, sale, and distribution of tobacco products, including ST products. Provisions of the law include manufacturer registration and product listing requirements, warning labels, and enforcement of a minimum-age-of-sale restriction. The FDA has authority to set tobacco product standards including, for example, imposing limits on the amounts of nicotine, toxicants, and/or additives that will be permitted in ST products.[28] The FDA is also examining the public health impact of novel smokeless/dissolvable tobacco products.

Canada

Generally, the prohibitions and requirements for tobacco products defined in Canada's Federal Tobacco Act apply to ST products, including the prohibition of selling tobacco to youth, restrictions on promotion, and requirements for reporting by manufacturers.

The labeling regulations, known as the 2000 Tobacco Products Information Regulations, also apply, but only to chewing tobacco, nasal snuff, and oral snuff. For these classes of products, the regulations require text-based health warnings that occupy at least 50% of the principal display surfaces.[29] In 2011, the Canadian House of Commons passed requirements, applicable only to cigarettes and little cigars, that limit the addition of flavorings, restrict the use of color packages (to make them less appealing to children), call for graphic health warnings on packages, and mandate that minimum quantities be purchased rather than single items (e.g., cigarettes must be sold in packs with a quantity of 20; sales of "loose" cigarettes are prohibited).[30–32] Smokeless tobacco products, however, will continue to be regulated under the 2000 regulations.

Brazil

Although at the forefront of tobacco product regulation, Brazil mainly targeted cigarettes for many years. Despite the low consumption of smokeless products in Brazil,[33] regulatory authorities have detected a slight increase in the use of other tobacco products, including ST products, since the passage of a 2007 law, Regime Diferenciado de Contratações Públicas (better known as "RDC") 090/07.[34] Tobacco companies or importers must submit information about tobacco product contents and emissions, packaging, and design features.[34] Brazil requires that ST products be registered with the Brazilian health surveillance agency, ANVISA (Agência Nacional de Vigilância Sanitária), in order to be sold within the country, but as of 2012 no ST products are registered, which means that they cannot be legally sold (and thus are effectively banned); labels on illegally marketed products do not display health warnings. In 2010, a regulatory task force conducting surveillance in the small municipality of

Maringa in southern Brazil seized the unique ST product rapé, which often contains agents such as tonka bean that have very high levels of coumarin, a liver toxicant (personal communication, Andre Oliveira). Tonka bean and coumarin are both banned in food for human consumption in the United States.[28]

The Eastern Mediterranean Region

Well-structured interventions and regulatory policies regarding ST product use are for the most part absent in the Eastern Mediterranean region. Only Bahrain and the UAE have introduced policies banning ST and ST sales. In 2009 the government of Bahrain introduced strong antismoking regulations and a law that prohibits the importation of ST products.[35] In 2008, Ajman Municipality in the UAE banned the sale, import, storage, and possession of ST and imposes heavy fines on violators.[36]

The African Region

Despite increasing prevalence of ST use, the countries of Sub-Saharan Africa have limited ST regulations and programs. Since ST is primarily produced by cottage industry in this region, distribution and marketing of these products often takes place on a local rather than national or international scale. Collating relevant data and information about importation and use of ST in African countries is important to helping these countries develop their capacity to regulate ST products.

Challenges and Recommendations for Regulation and Policy

Smokeless Tobacco Product Heterogeneity and Novelty

One of the challenges to creating and implementing any regulatory framework is the heterogeneity of ST products from country to country and within countries. Added ingredients and levels of nicotine and other toxic constituents vary widely among the various types of ST products, and forms of ST that are produced using non-standardized methods often pose the greatest risk to health because of the levels of toxicants they contain.

The wide variety of products and methods of manufacturing and distribution within a country make it more difficult for the country to set up regulatory means of dealing with them, and a wide variety of products across countries makes international cooperation on tobacco control more difficult. These difficulties are encountered especially in countries where products are manufactured and distributed in informal, cottage-industry-like settings that are less amenable to a conventional regulatory system of product registration, inspection, and enforcement.

The situation is further complicated by the fact that the novel forms of ST products introduced into some markets over the past decade—such as dissolvable tobacco sticks, strips, and lozenges—are unlike most of the oral ST products that preceded them. These products also pose new questions about use, especially because in some countries they are explicitly marketed to be used along with cigarettes. This dual use of ST with smoked tobacco, or any other form of tobacco, presents a further risk to the health of individuals and populations.

Understanding the toxicity and addictiveness profiles of the diverse and novel ST products requires thorough scientific evaluation. The research community could increase its efforts to provide data on

these products, their contents and toxicant levels, in order to help governments in countries and regions create effective systems for regulation. Dual use of smoked and smokeless products must be evaluated for its potential impact on quitting intentions, quitting behavior, and initiation of use; dual use of ST products and other tobacco products must also be addressed in developing cessation strategies and programs for smokeless tobacco.

Testing Challenges

Laboratory testing of tobacco products is a major challenge in regulating tobacco products. Although validated methods have been identified for measuring some constituents, most countries have not yet adopted specific product standards or testing regimens, and further development is needed in this area. Additionally, countries differ in their capacity to test tobacco products. Countries with limited budgets face significant challenges in acquiring costly equipment and in securing resources for technical training of staff.

The global tobacco testing network coordinated by the WHO Tobacco Free Initiative (TFI), TobLabNet, is validating standard operating procedures for testing the contents and emissions of tobacco products. Though time-consuming and costly, this effort is essential to global regulatory efforts. Although progress has been made in building capacity in a few selected laboratories in developing countries, regional and reference laboratories are still being relied on to assist in the technical training of staff in individual country laboratories. Regional efforts to consolidate tobacco product testing are ongoing and are exemplified by the European Network of Government Laboratories for Tobacco and Tobacco Products, and by the work of Brazil's ANVISA to coordinate testing activities and procedures in Latin America. The WHO TFI, the Centers for Disease Control and Prevention, the Netherlands National Institute for Public Health and the Environment, and other laboratories have been providing training and technical assistance to laboratories in low- and lower middle-income countries.

Further research is needed on the development of additional standardized testing methods that can be used to set limits on the allowable levels of toxicants in ST products.

Coordinated testing by region is valuable because of the unique characteristics of ST products in South-East Asian, North African, and Gulf countries. Although there are recognized inter-country differences in these products, coordinated testing can be useful for countries that have limited funding for independent testing. TobLabNet continues to explore the feasibility of scaling up lab capacities in low- and middle- income countries. A centralized website could serve as a source of validated information on tobacco product contents and emissions. It is also important that global partners help countries develop the capacity to identify counterfeit ST tobacco products in addition to counterfeit cigarettes.

The Evidence Base and Information Gaps

Effective policies to tackle the challenges posed by ST require quantification of the risks associated with ST use, including the burden on health, the economy, and the environment, and the social costs of increasing ST use by young people. There has been very little study or documentation of the adverse health care costs and the economic costs of ST use.[37] The WHO, government agencies, and academic

institutions have important roles to play in generating data and developing a body of evidence about the individual and societal risks of ST use.

A clearer picture of these risks could be achieved by disaggregating ST-related data from existing Global Tobacco Surveillance System studies such as the Global Youth Tobacco Survey (GYTS) and GATS, as well as from the WHO STEPwise Approach to Surveillance (WHO STEPS) and other national surveys. Valuable information could be obtained from investigations by academic and research institutions on the local factors responsible for high rates of ST use in some communities, as well as many other aspects of smokeless tobacco.

Current information-gathering tools should be adapted to collect more information on smokeless tobacco. Some deficits of information about ST reflect a lack of attention paid to ST by these instruments. For example, the *WHO Report on the Global Tobacco Epidemic, 2011* (GTCR) provides a qualitative assessment of progress made by countries in implementing the MPOWER package, which is a list of demand-reduction measures formulated by the WHO as guidance for countries implementing the FCTC's tobacco control guidelines.[18] The GTCR covers smokeless as well as smoked tobacco products, but the report does not contain ST-specific information regarding relative progress on interventions such as package warnings and labeling, taxation, or enforcement of bans on advertising, promotion, and sponsorship.[18] Similarly, the reporting instrument of the Conference of the Parties captures the progress made by Parties to the FCTC, but it does not include questions specifically on smokeless tobacco. Volunteering specific information on ST is left to the discretion of the individual Parties.

Information Dissemination

Smokeless tobacco products have a high degree of social acceptance in many countries, and their low cost and widespread availability make them easily accessible, especially for vulnerable groups such as youth and women. Much of the world's population is unaware of the dangers of using these products, and marketing efforts by the tobacco industry further distort the dangers. Even in high-income countries where information about the harms of tobacco use is more widely available, the tobacco industry has been marketing ST products as a safer substitute for cigarettes among adult smokers and adolescent initiators, particularly for use in situations where smoking is not allowed or where the smoker wants to use tobacco discreetly.[38]

Increasing public awareness of the risks and consequences of using ST products is critical to safeguarding public health. Depending on the country or region, this can mean combating long-held local customs as well as industry marketing efforts by delivering accurate information to dispel myths about ST use and explain the hazards of dual use of ST and cigarettes. Adolescent, school health, and maternal–child health programs are valuable means of educating the public about ST use.

It is essential that information and evidence about smokeless tobacco use be disseminated among policymakers, researchers, and other professionals in order to establish programs to combat ST use and ameliorate its effects. Nongovernmental organizations (NGOs) could play an important role in generating international awareness of the hazards of ST use through all relevant forums, such as the

WHO FCTC, the World Conference on Tobacco or Health, and other international conferences. NGOs could also share best practices for advocacy efforts and for building local, NGO, and country-level capacity. As part of the global tobacco control effort, the Conference of the Parties to the WHO FCTC should consider extending its efforts to coordinate the dissemination of product information on ST products. It is critical that these organizations and institutions continue to provide policymakers with the evidence necessary for ST control, surveillance, training of health professionals, and capacity building for cessation initiatives for smokeless tobacco.

Smokeless Tobacco Product Regulation

In addition to granting higher priority to the control of ST use, the global community can advance evidence-based ST regulation and policy in a number of ways.

- *Providing technical assistance.* Given the limited knowledge and expertise in the area of ST, it is important for global partners to develop their ability to deliver technical assistance in building the capacity to regulate ST in each country. The partners could assist governments by providing information on global best practices and by developing the ability to monitor and regulate the ST industry by carrying out all the key provisions of the Protocol to Eliminate Illicit Trade, including, for example, mandating secure supply chain controls. This international cooperation is especially important to protecting young people and assisting countries that have inadequate resources.
- *Developing and disseminating testing protocols and product standards.* Companies and organizations with advanced laboratory capacity can assist in developing product testing capacity where it is needed. They can also assist in disseminating basic product manufacture and handling standards—for example, by indicating the manufacturing date on packages and controlling temperature conditions until sale to prevent further increases in carcinogens during storage. Additionally, WHO's TobLabNet and TobReg have developed common testing protocols and recommended specific limits for some known constituents.
- *Revising existing tobacco control programs to better address smokeless tobacco.* A comprehensive tobacco control program that deals with ST and smoking on an equal footing is critical for the effective regulation of smokeless tobacco. Such a program would include legislative and administrative measures that address issues such as advertising, cross-country trade, Internet purchases, tax evasion by industry, and low levels of taxation on ST products. In regard to taxation, the global community should focus on building the capacity to administer taxes on all tobacco products, including ST products, especially in low- and lower middle-income countries. High-income countries with more mature tobacco control programs may want to review their policies in light of the latest evidence on ST use. Countries that have been successful in controlling the tobacco epidemic and are experiencing a decline in smoking prevalence should examine whether ST use is replacing smoking in a manner that is causing net harm at the population level.

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Chapter 9

Smokeless Tobacco Use in the Region of the Americas

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Description of the Region

According to the United Nations' *World Population Prospects,* the World Health Organization (WHO) Region of the Americas includes 35 countries (Table 9-1), accounting for a land area of around 41 million square kilometers, from the northern reaches of the Canadian Arctic to the southern parts of Argentina and Chile just above Antarctica.[1]

Table 9-1. Population and land area of countries in the Americas Region

Country*	Area (km^2)	Population (thousands)
Antigua and Barbuda†	440	90
Argentina	2,694,133	40,412
Bahamas	13,720	343
Barbados	429	273
Belize	22,286	312
Bolivia (Plurinational State of)	1,103,333	9,930
Brazil	8,475,913	194,946
Canada	11,339,000	34,017
Chile	744,087	17,114
Colombia	1,129,146	46,295
Costa Rica	51,198	4,659
Cuba	110,373	11,258
Dominica†	750	68
Dominican Republic	48,424	9,927
Ecuador	283,627	14,465
El Salvador	21,065	6,193
Grenada	342	104
Guatemala	109,008	14,389
Guyana	188,500	754
Haiti	27,758	9,993
Honduras	111,779	7,601
Jamaica	11,008	2,741
Mexico	1,955,569	113,423
Nicaragua	128,622	5,788
Panama	74,830	3,517
Paraguay	403,438	6,455
Peru	1,264,217	29,077
Saint Kitts and Nevis†	260	53

Country*	Area (km²)	Population (thousands)
Saint Lucia	539	174
Saint Vincent and the Grenadines	387	109
Suriname	175,000	525
Trinidad and Tobago	5,138	1,341
United States of America	9,699,500	310,384
Uruguay	177,316	3,369
Venezuela (Bolivarian Republic of)	905,625	28,980
Total	**41,276,760**	**929,079**

*Unless otherwise indicated, data are from United Nations 2011 (1).
†World Bank, 2010–2011 (93).
Abbreviation: km = kilometer.

The Region of the Americas holds a special place in the history of tobacco use because the tobacco plant is thought to have originated in this region. Cultivation of tobacco in the Americas dates back at least 5,000 years, and Native Americans were probably the first people to smoke, chew, and inhale tobacco.

This chapter presents an overview of smokeless tobacco (ST) use in countries in the Region of the Americas for which data are available. It discusses prevalence of use and the various forms of ST used, their toxicity and nicotine profiles, and their adverse health effects. Prevalence is usually reported in terms of current use, which can be defined in various ways. For example, some surveys define current use as any use within the past 30 days, while other surveys ask about different time periods; some surveys collect data on daily use and use on some days, and still other surveys ask about "current" use without defining the term further.

Prevalence of Smokeless Tobacco Use

Data on ST use prevalence are available for only a limited number of countries in the region. For data on young people, the Global Youth Tobacco Survey (GYTS) collected data on ST use in 14 countries in the region during the period 2007–2010, although the samples in Brazil and Mexico were for specific localities in those two countries and were not nationally representative. For Canada, data on tobacco use by youth (grades 6–9) are from the Youth Smoking Survey (YSS)[2]; for the United States, data on tobacco use by youth (grades 6–8) are from the National Youth Tobacco Survey (NYTS).[3] These data are summarized in Table 9-2. Because there are some differences in survey methods and questions (e.g., the inclusion criteria, question wording), comparisons of the estimates among the surveys should be made with caution. Overall national youth prevalence of current ST use ranged from 1.8% in Canada to 9.8% in Barbados. Smokeless tobacco use was more prevalent among boys than among girls in nearly all countries and localities. The prevalence of ST use among boys ranged from 2.6% in Canada to 11.5% in Barbados, and ST use among girls ranged from 0.8% (Canada) to 8.5% (Jamaica).

Table 9-2. Percentage of adolescents aged 13–15 years who currently used smokeless tobacco in the Americas Region, from the Global Youth Tobacco Surveys, 2007–2010

Country*	Year	Total (%)	Boys (%)	Girls (%)
Argentina	2007	4.3	5.5	3.2
Bahamas	2009	6.6	7.5	5.5
Barbados	2007	9.8	11.5	8.2
Brazil – Campo Grande	2009	8.2	9.1	7.5
Brazil – Vitória	2009	3.6	5.0	2.4
Brazil – São Paolo	2009	5.5	6.3	4.6
Canada†	2009	1.8	2.6	0.8
Dominica	2009	8.4	10.2	6.4
El Salvador	2009	3.7	4.5	2.8
Grenada	2009	8.4	10.1	6.9
Guyana	2010	7.5	7.9	6.6
Jamaica	2010	8.5	8.5	8.5
Mexico – Pachuca	2008	5.3	6.6	4.1
Mexico – Tlaxcala	2008	5.3	7.9	3.0
Mexico – Saltillo	2008	4.5	4.9	3.9
Mexico – Campeche	2008	6.3	5.1	7.2
Mexico – Villahermosa	2008	5.0	5.8	4.4
Mexico – Aguascalientes	2008	2.8	3.3	2.2
Mexico – Colima	2008	8.4	8.7	8.0
Mexico – Morelia	2008	4.4	5.6	3.3
Mexico – Queretaro	2008	4.1	4.6	3.5
Mexico – La Paz	2008	7.3	7.7	5.3
Mexico – San Luis Potosi	2008	4.1	5.3	3.1
Panama	2008	3.5	3.8	3.2
Peru	2007	4.7	4.3	4.8
Trinidad and Tobago	2007	5.5	5.4	5.5
United States of America‡	2009	2.6	4.1	1.2
Venezuela	2010	5.1	6.9	2.6

*Unless otherwise indicated, data are from the 2007–2010 Global Youth Tobacco Survey (35).
†Health Canada 2010 (2).
‡National Youth Tobacco Survey, Grades 6–8 (3).

For adults, basic ST prevalence data were available for nine countries in the region (Table 9-3; Map 9-1). Rates among men appear to be higher than among women, with the largest percentage among men reported in the United States (7.1%), and the highest rate among women, in Haiti (2.5%). (Statistical tests were not conducted.)

In general, detailed information on ST use is sparse or nonexistent for most countries in the Region of the Americas. This section describes trends for several countries where more detailed information exists.

Table 9-3. Percentage of adults who currently used smokeless tobacco in the Americas Region, 2005–2012

Country	Year	Age group (years)	Total (%)	Men (%)	Women (%)
Barbados*	2007	25+	0.3	0.0	0.6
Brazil†	2008	15+	0.4	0.6	0.3
Canada‡	2010	15+	1.0	1.0	—
Dominican Republic§	2007	Men, 15–59; Women, 15–49	—	1.9	0.3
Haiti§	2005–2006	Men, 15–59; Women, 15–49	—	—	2.5
Mexico†	2009	15+	0.3	0.3	0.3
Saint Kitts and Nevis (subnational)*	2007	25–64	0.1	0.3	0.1
United States¶	2012	18+	3.6	7.1	0.4
Uruguay†	2009	15+	0.0	0.0	0.0

**WHO Report on the Global Tobacco Epidemic, 2011* (94).
†Global Adult Tobacco Survey, 2008–2010 (34).
‡Canadian Tobacco Use Monitoring Survey, 2010 (95).
§Demographic and Health Survey, 2007 (96).
¶National Survey on Drug Use and Health, United States, 2012 (7).

Map 9-1. Prevalence of smokeless tobacco use among adults in the World Health Organization's Region of the Americas

Sources: WHO Report on the Global Tobacco Epidemic, 2011 (94); Global Adult Tobacco Survey, 2008–2010 (34); Canadian Tobacco Use Monitoring Survey (95); Demographic and Health Surveys (96); National Survey on Drug Use and Health (7).

United States

By total volume, the United States is among the world's largest producers and consumers of commercially manufactured ST products, and the vast majority of ST products consumed in the country are commercially manufactured. In 2008, 119.92 million pounds of ST (1.3 billion units) were sold in the United States, and another 31.7 million units were given away to wholesalers.[4] However, a diversity of products are being used and prevalence varies widely by region, ethnicity, and other population characteristics. Most of the ST products used in the United States are broadly categorized as snuff or chewing tobacco. Moist snuff, the dominant product category, accounted for 68% of ST sales in 2007.[5] Three companies account for nearly 90% of the retail market: U.S. Smokeless Tobacco Company (UST; a subsidiary of Altria), American Snuff Company (a subsidiary of Reynolds American, formerly Conwood Sales Company), and Swedish Match North America.[6] Small retailers such as convenience stores and small groceries represented 72% of the ST sales volume in 2010.[6]

General Population

Most U.S. surveillance systems used to monitor the prevalence of tobacco use do not report separate data for snuff and chewing tobacco, but report the prevalence of ST use in aggregate.

Smokeless tobacco use is a predominantly male behavior in the United States, although use among females is relatively common in selected regions and populations. In 2012, 7.1% of U.S. men and 0.4% of U.S. women ages 18 years or older had used ST in the past month. Current use was more common among men ages 18–25 years (10.5%) than among males ages 12–17 years (3.7%) or 26 years old or older (6.5%).[7] According to the 2009 Behavioral Risk Factor Surveillance System, the prevalence of current ST use by men varied widely among U.S. states, from a high of 17.1% in West Virginia to a low of 2.0% in the District of Columbia.[8]

Smokeless tobacco use by high school students had been declining for more than a decade when prevalence rates began to climb rapidly in about 2003 (Figure 9-1). The Youth Risk Behavior Survey found a 35% increase in the prevalence of current use by males in 12th grade between 2003 and 2009,[9,10] a pattern that was confirmed by the Monitoring the Future Survey.[11]

One emerging trend is a growing prevalence of dual use of cigarettes and ST, particularly among boys and young men. For example, about 60% of male high school students who use ST are also current smokers.[12] Most adult dual users are 18–34 years old, report using ST largely in places where they cannot smoke, and do not believe ST will help them quit smoking.[13] Nearly half of U.S. dual users have no plans to quit using tobacco.[13]

Figure 9-1. Trends in the prevalence of current smokeless tobacco use by U.S. male high school students in grade 12, from the Monitoring the Future Survey and Youth Risk Behavior Survey, 1993–2009

Sources: Monitoring the Future (MTF) Surveys, 1975–2010 (11); Youth Risk Behavior Survey (YRBS), 2009 (10); YRBS, 1995–2009 (97); YRBS, 1993 (97).

Special Populations

A high prevalence of ST use has been reported among some groups of athletes in the United States, including about one-quarter of professional baseball players.[14,15] Relatively high rates of ST use also have been reported among college athletes[16–18] and high school athletes.[16,19–21]

Nationally, Native Americans and Alaska Natives have a higher prevalence of current use of ST (8.9%) than any other racial or ethnic group.[7] Alaska Native prevalence of use varies widely, ranging between 3% and 34%, and the statewide prevalence of ST use among Alaska Native adults is almost three times that of Alaska non-Native adults (11% vs. 4%).[22] Tobacco use does not serve a spiritual function for Alaska Natives as it does for some Native American tribes.[23–25] Both commercial and homemade chewing tobacco are used throughout Alaska. The homemade product known as iqmik, unique to Alaska, is most common in the western region of the state,[23,24] where prevalence is 16–22% among adults.[26,27]

Immigrants to North America frequently bring their patterns of ST usage with them. For example, use of gutka or betel quid with tobacco was found to be very common among first-generation immigrants from Bangladesh and India (Gujarati) living in New York City.[28] South Asian males living in New Jersey had the highest prevalence of ST use of any ethnic group in the northeast region of the United States.[29]

Canada

Most of the ST products used in Canada are commercially manufactured and are categorized as snuff or chewing tobacco. Nearly all the snuff sold in Canada is U.S.-style moist snuff, and the chewing tobacco products available in Canada are predominantly the same as those sold in the United States. In 2010,

moist snuff accounted for 84% of ST sales by volume and 86% of sales by value.[30] The National Smokeless Tobacco Company dominates the Canadian market, with an 82% volume share; its primary brand names are Copenhagen and Skoal.

The prevalence of ST use among youth in Canada is similar to that in the United States. The Youth Smoking Survey, a school-based survey administered to 50,000 Canadian students in 2008–2009, showed that rates of ever having tried ST were 3.3% for boys and 1.1% for girls in grades 7–9, and 15.5% for boys and 3.8% for girls in grades 10–12.[2]

Based on the 2010 Canadian Tobacco Use Monitoring Survey (CTUMS), ST use within the 30 days before the survey was more prevalent among men than among women, although it was used by less than 1% of Canadians ages 15 years or older of either sex.[31] Use of snuff or chewing tobacco was higher among adults ages 20–24 than among other age groups, although prevalence was still less than 2%. Usage rates show little regional variation, with the highest prevalence reported for Saskatchewan, 1.7% of adults, and less than 1% reported in all other provinces.[31]

Although sales of ST in Canada by weight have hit some high points and low points between 1989 and 2010, the long-term trend has been relatively flat during the past two decades.[5]

Mexico

Little information is available on ST use in Mexico. The only known type of commercial product on the Mexican market is imported U.S.-style moist snuff. The market is dominated by Lieb International SA (importing and distributing products made by Swisher International Group), which essentially dominates the competitive landscape, eliminating competition for ST products.[32] Sales appear to be limited to one chain of variety stores and to tobacco specialty shops.

The 2009 Global Adult Tobacco Survey (GATS) conducted among a national sample of adults in Mexico reported an estimated prevalence of use of 0.3%, which did not differ appreciably by sex, age, education, or place of residence.[33,34] The Global Youth Tobacco Survey (GYTS) was conducted among 13- to 15-year-old students in 11 Mexican cities in 2008 (Table 9-2).[35] Among those cities, the prevalence of current ST use ranged from 2.8% (Aguascalientes) to 8.4% (Colima), with a median of 5%. Current use of those products generally was higher among boys (median = 5.6%) than among girls (median = 3.9%).

Venezuela

The main ST product used in Venezuela is chimó, a mixture of cooked tobacco leaves and flavorings (described below). The Venezuelan GYTS, conducted among students in grades 7–9, was the first tobacco-specific population surveillance system to estimate the prevalence of smokeless use and related behaviors in that country. GYTS results for Venezuela nationally and for the states of Barinas, Cojedes, Monagas, Nueva Esparta, Trujillo, Zulia, Yaracuy, and Lara in the years 2000, 2004, and 2008 found that the prevalence of chimó use was not uniform among the states: It ranged from 3.8% to 20.7% for boys and from 2.0% to 6.6% for girls, with a higher overall prevalence in Barinas, Cojedes, Monagas, and Lara.[36] The GYTS also found that students in grade 7 used chimó more often than cigarettes, which

may reflect the fact that school-based tobacco prevention programs only address cigarette smoking.[36–38] Based on the 2007 Lara State Heart Health Survey of adults over the age of 15, 15.4% of males and 3.1% of females reported ever using chimó, while 6.2% of males and 1.5% of females were current users.[39]

Brazil

In 2010, Brazil was the world's second largest tobacco producer and the world's largest tobacco exporter.[40] Despite barriers to implementing effective tobacco control policies, the prevalence of current tobacco use declined from about 33% of Brazilians in 1989 to 17% in 2008.[41] Brazil is among the few countries in the world to establish a public-health-based regulatory structure for tobacco products through its national health surveillance agency, ANVISA (Agência Nacional de Vigilância Sanitária) which was established in 1999.

There are two groups of smokeless products used in Brazil:

- Global products like dry snuff, snus, and chewing tobacco from multinational companies. These products are primarily used by young people and are common at rodeos and other rural-themed events.
- Regional products used only in Brazil, made by farmers, small tobacco industries, or native peoples. Examples of regional products include a type of dry snuff called rapé, chewing tobacco, and products used by natives, such as porronca. These products are available in a wide variety of flavors and forms (Andre Luiz Oliveira da Silva, unpublished results, 2012).

Data on the use of ST products in Brazil are very limited. About 17 million Brazilians use tobacco; most (>95%) are cigarette smokers. The use of ST is quite low, at around 0.4% of the general adult population (640,000 users), with 0.6% of men and 0.3% of women reporting current ST use. In Brazil, ST is primarily used in rural areas and is less common in urban environments.[34]

Types of Smokeless Tobacco Products and Patterns of Use

Snuff

Two types of snuff are manufactured and used in the United States: moist snuff and dry snuff (also called Scotch snuff). Moist snuff is by far the most widely consumed type in the United States[4] and Canada.[30] It is typically made from a mixture of fire-cured and air-cured tobacco laminae and stems, which are then shredded.[42] Traditional moist snuff contains 20%–60% moisture and often is flavored with wintergreen or various fruit flavors. Moist snuff consists of small particles of tobacco product of varying particle size. It is typically sold in 1.2 ounce (34 gram) tins and is also available in small teabag-like sachets. It can be as inexpensive as $1.50–$2.50 per can for some wholesale brands.[43]

Swedish-type "snus" moist snuff products were introduced on the U.S. market in about 2000. Although both Swedish snus and the U.S. product are marketed as "snus," research suggests that snus sold in the United States is a modified version of its Swedish cousin, and limited research is available to specify exactly how U.S. and Swedish snus differ in terms of chemical composition or manufacturing process.[44] Some of the snus products marketed in the United States bear the same brand names as popular cigarette

brands (e.g., Marlboro Snus and Camel Snus). Snus products sold in the United States generally are marketed in sachet-form and have moisture contents on the order of 10%–30% by weight, which is lower than in traditional moist snuff and Swedish snus products.[44,45]

Dry snuff is a finely powdered tobacco product produced mainly from Kentucky and Tennessee fire-cured tobaccos.[42] It can be used either nasally or orally, although oral use predominates in North America.

Chewing Tobacco

Three types of chewing tobacco are sold in North America: loose leaf, plug, and twist. Loose-leaf chewing tobacco consists mainly of air-cured tobacco and generally is heavily treated with licorice and sugar.[42] Plug tobacco is produced from heavier grades of tobacco leaves that are harvested from the top of the plant and separated from the stems. The tobacco then is immersed in a mixture of licorice and sugar, pressed into a plug, covered with a wrapper leaf, and reshaped. Twist tobacco is made from air- and fire-cured burley tobacco and is twisted to resemble a decorative rope. Prices vary for chewing tobacco products but average about $3.00 per can.[46]

Dissolvables

"Dissolvable tobacco products", or "dissolvables" were introduced on the U.S. market starting in about 2001. Dissolvables are made of ground tobacco shaped into compressed pellets, lozenges, strips, or sticks and sometimes packaged to resemble breath-freshening mints or strips. These products include Camel Sticks, Strips, and Orbs (R.J. Reynolds), Marlboro and Skoal Smokeless Tobacco Sticks (Philip Morris USA and UST, respectively), and Ariva and Stonewall lozenges (Star Scientific). Camel dissolvables cost on average $3.59–$4.19 for each package.[47] In January 2013, Star Scientific discontinued the manufacture, distribution, and sale of Ariva and Stonewall lozenges, which were the first dissolvable products on the market, introduced in the early 2000s.[48] Some dissolvable tobacco products have only appeared in test markets.

Iqmik

Alaska Native people make an ST mixture known as iqmik (Figure 9-2) by combining tobacco with the ashes from fungus or wood.[23] This custom-made ST mixture, with some regional variations, is used among the indigenous populations in western Siberia, Yukon, Labrador, the coast of British Columbia, and Nova Scotia.[49]

Iqmik, also known as "blackbull" or "dediguss," is traditionally used by the Cup'ik and Yup'ik Eskimo people of Alaska. Fungus ash, also called punk or buluq, is prepared by burning the basidiocarps of *Phellinus igniarius*, a fungus that grows on birch trees throughout Alaska. If the region is devoid of birch trees, such as in the coastal regions, where tundra does not support their growth, ash from driftwood, willow wood (*Salix arbusculoides*), or alder bushes (*Betulaceae Alnus glutinosa*) is used. The uncut air- or fire-cured twisted or leaf tobacco used in iqmik is a commercially packaged tobacco available in local stores.[23,24] Iqmik is prepared either by premastication or by hand mixing, using air- or fire-cured full leaf or twisted leaf tobacco in varying proportions, and different types of ashes based on

the user's personal practice.[49] In rural regions of Alaska, iqmik can be purchased for an estimated $5.00 a can.[50]

Figure 9-2. Iqmik preparation and use

Source: Photos courtesy of Caroline Renner, Alaska Native Medical Center, 2011.

Chimó

Chimó is the main ST product used in Venezuela (Figure 9-3). Chimó is typically used by placing a small amount under the tongue or between the lip or cheek and the gum, and left in place for about 30 minutes. The black-stained saliva is then expectorated.[36]

Figure 9-3. Examples of chimó product from Venezuela

Source: Photos courtesy of Scott Tomar, University of Florida School of Dentistry, 2011.

During the initial days of European exploration of the Americas, a 1497 report from Amerigo Vespucci provided one of the earliest written references to the Caribbean practice of chewing tobacco mixed with ashes.[51] According to a popular legend, "Chimauchu" was the name of a "cacique" (aboriginal chief) who first used tobacco in the form of a paste, now called chimó. Traditionally, chimó was the primary type of ST used in Venezuela, the Colombian state of Norte de Santander, and at one point, in Cuba. Use of chimó declined in the second half of the 20th century with the increase in urbanization and the introduction of mass-produced cigarettes. By the 1980s, chimó use was regarded as confined to older adults living in poor rural areas. In the past 20 years, chimó has re-emerged as a trendy urban youth phenomenon and is perceived among some sectors of Venezuelan society as part of the national identity.

Most chimó production occurs in small family-operated factories scattered across the Andes and the flat lands of Venezuela and Colombia. However, commercially manufactured production of chimó is growing in Venezuela, with increasing sophistication of equipment and methods.[36] The process is simple: The factory buys leftover tobacco leaf (commonly *N. tabacum* or *N. rustica)* from commercial cigarette manufacturers and some local tobacco producers. The tobacco leaf is cooked in large metal containers for several days to discharge fiber and starch. Within 48 hours, the mixture turns from a light to a dark brown color and increases in viscosity. At the end of this phase the product is a sticky, heavy black liquid that exudes a penetrating odor. This product is called "basic" chimó paste, which is stored for maturation for up to 2 years. Production of 1 kilo of this concentrated product requires about 10 kilos of tobacco leaf. The basic paste is then mixed with other ingredients: sodium bicarbonate, brown sugar, molasses, ashes from tobacco leaf and mamón trees (*Meliccoca bijuga*), vanilla, anisette, alkaline ash, yoco vine (*Paullinia yoco*), plantain peel, avocado seed, sodium hypochlorite, hot chili, burned sodium bicarbonate, and other ingredients that are part of a "secret" recipe that each factory has.

In Venezuela, chimó is widely available at local convenience stores across the country. It is produced by either commercial or cottage industries. Sold tax-free, chimó is relatively inexpensive compared with cigarettes, the price ranging from 1 bolívar fuerte (BsF) to 5 BsF (US$0.23–US$1.16) for each package, which contains at least 5 doses. In comparison, a hamburger meal at most international chain restaurants costs 47 BsF (US$10.93).

Rapé

In Brazil, regional ST products include a type of dry snuff called rapé (Figure 9-4). Rapé is used primarily in rural areas and small towns, or by Brazilian aboriginals in the Amazon rainforest, and cultural and historical elements are connected with its use (Andre Luiz Oliveira da Silva, unpublished results, 2012). Preliminary data from analysis of Brazilian rapé in 2011 show that the major constituents of the rapé samples (tonka bean, clover, cinnamon powder, and camphor) are unique compared with components of other smokeless products (Andre Luiz Oliveira da Silva, unpublished results, 2012). Since this product is mostly sold locally and in cottage industry settings, typical pricing information and evidence-based literature on the manufacture and use of rapé are not readily available.

Figure 9-4. Examples of Brazilian rapé

Source: Photos courtesy of Clifford Watson and Stephen Stanfill, Centers for Disease Control and Prevention, 2011.

Toxicity and Nicotine Profiles of Products

Moist Snuff

During the processing (curing, fermentation, and aging) of moist snuff, nitrosation of nicotine and the minor tobacco alkaloids nornicotine, anatabine, and anabasine gives rise to carcinogenic tobacco-specific nitrosamines (TSNAs).[52] TSNAs are widely considered the major class of carcinogens in ST products.[42,53] TSNA levels in the 39 top-selling brands of United States moist snuff ranged from 4.87 micrograms per gram (µg/g) (wet weight) for Red Seal Long Cut Wintergreen to 90.0 µg/g (wet weight) for Skoal Key.[54] All U.S. products had higher TSNA levels than the Swedish product Ettan snus (Swedish Match), which had a TSNA level of 2.8 µg/g. In the top selling U.S. brands, total nicotine ranged from 4.42 to 25 milligrams per gram (mg/g) (wet weight). The free nicotine in these same moist snuff products ranged from 0.01 to 7.81 mg/g (wet weight), which represents a free nicotine percentage between 0.3% and 79.9%, and pH values between 5.54 and 8.62.[54] Although the technology to reduce TSNA levels exists, U.S. smokeless tobacco manufacturers do not apply it to their most popular products.[55]

Iqmik

Because the alkaline ash used in iqmik has extremely high pH levels, nearly all nicotine in iqmik is in the free form, which is more rapidly absorbed than bound nicotine, the more common form in ST products with lower pH levels.[56] The total nicotine and free nicotine levels in iqmik are much higher than in popular U.S. commercial smokeless products.

Chemical analysis of iqmik samples found pH values between 11 and 11.8, and a total nicotine concentration of 22.9–23.38 mg/g. In addition to high levels of free nicotine, iqmik contains other hazardous substances such as TSNAs, polycyclic aromatic hydrocarbons (PAHs), and heavy metals.[57] In 17 iqmik tobacco samples, the average arsenic, cadmium, lead, and nickel concentrations were 0.19±0.06 µg/g, 1.41±0.56 µg/g, 0.55±0.19 µg/g, and 2.32±1.63 µg/g, respectively.[58]

Chimó

Chemical analysis of selected samples of commercially manufactured and cottage industry chimó products found the following upper values: pH = 9.82; total nicotine concentration = 30.1 mg/g; percentage of free nicotine = 95.9%; and free nicotine concentration = 27.4 mg/g. Therefore, chimó could be characterized as having among the world's highest levels of nicotine content and alkalinity in an ST product.[59,60] The concentrations of TSNAs were: *N'*-nitrosoanabasine (NAB), 57.3 ng/g; *N'*-nitrosoanatabine (NAT), 965 ng/g; *N'*-nitrosonornicotine (NNN), 4,620 ng/g; 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), 2,600 ng/g; 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL), 1,330 ng/g; and total TSNAs, 9,390 ng/g.[60]

Health Problems Associated With Product Use

All ST products contain nicotine, an addictive substance that has cardiovascular and other physiologic effects. These products also contain varying levels of TSNAs, several of which are human carcinogens.[53] This section summarizes documented health effects of various ST products used in the Region of the Americas. It should be noted that for some products, little research has been conducted.

North American Snuff

Use of U.S.-type snuff causes cancer in humans, particularly cancers of the oral cavity.[53] U.S. forms of snuff are strongly associated with oral mucosal lesions and localized gingival recession. Snuff use may increase the risk of fatal myocardial infarctions.

Snus

Although Swedish snus has been used in the Nordic region of Europe for many years, a modification of Swedish snus has only been marketed in North America since about 2000. Thus, as of 2012, no research is available on the long-term health effects of the products being marketed in the Americas. In Europe, the particular manufacturing process for Swedish snus has been in place for less than 15 years (since the late 1990s), so the health effects of long-term exposure to Swedish snus are largely unknown.

While snus use has demonstrated increased risks of oral cancer in some studies,[61] there is a lack of clear and consistent evidence that snus use is associated with oral cancer.[53,62,63] Several epidemiologic studies in Scandinavia and Asia have demonstrated a causal link between the use of snus (and other ST products) and pancreatic cancer.[53,62,64]

Swedish snus use appears to increase the risk of mortality from cardiovascular disease, including myocardial infarction and stroke,[65] but the evidence regarding its relation to stroke is too limited to allow firm conclusions. Heavy use of Swedish snus appears to be associated with an increased risk of developing type 2 diabetes,[66] while evidence from a few studies on insulin resistance, metabolic syndrome, and diabetes have yielded conflicting results.[53,66]

Using Swedish snus during pregnancy may increase the risk for adverse birth outcomes, including pre-term delivery, pre-eclampsia, stillbirth, neonatal apnea, and infants who are small for their gestational age.[67,68]

Iqmik

Abnormal neonatal neurobehavioral outcomes associated with iqmik were assessed in a pilot study of 41 pregnant Alaska Native women.[69] Compared with women who used no tobacco products, women who used iqmik had significantly higher levels of nicotine and cotinine in umbilical cord blood and higher levels of cotinine in maternal blood. Neonates born to mothers who used iqmik during pregnancy had a significant increase in the number of abnormal neurobehavioral signs, as assessed by the Lipsitz score (a scoring system for neonatal drug-withdrawal),[70] compared with infants born to mothers who did not use tobacco.

Chimó

The acute physiologic effects of using chimó include elevation of blood pressure and heart rate. Chimó produces histologic changes in oral tissues, from tooth stain to orthokeratosis, epithelial dysplasia, granulocytes, hyperkeratosis, acanthosis, fibrosis, stroma collagen disease, chronic inflammation, and cancer.[37,59,71]

The commercial and cultural profile of chimó can be explained by a matrix of factors including health beliefs. Popular folklore considers chimó a beneficial product for health, and some youth link it to the national identity.[36,72] These beliefs even influence health professionals. For example, while the majority of dentists in Venezuela's Lara State think chimó is a drug that is and will remain a public health problem, 33% think it is harmless or even beneficial for health. Fourteen percent of male dentists and 18.8% of female dentists think it does not cause damage to oral tissues. However, few of those dentists had received information on this product, 79% never had a lesson about chimó as undergraduate students, and less than 30% had ever read a scientific article about chimó. Eighty percent of the dentists said they had not had a patient who used chimó in the last year, but among those dentists, 60% said they never asked their patient about their possible use. Eighty percent of dentists thought they were prepared to help patients stop using tobacco, but 40% never offered any counseling.[72]

Brazilian Products

Data about health impacts of the products sold in Brazil are very limited. However, one study conducted among 129 ST users found that 49 had gingival recession, 25 exhibited leukoplakia, and 14 had dental pigmentation.[73]

Marketing and Production Practices of Industry

Marketing practices vary throughout the Americas Region, depending on the type of product used and its scale of production. For example, while the U.S. market consists of many commercially manufactured brands (which are exported to many areas including Canada and Mexico), in countries like Brazil and Venezuela ST is a cottage industry product. For decades, the U.S. smokeless tobacco market was dominated by a small number of companies that sold only smokeless tobacco. That changed with the acquisitions of Conwood Company by R.J. Reynolds in 2006 and U.S. Smokeless Tobacco Company by Altria Group in 2009. Cigarette companies also have introduced new ST products, including moist snuff, snus, and dissolvable products, which are sold under cigarette brand names such as Marlboro and Camel.

Adolescent and young adult males have long been the primary target of ST marketing in North America.[74,75] Two patterns of marketing and promotion of ST have emerged: (1) continued marketing to traditional targets such as men living in rural areas and those engaged in outdoor and sporting activities; and (2) increasing promotion of ST products as an alternative to cigarettes where smoking is not permitted.[76,77] Smokeless tobacco continues to be heavily advertised in U.S. magazines with substantial youth readership, as it had been before the 1998 Smokeless Tobacco Master Settlement Agreement (STMSA) was reached between state attorneys general and the U.S. Smokeless Tobacco Company.[75] (The STMSA was executed specifically for ST products at the same time as the more widely known

Master Settlement Agreement for cigarettes.) Although data on advertising and promotional expenditures by ST companies are available only through 2008, the pattern during the past decade indicates a massive increase in spending to market moist snuff products. Expenditures to advertise and promote moist snuff in the United States increased by 257% between 1998 and 2008, from $117.3 million to $287.3 million.[4] Not only has ST been marketed as an alternative to cigarettes and for use in indoor settings, but the proportion of advertisements related to flavored products increased markedly between 1998–1999 and 2005–2006.[77] In addition, ST manufacturers increasingly are using YouTube and other online social media to market their products.[78]

Data are lacking on marketing of traditional and cottage industry products. In Venezuela, packaging of chimó is becoming more sophisticated, including the use of attractive candy-style packaging and small tin cans. In Brazil, no ST products, including rapé, are registered with the national health regulatory agency ANVISA, which means that these products are sold illegally. Because most users of rapé are residents of rural areas and small towns or are Brazilian aboriginals living in the rainforest, there are no large-scale marketing or advertising activities.

Interventions and Policies

United States

The Family Smoking Prevention and Tobacco Control Act (Tobacco Control Act) gave the U.S. Food and Drug Administration (FDA) regulatory authority over ST products.[79] Signed into law on June 22, 2009, the Tobacco Control Act required FDA to reissue regulations prohibiting: (1) sales of cigarettes and ST to individuals less than 18 years old; (2) sales of cigarettes and ST in vending machines, self-service displays, and other modes of sale that lack direct, face-to-face exchange, except in very limited situations; (3) tobacco brand name sponsorship of any athletic, musical, or other social or cultural event, or any team or entry in those events; and (4) gifts or other items in exchange for buying cigarettes or ST products, and sale or distribution of items with tobacco brands or logos, such as hats and tee shirts. The law also limits distribution of smokeless tobacco products and requires that audio advertisements use words only, with no music or sound effects. Effective July 22, 2010, the law prohibited the manufacturing, distributing, importing, selling, or advertising of ST products unless they carry text warnings that take up at least 30% of each principal display panel on the package and at least 20% of advertisements, with four specific rotating random messages: (1) “WARNING: This product can cause mouth cancer.” (2) “WARNING: This product can cause gum disease and tooth loss.” (3) “WARNING: This product is not a safe alternative to cigarettes.” (4) “WARNING: Smokeless tobacco is addictive.” [Sec. 204(a), Smokeless Tobacco Labels and Advertising Warnings[79]].

The Tobacco Control Act also gives the FDA authority to set tobacco standards and establish manufacturing practices, requires premarket review of new tobacco products, and requires manufacturers who wish to market a tobacco product with a claim of reduced exposure, risk, or harm to obtain a marketing order from the FDA.

The requirements set forth in the Tobacco Control Act differ for regulation of smokeless tobacco manufacturing and marketing compared to cigarette manufacturing and marketing. For example, the Act does not require FDA to issue regulations requiring pictorial labeling on ST packaging as it does

for cigarettes; does not ban characterizing flavorings in smokeless tobacco as it does for cigarettes; and does not call for a report and recommendations on certain characterizing flavors (i.e., wintergreen) of ST products as it does for menthol cigarettes. However, the Act does give the FDA the authority to require pictorial warnings or ban flavorings in smokeless tobacco products by issuing a regulation.

In the United States, taxes are levied at the federal and state levels. The federal tax rate on snuff products in 2012 was $1.51 per pound, which translates to 11.3 cents per typical (1.2 oz) package of moist snuff, and 1.6 to 7.7 cents per 20-piece package of snus or dissolvables. Chewing tobacco is taxed at 50.3 cents per pound, or 9.3 cents per 3-ounce package. This is compared to the $1.01 federal tax on a pack of 20 cigarettes.[80,81] State excise taxes on ST products vary widely in rate and formula. Some states apply an excise tax rate based on weight, ranging from Alabama's rate of 1.0 cent per ounce for snuff, to 202.0 cents per ounce in Maine in 2012.[82] Other states set their ST excise tax rate as a percentage of wholesale price, ranging from a low of 5% in South Carolina to a high of 95% in Washington State.[80,82,83]

U.S. prevention and cessation programs have largely been focused on cigarette smoking, given the higher percentage of use. However, effective interventions for ST use have been developed and are described in detail in chapter 7.

Canada

Advertising of smokeless tobacco is subject to the same restrictions as cigarette advertising: These products can only be advertised to retailers or to adults through direct mail or in adult-only venues such as bars. Tobacco products cannot be sold to children (that is, anyone under 18). Smokeless tobacco manufacturers must report their products' ingredients and additives to Health Canada. However, ST products in Canada can still be sweetened with sugar or contain fruit flavorings, even though such flavorings have been banned in cigarettes and little cigars. One of four rotating health messages is required on ST product packaging: (1) "This product is highly addictive." (2) "This product causes mouth diseases." (3) "Use of this product can cause cancer." (4) "This product is not a safe alternative to cigarettes." Unlike cigarettes, ST products do not have to display pictorial warnings. Although smoking has been banned in indoor public spaces and workplaces in Canada, ST products generally can be used in those venues.[84]

Smokeless tobacco products are subject to federal and provincial tobacco laws in Canada, including taxation. Excise taxes on ST products vary by province, but they are taxed by weight at rates comparable to excise taxes on cigarettes.[85–87] Smokeless tobacco products are not subject to a minimum package size as are cigarettes or little cigars, but they are taxed in a way that discourages the sale of quantities less than 50 grams.[84]

Mexico

Mexico has few restrictions or policies related to smokeless tobacco. There are no bans on consumption, no known restrictions on advertising, no requirements for warning labels, and taxes are relatively low compared with taxes on cigarettes.[32] The General Health Law of Mexico prohibits the sale of tobacco products including ST products to anyone younger than 18 years old.[88]

Venezuela

In Venezuela, ST sales are subject to the same legal regulations as cigarettes and cigars, but chimó is not taxed. Resolutions 11 and 12 from the Ministry of Health prohibit sale of any tobacco product to anyone less than 18 years of age, and sales are prohibited in retail outlets near schools.[89,90] Although pictorial health warnings covering 50% of the pack are required for cigarettes, no such warnings are required for ST products sold in Venezuela.[91,92]

There are no specific ST prevention initiatives in Venezuela. A nongovernmental cardiovascular health organization called ASCARDIO offers a cessation program for chimó as part of its Tobacco Cessation Clinic.

Brazil

In Brazil, manufacturers must submit information about the contents, emissions, packaging, and design of every tobacco product to ANVISA, the national health surveillance agency. However, because the list of commercially permitted brands in Brazil does not include ST brands (effectively making ST product sales illegal), smokeless products marketed and sold illegally in Brazil usually do not contain any health warnings.

In the Brazilian legislation, ST products are classified as "other tobacco product (not cigarette)." Taxes include:

- Importation taxation: 14%
- PIS/COFINS (Social Integration Program/Contribution to Finance Social Security): 9.25%
- Industrialized products taxation: 30%
- State taxation on commercialized products: 25% (the same applies to cigarettes).

Still, ST prices in Brazil are considered very low, making purchasing them relatively affordable for young people.

Because of the much higher prevalence of cigarette smoking, health professionals generally do not focus on treating ST use. Health promotion and cessation efforts concerning smokeless products essentially do not exist.

Summary and Conclusions

The Region of the Americas holds a place of significance in the history of tobacco use because the tobacco plant is thought to have originated on the mainland in North, Central, or South America. In the United States and Canada, moist snuff is still the most widely consumed smokeless product type by far. Since 2001, companies in this region began selling novel ST products, which include dissolvables. Across North America, three types of chewing tobacco are sold: loose leaf, plug, and twist. Other types of products in the region include iqmik, traditionally used by Alaska Natives; chimó, the main smokeless product used in Venezuela; and rapé, a type of dry snuff used in Brazil.

In this region, current ST use among youth ranged from 1.8% in Canada to 9.8% in Barbados. Smokeless tobacco use was more prevalent among boys than among girls in nearly all countries and localities, with the greatest gender difference in the United States. For adult men, the highest prevalence of use was in the United States (6.9%), while use among women was highest in Haiti (2.5%). In general, detailed information on ST use is sparse or nonexistent for most countries in the region. Additionally, little is known about potential adverse health effects of many of the locally used products such as rapé and iqmik.

Regulation of ST products in the Americas is variable; in some countries it is generally weak or absent, while others have placed regulations on sales, marketing, and product ingredients. Many tobacco control measures applied to cigarettes are not applied to ST products or are less stringent, such as lower taxes, lack of pictorial warning labels, and lack of targeted cessation interventions. In Brazil, no ST products are licensed for sale, but they are still available in some areas. Stronger tobacco control policies and programs are needed that are targeted to smokeless tobacco. Established tobacco control measures, such as increased pricing (mainly achieved through taxation), graphic warning labels, and limits on advertising and promotion, are not currently applied consistently across all tobacco products. Taxation may be optimal if applied equally to all tobacco products, and taxes for both ST and cigarettes could then potentially be set at the same rate and increased at the same time, which would change the focus from ST tax structures or cigarette taxation to tax structures that address all tobacco use. Controlling and taxing cottage industry products such as rapé poses a greater challenge. Surveillance of ST products, particularly in areas where there are indications that these products are being used, could be enhanced. And continuation of epidemiologic studies on the adverse health effects of a variety of ST products, including traditional products, and of dual use of ST and cigarettes is critical.

Implementation of the World Health Organization Framework Convention on Tobacco Control and proliferation of smoke-free regulations throughout the region can be expected to accelerate the decline in consumption of cigarettes. The social acceptability of smoking continues to wane. At the same time, major cigarette manufacturers now control of most of the ST industry in North America and are marketing novel products to non-traditional users, including cigarette smokers. Dual use of cigarettes and ST is an emerging pattern, especially among young people, and may be influenced by marketing that encourages dual use. In this dynamic and shifting landscape, it is increasingly urgent to address ST throughout the region, while preserving the gains made in reducing smoking consumption.

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Chapter 10

Smokeless Tobacco Use in the European Region

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Description of the Region

The World Health Organization (WHO) European Region consists of 53 member states and a population of over 890 million. The European Region includes high-income countries (e.g., Germany, Norway) and lower income countries (e.g., Uzbekistan, Georgia, Kyrgyzstan).[1] This region also includes the European Union (EU), which consists of 27 predominantly Western European member countries with a population of over 500 million (see Table 10-1 for the population of select European countries). The five Nordic countries, all considered high-income countries, have a total population estimated at 25.5 million. Within the EU, tobacco products remain widely traded. Globally, the EU is the fourth largest tobacco producer, after Asia, the Americas, and Africa.[2]

The European Region is home to two populations that have longstanding traditions of smokeless tobacco (ST) use: Scandinavians, particularly in Sweden and Norway, and the large South Asian community that has immigrated to Europe and especially to the United Kingdom (UK). Sweden is exempt from the EU's tight regulations on the sale of many types of oral and ST products and can therefore manufacture and sell snus legally nationwide.[3] The UK is home to the largest South Asian community within Europe, estimated at 4.2 million people in 2011.[4] Research shows that these groups have to varying degrees brought ST products with them from their countries of origin such as Bangladesh and India, which have the highest rates of ST use in the world. And studies show that a third population, the Uzbeks, have one of the highest rates of ST use in the European Region, although published information about ST use in Uzbekistan is limited.[5]

This chapter examines ST use—its health effects, industry marketing practices, government policy, and interventions to combat use—in the United Kingdom, the Scandinavian countries (especially Sweden), Kyrgyzstan, and Uzbekistan. These countries were selected based on the availability of survey and other research information and on the availability of documented ST prevalence rates. Because survey methods and questions differ, comparisons of estimates among the surveys should be made with caution.

Prevalence of Smokeless Tobacco Use

European regional data on tobacco use are largely focused on cigarette smoking; limited information is available on ST use.[6] In addition, surveys' definitions of current use may vary. For example, some surveys define current use as any use within the past 30 days, while other surveys ask about different time periods; some surveys ask about daily use and use on some days, and still other surveys ask about "current" use without defining the term further.

The Global Youth Tobacco Surveys provide national and/or subnational prevalence data for adolescents aged 13–15 years in 12 countries[7] (Table 10-2). The prevalence of current ST use among adolescents (defined as use in the past 30 days) ranges from 1.1% in Montenegro to 6.9% in Estonia. Smokeless tobacco use appears to be higher among boys than girls in all countries and locations except in Warsaw, Poland.[7]

Table 10-1. Population and land area of selected countries in the European Region

Country	Area (km²)	Population (thousands)
Albania	28,864	3,204
Armenia	29,731	3,092
Azerbaijan	86,679	9,188
Croatia	56,449	4,403
Denmark	43,023	5,550
Estonia	44,700	1,341
Finland	335,313	5,365
Georgia	70,194	4,352
Germany	356,286	82,302
Hungary	93,308	9,984
Iceland	106,667	320
Kyrgyzstan	197,556	5,334
Latvia	64,343	2,252
Macedonia	25,730	2,061
Moldova	33,867	3,573
Montenegro	13,717	631
Norway	375,615	4,883
Poland	70,144	38,277
Russian Federation	17,869,750	142,958
Serbia	88,000	9,856
Slovenia	20,300	2,030
Sweden	46,667	9,380
Switzerland	41,204	7,664
United Kingdom	243,278	62,036
Ukraine	605,973	45,448
Uzbekistan	449,918	27,445
Total	**21,397,252**	**492,929**

Abbreviation: km = kilometer.
Source: United Nations 2011 (69).

Table 10-2. Percentage of adolescents aged 13–15 years who currently used smokeless tobacco in the European Region, from the Global Youth Tobacco Surveys, 2007–2009

Country	Year	Total (%)	Boys (%)	Girls (%)
Albania	2009	2.0	2.3	1.7
Croatia	2007	1.9	2.7	1.1
Estonia	2007	6.9	9.4	4.5
Hungary	2008	1.7	2.1	0.9
Kyrgyzstan	2008	2.5	3.3	1.8
Macedonia	2008	3.0	3.2	2.8
Moldova	2008	3.8	5.2	2.6
Montenegro	2008	1.1	1.1	0.9
Poland – Warsaw	2009	1.8	1.3	2.2
Poland – Mazovia Province	2009	1.4	1.5	1.0
Serbia	2008	1.2	1.6	0.7
Slovenia	2007	2.2	2.0	1.8
Srpska	2008	1.4	1.8	1.1

Source: Global Youth Tobacco Survey, 2007–2009 (7).

National prevalence data on ST use among adults (people aged 15 years and older) are available in 16 countries in this region (see Table 10-3; Map 10-1). These data were collected from multiple surveys including the Global Adult Tobacco Surveys (GATS), the Demographic and Health Surveys (DHS), the WHO STEPwise Approach to Surveillance (WHO STEPS), and individual country surveys as reported in the *WHO Report on the Global Tobacco Epidemic, 2011* (GTCR). While these surveys may employ different measures for smokeless tobacco use, comparisons among them should be made with caution; however, they represent the best available national estimates of prevalence. Reported prevalence of current ST use among adults (defined as use on some days or every day) varies from 0.1% in Switzerland to 17.0% in Sweden. Men reported higher rates of current use of ST products than women, with 17.0% of Norwegian men, 22.5% of Uzbek men, and 26.0% of Swedish men reporting current use.

Table 10-3. Percentage of adults who currently used smokeless tobacco in the European Region, 2005–2010

Country	Year	Age group (years)	Total (%)	Men (%)	Women (%)
Armenia*	2005	15–49	—	1.8	0.0
Azerbaijan*	2006	Men, 15–49	—	0.3	—
Denmark†	2010	15+	2.0	3.0	1.0
Finland†	2009	15–64	—	5.5	0.4
Georgia‡	2010	18–64	0.6	1.0	0.2
Iceland† (daily use only)	2008	15–89	2.9	6.0	—
Kyrgyzstan†	2005	15+	3.4	7.0	0.3
Latvia† (daily use only)	2008	15–64	0.1	0.2	—
Moldova*	2005	Men, 15–19; Women, 15–49	—	0.1	0.0
Norway†	2009	16–74	10.0	17.0	5.0
Poland§	2009	15+	0.5	1.0	0.1
Russian Federation§	2009	15+	0.6	1.0	0.2
Sweden†	2010	16–84	17.0	26.0	7.0
Switzerland†	2009	14–65	0.1	0.2	0.0
Ukraine§	2009	15+	0.2	0.5	0.0
Uzbekistan†	2006	15+	11.3	22.5	0.4

*Demographic and Health Surveys (71).
†Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (15).
‡WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (15).
§Global Adult Tobacco Survey (70).

Map 10-1. Prevalence of smokeless tobacco use among adults in the World Health Organization's European Region

Sources: Demographic and Health Surveys (71); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (15); WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (15); Global Adult Tobacco Survey (70).

United Kingdom

Varying estimates of the prevalence of ST use in South Asian communities in the UK have been reported in 22 published papers.[8] The most comprehensive dataset is provided by the Health Survey for England (HSE), which has oversampled black and minority ethnic groups. The 2004 HSE suggested a decrease in use among Bangladeshis in the UK compared to a similar survey conducted in 1999.[9] Only two studies validated self-reported tobacco use with salivary cotinine analyses. One found a prevalence of 26% for Bangladeshi women in 1999 and 16% in 2004,[9] but the second found a prevalence of 48.5% for the same population in 2000–2001.[10] Thirteen other studies focusing on Bangladeshi samples yielded prevalence estimates between 2% and 57%, with prevalence rates higher among women.[8]

Evidence that prevalence is declining is contradicted by other sources, which indicate that (1) legal imports of ST from India increased nineteenfold between 1995 and 2009; (2) the number of retail outlets for these products has not decreased in one London municipal area, where a large Bangladeshi community lives, in the previous 11 years[11]; and (3) generational analyses have identified no significant differences in consumption between first and second generation immigrants.[12]

Studies of ST use in the UK have been criticized for using poor quality sampling methods, relying on self-reports,[8] and asking ambiguously worded questions. Terminology is also an issue. Members of Indian communities will more commonly use the term *paan* instead of *betel quid* (the term this report uses), whereas members of Bangladeshi communities might also use *khilli paan.* Many studies have failed to distinguish between paan or khilli paan with or without tobacco. The HSE includes *paan masala* as a possible response even though samples of this product, when analyzed in the laboratory, rarely contain tobacco.

No data are available on the use of ST products by the general population of the United Kingdom.[5]

Nordic Countries

In addition to the EU's ban on the sale of Swedish snus, individual countries have further restricted ST products. Sweden was exempted from the ban when it joined the EU in 1995. The market for Swedish snus in Finland and Denmark is limited because both countries are members of the EU; Swedish snus has been marketed more widely in Norway and Iceland, neither of which are EU members.

According to national WHO surveys conducted in 2009 using representative samples, the prevalence of daily snus use among adults in Sweden was 19% for men and 4% for women.[13] In Norway, 11% of men and 1% of women use snus every day.[14]

Uzbekistan and Kyrgyzstan

According to WHO data, in 2006 the prevalence of current ST use was 11.3% among the Uzbek population aged 15 years and older.[15] Males in this age group (22.5%) were much more likely to be users than females (0.4%). An earlier national survey found an "ever in lifetime" prevalence of 37.9% among males and 0.4% among females.[16] A separate study found that men who are married (odds ratio [OR] = 2.8, 95% confidence interval [CI]: 1.5–5.1), older (35–54 years: OR = 2.5, 95% CI: 1.3–4.8), or live in rural areas (negatively associated with urban residence: OR = 0.5, 95% CI: 0.3–0.7) were more

likely to use nasway, a form of ST widely used in Uzbekistan.[17] It may be that the prevalence of nasway use in Uzbekistan is influenced by the relatively higher price of cigarettes.

Less information is available for Kyrgyzstan. According to data from the National Epidemiological Study of Tobacco Use Prevalence in Kyrgyzstan, in 2005, 3.4% of adults currently used smokeless tobacco. Among men, 7% reported current ST use, compared to only 0.3% of women.[15]

Types of Smokeless Tobacco Products and Patterns of Use

Europeans use a variety of ST products. Snus originated in Sweden and is traditionally used in the Nordic countries of Sweden, Norway, Finland, and Iceland; a range of products are imported from South Asia (India, Pakistan, Bangladesh, and Sri Lanka) and used by communities of South Asian origin in Great Britain; and three national companies produce twisted tobacco for oral use in Denmark, Germany, and the UK (primarily used by the Danes). The product used in Kyrgyzstan and Uzbekistan is nasway or nasvay, a multinational product made of locally grown tobacco and an alkaline modifier such as ash or slaked lime (calcium hydroxide).

United Kingdom

Following a protocol for determining the availability of South Asian ST products in England,[18] researchers identified municipal areas with high proportions or numbers of residents of South Asian origin catalogued ST retail outlets in these areas. Then ST products for each outlet were listed, along with their branding, regulatory compliance, and sale price. South Asian ST products were found to be widely available from a variety of outlets.

Employing this protocol in a further exploration of product and brand availability within the five London municipal areas with the highest numbers of residents of South Asian origin, 54 non-duplicated brands were identified. These were prepackaged products, excluding in-store, custom-made products or products sold loose. Fifty-two percent of them originated in India, and 33% in Bangladesh. The three main types available for purchase were zarda (60%), gutka (14%), and khaini (11%).[19] Other available products included tobacco leaf, toothpowder, mawa, and qiwam. Common ingredients in zarda, gutka, and khaini are tobacco flakes or powder, with slaked lime (calcium hydroxide) as an alkalinity enhancer. Gutka also contains areca nut, which is recognized by the International Agency for Research on Cancer (IARC) as a carcinogen.[20] Gutka and zarda contain additional spices and flavorings such as saffron and menthol. Zarda is often mixed with areca nut and other ingredients to produce the homemade product paan/khilli paan. Gutka and khaini are typically sold in small individual sachets, and zarda is sold in larger containers so it can be used in the production of paan by the user at home or by a vendor at a kiosk.

Seven brands have been identified as dominant—six from India and one from Bangladesh (Table 10-4).[19] Within individual boroughs, or neighborhoods, these brands represented between one-quarter and two-thirds of the products available. Outlets serving communities of Indian origin were likely to sell a more homogeneous group of products (gutka and khaini), but those serving the Bangladeshi community were more likely to sell a variety of zarda brands from Bangladesh. These variations reflect differing cultural contexts, with domestically made khilli paan being the predominant

form of consumption in Bangladeshi communities. Zarda is produced commercially, gutka and khaini are often produced by both commercial and cottage industries, but betel quid is mostly a cottage industry or custom-made product.

Table 10-4. Dominant smokeless tobacco products and brands available in five London boroughs

Product	Brand	Origin	Price per portion			Warning
			U.S.	UK	Weight	
Gutka	Tulsi Mix	India	US$1.25–$4.20	80p–£2.69	20 g	Yes
Gutka	RMD	India	US$0.40–$1.98	25p–£1.20	5 g	No
Zarda	Baba 120 Blend	India	US$4.94–$11.56	£2.99–£7	50 g	No*
Zarda	Baba 600 Blend	India	US$57.78–$82.55	£35–£50	50 g	No*
Zarda	Dulal	Bangladesh	US$0.83–$1.63	50p–99p	15 g	No
Khaini	Mirage	India	US$0.83–$1.24	50p–75p	12 g	No
Khaini	Kuber	India	US$1.47–$2.81	89p–£1.70	10 g	Yes
Khaini	Ansal Udta Panchi	India	US$1.47–$2.81	89p–£1.70	10 g	No

*A correctly worded warning sticker is now placed on the base of the packaging.
Source: Croucher 2011 (19).

According to an assessment of 73 types of paan/khilli paan prepared for local consumption and purchased from 31 shops in these five areas of London, the mean total weight was 10.06 grams (g) per packet (95% CI: 9.26–10.86) with a mean price of US$2.32 (£1.43) (range = US$0.81–5.68, £0.50–3.50) per packet. Zarda alone was the most commonly used tobacco type in paan/khilli paan (64.4%).[21]

The excise duty for these products as of 2011–2012 was US$14 (£8.49) per 10 grams of weight, regardless of the proportion of tobacco present.[21] It has been estimated that the legal price (incorporating excise and other taxes) of a 5-gram individual packet should be at least US$1.14 (69p), but the prices identified were almost always higher. The approximate retail price of a pack of 20 cigarettes in January 2011 was US$10.95 (£6.63). Although smokeless tobacco products are required to display warning labels, it was found that the dominant brands identified here were mostly non-compliant.

The assumption that ST use will decline as immigrants become acculturated is not supported in the literature. First, chewing of paan/khilli paan with tobacco is recognized as a longstanding traditional behavior among South Asian women, whereas cigarette smoking stigmatizes women in South Asian communities. Second, although paan/khilli paan without tobacco may be chewed from an early age, women start to add tobacco to it as they reach early adulthood, marry, and leave their family home. Women's initial use of these products with tobacco is commonly attributed to social pressure from family and friends; Bangladeshi male smokers are sometimes described as chewing paan/khilli paan with tobacco as a way of building a relationship with their wives, although chewing is not regarded as a male behavior. Third, use of paan/khilli paan with tobacco is thought to relieve various health problems. It is mistakenly believed to alleviate nausea during pregnancy, promote digestion, and reduce bad

breath; there are recurrent reports that its use alleviates dental pain.[22] Finally, in the Hindu tradition, areca nut is considered a vital ingredient in paan/khilli paan and is known as the food for God; it may be used while praying if images or idols are unavailable. Paan/khilli paan is very commonly offered to guests at social occasions such as weddings.

Nordic Countries

Although *snus* is the Swedish word for all oral or nasal tobacco products, it has become synonymous with the oral moist form of pasteurized ST placed under the upper lip, and is increasingly recognized as such in the international literature. Snus has been manufactured and marketed in Sweden since the 1820s. It remained the best-selling tobacco product in Sweden for the next 100 years, until the early 1940s, when cigarettes became the preferred way to consume tobacco. Snus use and tobacco chewing were strictly male behaviors, and spittoons were found in banks, on railway trains, and in hotels. However, with the rapid increase in smoking, snus use came to be seen as a behavior of rural and older men.

In Sweden, snus consumers are now mainly under the age of 50, which reflects heavy marketing efforts by the commercial industry since the 1970s, when snus use was becoming unfashionable.[23] Patterns of snus use between regions of Sweden, however, may differ. The proportion of snus users is greater in the northern parts of Sweden, particularly among women. Cultural barriers against snus use by women have been lowered, but the percentage of women who are daily users is still low—less than 5%.[13] Among Swedish 6th graders, 2.7% of boys and 1.8% of girls use snus in addition to the 15% of boys and 5.2% of girls who use both cigarettes and snus.[24]

Swedish snus is sold either packed loose or portion-packed in small teabag-like sachets. Both varieties are sold in tins or round paper or plastic boxes. Loose snus is a moist powder which can be formed into a cylindrical or spherical shape with the fingertips. The end result is referred to as a *pris* (pinch) or *prilla.* Longtime users may simply pinch the tobacco in place under the upper lip where it is kept in the recess between gingiva and lip. Prepacked portion snus, the better selling variety, usually contains smaller doses that can be used more discreetly. Swedish snus, in both loose and sachet forms, is placed under the upper lip for a period of 30 minutes to a couple of hours. The nicotine in snus is absorbed through the mucous membrane of the oral cavity, as are other substances. The juice produced in this process is usually swallowed and spitting is uncommon. Prepacked portion snus comes in two variants. The original portion, introduced in 1977, is packed in a moisturized brown material when manufactured; the white portion is packed in white sachet material and not moisturized. Prepacked portion snus is available in three different sizes: mini, normal/large, and maxi. Total portion weight in boxes or tins may vary, but mini portions weigh 0.5 g, normal/large portions weigh 1 g, and maxi portions weigh 1.7 g. Swedish snus is sold in general stores, convenience stores, gas stations, tobacco shops, and from vending machines in shops and restaurants. It is often stored in refrigerators to minimize fermentation and bacterial growth.

The price of snus compared to cigarettes varies according to country. A box of the General brand of Swedish snus costs between US$5.50 and $7.20 (37 to 49 Swedish kronor), and a pack of Marlboro cigarettes costs US$7.20 (49 Swedish kronor).[25] In Norway these two products cost

between US$8.50 and $13.50 for General snus (51 to 81 Norwegian kronor) and roughly US$14.00 (84 Norwegian kronor) for Marlboro cigarettes.[26]

In 2012, it was estimated that over 200 different varieties of snus were offered on the Swedish market.[27] The products differ in packaging, alkalinity, other additives, and flavoring. Flavoring of snus is abundant. The largest manufacturer, Swedish Match, lists over 240 ingredients that are used as flavors in snus, including herbal extracts (e.g., menthol), spices/flavorings (ginger, basil, and lime oil/extract), and alcohol (whiskey).[28] General is the best-selling brand of snus in Sweden.

Snus manufactured in Sweden is sold in Nordic countries as well as in other countries around the world. There are about a dozen manufacturers of snus, and Swedish Match is the dominant producer, with about 85% of the market in Sweden and 70% of the market in Norway.[29] Smaller domestic companies market products mostly within the Nordic region. The Nordic market has been fairly stable since the year 2000. In European Region countries other than the Nordic countries, international tobacco companies such as British American Tobacco, Japan Tobacco International, Philip Morris, and Imperial Tobacco market snus products that are not considered Swedish snus and do not meet the manufacturing standards set for Swedish snus.

Uzbekistan and Kyrgyzstan

In both Uzbekistan and Kyrgyzstan, the most commonly used form of ST is known as nasway or nasvay. As central Asian countries, they are geographically close to Pakistan and Afghanistan (in the WHO Eastern Mediterranean Region) where this product is referred to as nass, naswar, or niswar.[20,30] Nasway contains the same main ingredients as nass, but the published information is insufficient to determine if nass and nasway are exactly the same product.

In Uzbekistan and Kyrgyzstan, nasway is mostly produced as a custom-made or cottage industry product. Nasway is partially manufactured before it is sold to consumers. The core ingredients are locally grown, sun-dried tobacco and an alkalinity modifier such as ash or slaked lime (calcium hydroxide).[20,30] Other flavorings and spices such as cardamom or menthol may be added according to preference. The product also contains an emulsifying agent such as butter or oil. Water is added during mixing of the ingredients, and the mixture is then rolled into balls. A ball is placed under the tongue on the floor of the mouth and sucked. Nasway is sold in 15- to 20-gram packs at US$0.21 in Uzbekistan, where it is cheaper than locally produced cigarettes (US$0.35 per pack).[17]

Toxicity and Nicotine Profiles of Products

United Kingdom

Some of the South Asian ST products used in the UK contain *Nicotiana rustica,* a tobacco with high alkalinity and a higher concentration of nicotine than the more commonly used tobacco, *N. tabacum*. In India, most ST products are made of *N. rustica*, while smoking tobacco tends to be made of *N. tabacum.* (For more information on the toxicity and nicotine profiles of ST products used in England, see chapter 3.)

One study investigating the toxicity of some of the products available in the UK assessed data on nicotine content and tobacco-specific nitrosamine levels, and found that all the tested products were likely to be hazardous to users' health, with all but 1 of 11 tested brands containing tobacco-specific nitrosamines (TSNAs) at varying levels. Nicotine ranged from 3 milligrams per gram (mg/g) to 83.5 mg/g in these tobacco products, with gutka at the low end of the range and tobacco leaf at the highest. Free nicotine was also high in several of the gutka products as well as in tooth-cleaning powder and Swedish snus (between 3 mg/g and 63.2 mg/g in these products). Gutka and tooth-cleaning powder also had the highest pH levels of the products tested.[31]

An additional UK data source is the Niche Tobacco Products Directory (NTPD).[32] This website informs the activities of local authorities and excise enforcement officers with respect to ST regulation and seizure. The directory focuses primarily on the tobacco content of a product; it does not report additional toxicity information. The NTPD data suggest that tobacco content varies considerably, particularly in Bangladeshi products; the tobacco content of one popular zarda brand was observed as varying between 5% and 20%. An assay of the contents of paan/khilli paan sold in London found that the mean tobacco weight was 0.65 g (95% CI: 0.56–0.76) and the mean weight of slaked lime (calcium hydroxide) was 0.58 g (95% CI: 0.41–0.75).[21] Although zarda alone has a relatively low pH, the mixture of slaked lime and zarda used in paan/khilli paan varied between pH 12.2 and pH 12.5, indicating that 99% of the nicotine was available as free nicotine.[21]

Nordic Countries

Swedish snus products vary in their levels of nicotine content and free nicotine. For example, so-called "starter" brands such as Catch Mint often have a lower pH and less free nicotine, and stronger varieties such as General, the market's leading brand, have a higher alkalinity.

All manufacturers of Swedish snus pasteurize their products, and most adhere to the GothiaTek standard (Table 10-5).[33] As a consequence, snus products manufactured in Sweden using this standard have lower levels of toxicants than most products found in other countries. This voluntary standard[34] comprises the following requirements with respect to:

- *Manufacturing*
  - Adherence to the International Organization for Standardization's quality standard ISO 9001:2000 and environmental standard 1401:1996.
- *Raw materials*
  - Selected leaf tobacco is used; additives should comply with requirements specified in the Swedish Food Act.
- *Process*
  - Snus pasteurization involves heat treating to kill the natural microbial flora. The manufacturing process must be performed in a closed system, and the tobacco must be comminuted (i.e., made into a powder) in a controlled process. Directly after packaging, the finished product is placed into cold storage with a maximum temperature of 8ºC.

- *Manufacturing hygiene*
  - All product exposure must satisfy the hygiene requirements of food manufacturing.
  - The processing equipment is cleaned and disinfected at least once in every production cycle, and packaging machinery is cleaned and disinfected at least once every 24 hours. Water activity, bacterial content, and shelf-life stability are tested on finished products. The packaging material must also satisfy hygiene standards.
  - The results of all controls must meet the tolerance limits specified for Swedish snus by GothiaTek.

Table 10-5. The GothiaTek standard limits and average content for important toxic constituents in tobacco, 2011

Component	Limit	Content* (2011) (±2 SD)	Component (mg/kg)	Limit*	Content* (2011) (±2 SD)
Nitrite (mg/kg)	3.5	1.0 (<0.5–1.9)	Cadmium	0.5	0.2 (0.1–1.4)
TSNA (mg/kg)	5	0.7 (0.5–1.1)	Lead	1.0	0.1 (0.05–0.2)
NDMA (µg/kg)	5	0.4 (<0.3–1.1)	Arsenic	0.25	<0.05 (<0.05–0.09)
BaP (µg/kg)	10	0.5 (<0.5–0.8)	Nickel	2.25	0.7 (0.3–1.0)
Agrochemicals	According to Swedish Match Agrochemical Management Program	Below Swedish Match internal limits	Chromium	1.5	0.3 (0.1– 0.6)

*Limits and average contents are based on Swedish snus with 50% water content.
Abbreviations: TSNA = tobacco-specific nitrosamines; NDMA = *N*-nitrosodimethylamine; BaP = benzo*(a)*pyrene; SD = standard deviation; mg/kg = milligram per kilogram; µg/kg = microgram per kilogram.
Source: Swedish Match 2012 (34).

Uzbekistan and Kyrgyzstan

The predominant product in these countries, nasway, is made from *N. rustica,* which has a higher concentration of nicotine than common tobacco. Nasway samples have high pH levels and contain more than 70% free nicotine, indicating their high potential for causing dependency.[35]

Health Problems Associated With Use

The carcinogenicity of ST has been evaluated by the IARC,[20] which concluded that ST is carcinogenic. This section discusses data on cancer, addiction, and other health problems associated with ST use specific to the UK, the Nordic countries, Uzbekistan, and Kyrgyzstan.

United Kingdom

Data on cancer incidence rates suggest that cancer of the oral cavity (excluding the inner part of the lip and the hard palate) is one of the most common subtypes of head and neck cancer.[36] Among the more than 6,400 people diagnosed with head and neck cancers in 2007 in the UK, more than

2,000 (approximately 1,200 men and 800 women) had oral cavity cancer. Rates of oral cavity cancer in the UK increased between 1990 and 2007 by nearly 30%.[36] In addition to smoking and drinking alcohol, chewing paan/khilli paan by ethnic South Asians is suggested as the main risk factor. London, which has many South Asian communities, has the highest incidence rate for oral cancer, with a higher incidence of oral and pharyngeal cancer among women of South Asian origin. Other data indicate that women of South Asian origin were more than three times more likely to have oral cancer than non–South Asian women (incident rate ratio = 3.7, 95% CI: 3.0–4.5), after controlling for levels of social deprivation.[37]

A second major health consequence in the UK is the creation of nicotine dependence, specifically among people who chew paan/khilli paan with tobacco. Studies validating self-report measures of dependency with salivary cotinine scores found associations with a high daily consumption frequency, having the first paan within 1 hour of waking, and feelings of craving.[11] Of particular concern in relation to high dependency is the dual use of tobacco leaf and zarda together in paan/khilli paan.

Nordic Countries

Because the GothiaTek standard of snus manufacturing and storage was adopted in the late 1990s, the health effects of long-term exposure to modern Swedish snus manufactured under this standard are largely unknown as of this writing (2014).

Habitually placing snus in the same place in the mouth often leads to irritation of the gum ("the snus lesion").[38] A comprehensive meta-analysis of the health effects of ST found mixed, inconclusive evidence for the role of snus in periodontal conditions including gingival diseases.[38] This work (and the earlier reviews underpinning it) was supported by Philip Morris Products, Swedish Match, and the European Smokeless Tobacco Council (comprised of tobacco manufacturers and distributors and representing tobacco industry interests).

In 2008 the EU Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) published its opinion "Health Effects of Smokeless Tobacco Products," with particular emphasis on snus, noting that these products are addictive and hazardous to health.[30] Results of epidemiologic studies on snus use and cancer are not fully consistent. A 2008 review[39] of the existing evidence concluded that snus is carcinogenic. In Northern European studies, the relative risk of snus use for esophageal cancer was found to be 1.6 (95% CI: 1.1–2.3) and for pancreatic cancer, 1.6 (95% CI: 1.1–2.2). A meta-analysis funded by the European Smokeless Tobacco Council found that when adjusting for smoking, smokeless tobacco products in general had a significant association of 1.4 for oropharyngeal cancer (95% CI: 1.0–1.8) and 1.3 for prostate cancer (95% CI: 1.1–1.6).[40] When only looking at reports published since 1990, the Council found that the association with oropharyngeal cancer was not significant.

Epidemiologic studies and experimental animal studies show that snus affects the cardiovascular system—for example, blood pressure and pulse rate. The evidence regarding an association between long-term use of snus and hypertension is not consistent. Snus use does not appear to increase the risk of myocardial infarction (heart attack),[41,42] but it is associated with an increased risk of mortality from heart disease, including myocardial infarction.[41,43] Similarly, long-term snus users seem to be at increased risk for fatal stroke (relative risk: 1.4, 95% CI: 1.3–1.5).[41,44]

The available evidence is too limited to allow firm conclusions about snus use in relation to diabetes. The evidence regarding snus use during pregnancy is also limited. Results of one Swedish study showed an increased risk of pre-term delivery and pre-eclampsia for mothers who used snus during pregnancy.[45]

Uzbekistan and Kyrgyzstan

In addition to the potential for dependency, the literature identifies use of nasway in these countries as a risk factor for esophageal squamous cell carcinoma and oral precancerous lesions such as oral leukoplakia (precancerous lesions).[46] Lifetime Uzbek nasway users were more than five times as likely (OR = 5.2, 95% CI: 3.1–8.6) to develop oral leukoplakia as never users.[46]

Marketing and Production Practices of Industry

United Kingdom

Marketing of ST in the UK is informal, relying on point-of-sale displays, packaging styles, and affordability. Since most of the ST products in the UK are imported from India, they are marketed and sold to differing ethnic subgroups in the region.

Product brands and their associated packaging and displays follow recognizable themes:

- *Respect.* "Baba," the name of a zarda brand from India, is an honorific denoting respect; it means sir, father, grandfather, wise old man. References to age and wisdom may also be made through illustrations on packaging.
- *Health, medicinal plants.* "Tulsi," a gutka brand from India, is the name of the herb basil, which contains eugenol, a substance with analgesic and antiseptic properties. Basil is widely known across South Asia as a medicinal plant and is commonly used in Ayurvedic medicine to treat a range of conditions, including bronchitis, asthma, malaria, and arthritis.
- *Prosperity.* "Kuber," a khaini brand from India, is the name of the lord of wealth in Hindu tradition; he is also recognized within Buddhism and Jainism. Kuber is usually depicted as a fat, bejeweled man carrying a money bag.

Nordic Countries

As previously mentioned, all manufacturers of Swedish snus must adhere to the GothiaTek quality standard that was voluntarily adopted by the industry in the late 1990s.[33] Initial efforts to improve production standards began in the late 1960s when concerns were raised about the formation of ammonia and nitrate in snus, as well as other quality problems. In 1971, snus came under jurisdiction of the Swedish Food Act, requiring manufacturers to implement new quality control measures, which continued to be developed over several decades.[33]

The EU prohibits the sale of oral tobacco products—that is, moist snuff or snus—in EU countries such as Denmark and Finland, but allows these products to be sold in Sweden. Swedish snus is rarely used in Denmark, but it is acquired illicitly in Finland, particularly by that country's Swedish-speaking minority. The prohibition of snus sales within the EU has repeatedly been challenged by Swedish Match and by the Swedish Ministries of Trade and of Health and Social Affairs. Swedish Match dominates

the production in this region, and its market has not changed much in the last decade. Internet purchases are still possible, but most Internet-based vendors are located in Sweden and they market to other EU citizens.[47]

Point-of-sale advertising is largely unrestricted in Sweden but banned in Norway, where all tobacco products are stored behind closed shutters marked "Tobakk" (grey cabinet) or "Snus" (white cabinet). Media advertising of all tobacco products (on TV, radio, print media, and outdoor billboards) is banned or restricted in Sweden, Norway, and Iceland. Norway's comprehensive ban on tobacco advertising also bans indirect advertising, such as advertisements for non-tobacco products that depict tobacco or advertising using colors and designs that resemble tobacco brands.

Uzbekistan and Kyrgyzstan

Nasway is produced by cottage industries, or in some cases, is custom-made. Nasway originating from Pakistan is available for wholesale purchase on the Internet. No marketing data are available for Kyrgyzstan.

Current Policy and Interventions

The European Union

The health risks of tobacco use are well recognized within the EU, where initial tobacco control measures were introduced in 1987.[48] The EU is the only regional political and economic entity that has become a full signatory to the WHO Framework Convention for Tobacco Control (FCTC). At the beginning of the FCTC negotiations, the EU had already implemented a public information campaign and banned TV advertising of tobacco products and sponsorship by tobacco companies.[49] The EU tobacco product labeling requirements predate FCTC Article 11. Since the introduction of the FCTC, the EU has chaired the Intergovernmental Negotiating Body on Illicit Trade (FCTC Article 15). EU tobacco control activity is cross-cutting, also affecting taxation, illicit trade, and agricultural policies. As of 2013, two Nordic countries, Norway and Iceland, are not EU members but follow most of the EU tobacco regulatory framework.

The EU Tobacco Products Directive (EU Directive 2001/37/EC) was issued in 2001 and intended to be a model on which individual states could pattern their own tobacco regulations.[3] The Directive establishes warnings on packs, product traceability, annual reporting of ingredients, and maximum yields of tar, nicotine, and carbon monoxide in cigarettes, and prohibits use of the terms "mild" and "light." According to the Directive, text warnings are mandatory but pictorial warnings are optional (Table 10-6). Seven EU member states and three non–EU European states have adopted pictorial warnings for cigarettes.

In December 2012, the EU adopted a proposal to revise the Tobacco Products Directive that would further restrict the manufacture, sale, and presentation of tobacco products. The proposal maintains a ban on oral tobacco products, except in Sweden, and proposes major revisions such as a ban on characterizing flavors, prior notification for retailers intending to sell products across borders (such as Internet retailers) and for manufacturers intending to sell novel tobacco products, and mandatory pictorial health warnings for cigarettes but not ST products. The proposal is expected to be adopted by the EU in 2014 and go into effect in 2015–2016.

Table 10-6. EU Tobacco Products Directive: Regulations for cigarettes and smokeless tobacco in the 2001 Directive (2001/37/EC) and the December 2012 proposal

Legal control	Year	Cigarettes	Smokeless tobacco
Ingredients	2001	List of ingredients and their quantities, purpose, and health effects must be disclosed and made public	List of ingredients and their quantities, purpose, and health effects must be disclosed and made public
	2012 Proposal	Ban on characterizing flavors	Ban on characterizing flavors
Maximum yields information	2001	Maximum yields of tar, carbon monoxide, and nicotine covering at least 10% of the package	No maximum yields required
	2012 Proposal	Maximum yields are maintained, but labeling of this information is considered misleading and will be changed	No maximum yields required
Traceability	2001	Code identifying place, time, and date of manufacture	Code identifying place, time, and date of manufacture
	2012 Proposal	Fully implement tracking system with security features to easily identify authentic tobacco products and hinder illicit trade	Same as cigarettes, except ST products are granted a 5-year transitional period
Health warnings	2001	Two warnings: Front: One of two general warnings covering at least 30% of surface; Back: One of 14 rotating warnings covering at least 40% of surface	One warning: "This product can damage your health and is addictive." Warning covers at least 30% of surface
	2012 Proposal	Combined pictorial and text warning must cover 75% of front and back of the package	Health warning must be placed on both sides package, but size remains the same
Pictorial warnings	2001	Optional*	Optional
	2012 Proposal	Required	Optional

*As of 2011, pictorial warnings for cigarettes have been adopted voluntarily by seven EU members.
Sources: For information on the 2001 Directive: The European Parliament and the Council of the European Union 2001 (3). For information on the 2012 proposal: European Commission 2012 (72).

With respect to ST products, the Directive distinguishes between:

- *Tobacco products*: "products for the purposes of smoking, sniffing, sucking or chewing inasmuch as they are, even partly, made of tobacco," and
- *Tobacco for oral use*: "all products for oral use, except those intended to be smoked or chewed, made wholly or partly of tobacco, in powder or particulate form … particularly those presented in sachet portions … or in a form resembling a food product."[3]

Tobacco products "for oral use," namely snus and moist snuff, are prohibited within the EU at this writing (2013). The UK had previously banned these products following an attempt in the mid-1980s to introduce a new ST product (Skoal Bandits) that targeted adolescents in the UK.[50] Sweden was allowed to retain its use of snus, an oral moist snuff, at its accession to the EU.

The Directive's regulations differ for smoked tobacco and ST (see Table 10-6), most obviously with respect to requiring that packaging display health warnings. There have been no EU–wide proposals for pictorial warnings on ST products specifically, although some member states have proposed adopting pictorial warnings and increasing the size of warnings for cigarettes.

Reports and consultations from the UK have contributed to regional debates about the possible role of ST in helping smokers quit, and about appropriate public health responses to diversification of the ST market.[51,52] These efforts have collectively highlighted the need to develop a consistent and inclusive regulatory approach sufficient for all nicotine-containing products, whether medicinal, smoked, or smokeless.

United Kingdom

An example of a campaign to prevent the adverse health effects of ST use, an oral cancer prevention program, Open Up to Mouth Cancer, developed by Cancer Research UK, was introduced in a Bangladeshi community in the UK.[53] More than 1,300 participants were recruited, of whom 75 were urgently referred for further investigation. Participants with low education levels or who chewed paan with tobacco were more likely to be referred for further investigation. Four in 10 tobacco users attending one phase of the screening were recruited into a flexible community outreach service offering cessation support.[53] An evaluation of the campaign materials developed for this community demonstrated that accessing these materials improved participants' knowledge of oral cancer prevention and of the adverse effects of using smokeless tobacco.[54]

Regarding ST cessation interventions, the English National Health Service developed guidance for the Stop Smoking Service[55,56] that reflects advances in the evidence base. These guidelines advise that cessation services for ST users should be discretionary, and limited evidence suggests that behavioral support may be effective for some individuals.

Two studies have been published on cessation support for UK resident Bangladeshi ST users.[22,57] The first study compared a single session of brief advice and encouragement with weekly behavioral advice and access to nicotine replacement therapy (NRT) patches. The researchers found that the intervention providing advice and access to NRT was associated with more successful, although not statistically

significant, cessation with respect to cotinine-validated abstinence at 4 weeks. The second report, a prospective cohort study of a flexible community outreach service, found that NRT use, community recruitment, and living in a relatively less deprived area predicted short-term self-reported quit success. Wider dissemination of this service delivery model has continued to demonstrate similar outcomes and high levels of client satisfaction.[58]

The tobacco control plan for the UK as of 2011 is built around the WHO MPOWER principles and includes proposals for (1) harmonizing the regulation of smoked and ST products within the context of the EU Tobacco Products Directive, (2) implementing the Health Act (2009), and (3) calling upon the National Institute for Health and Clinical Excellence (NICE) to provide public health guidance to help people of South Asian origin stop using smokeless tobacco.[59] Although the UK was the third country in the EU to introduce pictorial warnings on cigarettes specifically, it was the first nation to introduce them on all tobacco product packaging.[60] The 2009 Health Act prohibits displays of tobacco products, whether smoked or smokeless, at point of sale, and is the first UK legislation to include both tobacco types. However, the timetable for implementing the Act has been relaxed, and small retail outlets, such as those selling ST products, will not be required to comply until 2015. The NICE Public Health guidance, published in 2012, proposes a systematic engagement with South Asian communities in the planning and implementation of smokeless tobacco cessation services.[61] While endorsing the current advice to adopt behavioral support for cessation attempts, the report notes that nicotine replacement therapy should be used for clients with demonstrable clinical need. The UK's tobacco control plan commits to further developing the Web-based Niche Tobacco Products Directory.

In addition, local initiatives have also been attempted, such as classifying spitting paan/khilli paan juice as criminal damage liable to a fixed-penalty enforcement.[62]

Nordic Countries

Prominent among the nongovernmental organizations in Sweden that have successfully advocated for tobacco control is Health Professionals Against Tobacco. This alliance of doctors, dentists, nurses, teachers, and psychologists has worked since 1992 to promote a tobacco-free Sweden through monitoring the political process, increasing awareness and availability of information material, and engaging in international cooperation.[63]

Although switching from cigarette smoking to snus use is sometimes presented as a preventive measure, the public health community has not supported it. No community programs have advised this switch, but an estimated 20% of general medical practitioners may advise individual patients to switch from smoking to snus.[64] However, rates of cessation and attempts to quit are lower among snus users than cigarette users.[65,66] Although limited research is available for snus-specific interventions, varenicline has been demonstrated to significantly aid snus cessation.[67]

Uzbekistan and Kyrgyzstan

Kyrgyzstan is an FCTC signatory; Uzbekistan is not. The two countries vary in their commitments to population protection, cessation promotion, provision of health warnings, and enforcement of bans on tobacco advertising. Kyrgyzstan has adopted specific national objectives for tobacco control and a tobacco control budget that funds a national unit for tobacco control, but Uzbekistan has undertaken neither of these initiatives.

In Uzbekistan, health warnings are required on cigarette packaging only. Tobacco advertising in the national media and outdoors is banned. Kyrgyzstan is reported to require health warnings on ST products. Legal mandates also control the percentage of the package these warnings will cover and specify the number and wording of health warnings as well as the fines for violations. Kyrgyzstan has a wider range of bans on tobacco advertising, promotion, and sponsorship than Uzbekistan.

Summary and Conclusions

Given that the European Region contains two populations with longstanding traditions of ST use—the Scandinavian countries of Sweden and Norway, and the large South Asian community that has immigrated to Europe, particularly the UK—the trajectory of ST use in this region is of vital importance.

European regional data on tobacco use are primarily focused on cigarette smoking, therefore additional information is needed on smokeless tobacco. The dataset cited in this chapter provides adult ST prevalence data for fewer than one-third of the European Region's countries. In addition to the paucity of data about adult prevalence, little information is available on youth ST use. From the available evidence, ST prevalence among adults varies from 0.1% in Switzerland to 17.0% in Sweden.

Swedish snus has been historically used in the Nordic countries, and additional products are imported from South Asia and used by communities of South Asian origin in the UK. In the European region, nasway (nasvay) is used primarily in Uzbekistan and Kyrgyzstan. In Denmark, Germany, and the UK, national companies produce twisted tobacco for oral use.

Swedish snus and South Asian ST products have demonstrably different health risk profiles, although the adverse health effects of snus products specifically manufactured according to the GothiaTek standard are largely unknown. With respect to preventing ST use, screening and diagnosing health consequences, and assisting chewers to quit, there is little coherent activity throughout the region. Prevention and cessation efforts have remained focused predominantly on smoking. The mandated requirement in Kyrgyzstan for health warnings on nasway is an example from outside the EU of tobacco control regulation that may have a wider geographical applicability.

This chapter has highlighted the role of the EU as a key player in leading tobacco control efforts within the European Region. Although the sale of moist snuff or snus is restricted in EU countries such as Denmark and Finland, it is allowed in Sweden. The prohibition of snus sales within the EU has been challenged by Swedish Match and by the Swedish Ministry of Trade and Ministry of Health and Social Affairs on numerous occasions. Identified gaps in surveillance activity have had a negative impact on

the development of coherent, inclusive, evidence-based tobacco control regulation within the EU. Characterizing some of these products as "niche" or marginal may preclude development of the desired evidence base.

In addition to European Union efforts, local initiatives can make important contributions to global tobacco control and prevention. For example, bilateral agreements could ensure that exported ST products comply with regulations of the importing countries. Three of the seven leading ST brands sold in the UK are manufactured and distributed by two Indian conglomerates. Implementation of bilateral arrangements might also benefit consumers in these conglomerates' domestic markets. The number of gutka brands available for purchase in the UK declined following a 2011 Indian Supreme Court order banning the use of plastic as a gutka packaging material,[68] thus restricting its export. In Sweden, there are no fines for throwing away cigarette butts and snus sachets on the streets, and these discarded items make up most of the litter on the streets; the environmental impact of this litter awaits appropriate investigation. In the UK, the 2009 Health Act demonstrates how ST products can be included in legislation along with smoked tobacco products simply by using the more general term "tobacco" to define these products. Lastly, in the UK the Niche Tobacco Products Directory illustrates the potential of a publicly available Web-based resource to strengthen the ST policy agenda.

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Chapter 11

Smokeless Tobacco Use in the Eastern Mediterranean Region

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Description of the Region

According to the World Health Organization (WHO), the Eastern Mediterranean Region consists of 23 countries, extending from Morocco to Pakistan. It includes most countries of the Middle East, North Africa (except Algeria), and South-West Asia (Table 11-1). The Eastern Mediterranean Region covers an area of 13,962,083 square kilometers, and its population is estimated at 608 million people, or about 8% of the total world population.[1] Tobacco use is prevalent in this region, the predominant form being manufactured cigarettes, followed by tobacco used in waterpipes (shisha, nargila).

Table 11-1. Population and land area of countries in the Eastern Mediterranean Region

Country*	Area in km^2	Population (thousands)
Afghanistan	654,412	31,412
Bahrain	694	1,262
Djibouti	23,395	889
Egypt	1,001,494	81,121
Gaza Strip (Palestine)†	360	1,710
Iran (Islamic Republic of)	1,643,867	73,974
Iraq	439,889	31,672
Jordan	89,667	6,187
Kuwait	17,773	2,737
Lebanon	10,414	4,228
Libya	1,588,750	6,355
Morocco	443,764	31,951
Oman	309,111	2,782
Pakistan	796,298	173,593
Qatar	10,994	1,759
Saudi Arabia	2,111,385	27,448
Somalia	622,067	9,331
South Sudan†	644,329	10,625
Sudan	2,561,882	43,552
Syrian Arab Republic	185,555	20,411
Tunisia	163,765	10,481
United Arab Emirates	83,467	7,512
West Bank (Palestine)†	5,860	2,623
Yemen	552,891	24,053
Total	**13,962,083**	**607,668**

*Unless otherwise indicated, data are from: United Nations 2011 (1).
†For data on the Gaza Strip, the West Bank, and South Sudan: Central Intelligence Agency 2012 (57).
Abbreviation: km = kilometer.

Prevalence of Smokeless Tobacco Use

In a few countries of the Eastern Mediterranean Region, such as Sudan, Yemen, and Pakistan, locally made or produced smokeless tobacco (ST) products are widely consumed. In other countries such as Egypt, the most populous Arab country, ST use has markedly increased among adults, according to the Global Adult Tobacco Survey (GATS).[2,3] This section focuses on the prevalence of ST use among adults in countries for which some data are available. Table 11-2 shows the types of ST products used in Eastern Mediterranean Region countries.

Table 11-2. Types of smokeless tobacco products used in the Eastern Mediterranean Region, by country

Country	Smokeless tobacco product used	Source*
Bahrain	Chewable-based tobacco products (undefined)	Time Out Bahrain 2009 (55)
Egypt	Undefined	World Health Organization (WHO) 2010 (2)
Iran	Nass	Islami 2009 (51); Joint Iran–International Agency for Research on Cancer Study Group 1977 (52)
Libya	Chewing tobacco (undefined)	International Agency for Research on Cancer (IARC) 2007 (32); WHO 2011 (11)
Pakistan	Paan and naswar	Ali 2009 (7); Imam 2007 (9); Khawaja 2006 (8); Merchant 2000 (12); Maher 1994 (13); Shah 1992 (14); Euromonitor 2010 (6)
Qatar	Chewing tobacco (undefined)	Al-Kuwari 2008 (58)
Saudi Arabia	Mainly shammah	Allard 1999 (17); Ibrahim 1986 (18); Salem 1984 (19)
Sudan	Toombak	Costea 2010 (39); Ibrahim 1996 (41), 1998 (42); Ahmed 2003 (36), 2007 (37); Ibrahim 2002 (43); Idris 1991 (44), 1992 (45), 1994 (46), 1995 (47), 1995 (48), 1996 (49), 1998 (4), 1998 (50); Elbeshir 1989 (40); Boulos 1977 (38)
Tunisia	Snuff	WHO 2011 (11); Fakhfakh 2005 (59)
United Arab Emirates	Paan and niswar	The National 2009 (15); Bowman 2008 (16)
Yemen	Shammah	Ministry of Public Health (Yemen) 2003 (5)

*Numbers in parentheses correspond to full citations in the References at the end of this chapter.

Few studies and reports have been published on ST use in the Eastern Mediterranean Region. Table 11-3 illustrates the prevalence of ST use among adolescents aged 13 to 15 years, and Table 11-4 and Map 11-1 show the prevalence among adults, according to national surveys. Data was collected from multiple surveys including the Global Youth Tobacco Survey (GYTS), Global Adult Tobacco Survey (GATS), WHO STEPwise Approach to Surveillance (WHO STEPS), and various individual country surveys as reported in the *WHO Report on the Global Tobacco Epidemic, 2011* (GTCR). Some clinical researchers have reported the use of ST in specific countries without stating the prevalence of use in those countries. Comparisons among surveys should be made with caution because of differences in definitions and methods, including sampling methods, used across surveys. Surveys' definitions of

current use vary. For example, some surveys define current use as any use within the past 30 days, while other surveys ask about different time periods; some surveys ask about daily use and use on some days, and still other surveys ask about "current" use without defining the term further. Surveys of this region define current use by youth as at least one use in the past 30 days; current use among adults is defined as daily or less than daily use.

Table 11-3. Percentage of adolescents aged 13–15 years who currently used smokeless tobacco in the Eastern Mediterranean Region, from the Global Youth Tobacco Surveys, 2007–2010

Country	Year	Total (%)	Boys (%)	Girls (%)
Djibouti	2009	12.6	15.2	9.0
Gaza Strip (Palestine)*	2008	8.9	9.2	8.3
Iraq – Baghdad	2008	6.9	7.2	5.8
Iran	2007	5.1	5.4	4.8
Libya	2010	2.3	2.0	2.3
Lebanon*	2008	6.5	6.5	6.4
Oman	2010	1.6	2.5	0.9
Pakistan – Karachi	2008	10.8	13.8	7.4
Pakistan – Quetta	2008	7.5	6.8	7.9
Pakistan – Lahore	2008	4.2	5.8	3.1
Pakistan – Peshawar	2008	6.0	8.0	2.6
Qatar	2007	7.0	7.6	6.1
Saudi Arabia	2010	3.4	4.8	1.8
Syrian Arab Republic	2010	5.7	7.9	3.5
Tunisia	2010	2.3	3.9	0.9
West Bank (Palestine)	2008	9.1	7.7	9.2
Yemen	2008	8.6	8.2	8.4

*These surveys were conducted in schools run by UNRWA (the U.N. Relief and Works Agency for Palestine Refugees in the Near East).
Source: Global Youth Tobacco Surveys, 2007–2010 (60).

Table 11-4. Percentage of adults who currently used smokeless tobacco in the Eastern Mediterranean Region, 2003–2009

Country	Year	Age group (years)	Total (%)	Men (%)	Women (%)
Egypt*	2009	15+	2.2	4.1	0.3
Libya†	2009	25–64	1.2	2.2	0.1
Saudi Arabia†	2004	15–64	—	1.3	0.5
Tunisia‡	2005–06	35–70	5.4	8.6	2.2
Yemen‡	2003	15+	10.7	15.1	6.2

*Global Adult Tobacco Surveys, 2008–2010 (3).
†WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (11).
‡Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (11).

Map 11-1. Prevalence of smokeless tobacco use among adults in the World Health Organization's Eastern Mediterranean Region

Note: Prevalence rate for males and females combined was not available for Saudi Arabia. A total figure was calculated by averaging the available male and female rate.
Sources: Global Adult Tobacco Surveys, 2008–2010 (3); WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (11); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (11).

Sudan

Toombak is the type of ST most commonly used in Sudan, where historical prevalence of use was reported at 34.0% among men and 2.5% among women in the Nile states.[4] According to 2011 unpublished estimates presented by the Sudan Toombak and Smoking Research Center, the prevalence of toombak use is 24.2% in the Nile states, 40.7% in the Northern states, 36.5% in the Eastern states, and 21.2% in the capital, Khartoum. In western Sudan, the prevalence of use is exceedingly low, which reflects cultural and tribal influences on the use of tobacco.

Yemen

Despite the wide use of ST, known as shammah, in Yemen, up-to-date data are limited. The most comprehensive study is the 2003 Family Health Survey, which used weighted sampling units or cluster methodology to produce estimates of general indicators for Yemen as a whole and for urban and rural areas.[5] The total sample size was 13,815 households (3,173 in urban areas, and 10,642 in rural areas). According to this survey, 10.7% of the population aged 10 years or older used shammah; in rural areas, this percentage was 12.5%. In addition, 6.2% of females were current users of shammah (Table 11-5), while current use among men was reported as 15.1%. The percentage of current users increased with age for both males and females (Figure 11-1).

Table 11-5. Prevalence of shammah use in Yemen, by residence and sex

Shammah*	Urban	Rural	Male	Female	Total†
Current users	5.2%	12.5%	15.1%	6.2%	10.7%
Previous users	0.5%	0.8%	1.0%	0.5%	0.8%
Never used	93.7%	86.1%	83.3%	92.7%	88.0%
Don't know/not stated	0.6%	0.6%	0.6%	0.5%	0.6%
Total respondents	15,030	46,568	31,094	30,504	61,598

*Prevalence is indicated in this table by number and percentage of individual users; the text describes the prevalence by household.
†Because of rounding, percentages total 100.1%.
Source: Ministry of Public Health (Yemen) 2003 (5).

Figure 11-1. Prevalence of shammah use in Yemen, by age and sex

Source: Ministry of Public Health (Yemen) 2003 (5).

Egypt

The 2009 Global Adult Tobacco Survey in Egypt[2,3] found that between 2% and 3% of the population uses smokeless tobacco. This is the first study in Egypt to document that ST is the third most widely used form of tobacco in the country after cigarettes and shisha. Among survey respondents aged 15 years and older, 2.2% (over 1 million Egyptians) used ST; prevalence of ST use was 4.1% for males and 0.3% for females. Daily use of ST increased with age: from 1.9% for males aged 15–24 years to greater than 5% for men over the age of 25.

Prevalence of current ST use among males and females ranged from 1.4% in urban Lower Egypt to 3.5% in rural Upper Egypt; in the most urbanized cities, called the Cosmopolitan Governorates, 5.3% of males and 0.6% of females were ST users (Figure 11-2). The use of ST was higher for males with at most some primary education (8%, 95% confidence interval [CI]: 5.9%–10.9%) compared with those with university or higher education (2.4%, 95% CI: 1.6%–3.7%) (Figure 11-3).

Figure 11-2. Percentage of the Egyptian population using smokeless tobacco, by geographic area

Source: World Health Organization 2010 (GATS, Egypt) (2).

Figure 11-3. Percentage of the Egyptian population using smokeless tobacco, by education level

Source: World Health Organization 2010 (GATS, Egypt) (2).

Pakistan and India

High rates of ST use are reported in both Pakistan and India. The traditional product, paan (also known as betel quid) which can be used with or without tobacco, has been losing favor in recent years (as of 2010) to gutka and khaini, the two tobacco products most widely used in India.[6] Other frequently used tobacco products in Pakistan include naswar.[6]

In a cross-sectional study of 502 adults attending family practice clinics, 52.4% used ST in at least one form.[7] In another study in a low socioeconomic group in Karachi, 40% of those surveyed were daily users.[8] Use by men significantly exceeds use by women.[9] As noted in many low- and middle-income countries, social acceptance of ST is widespread, its serious health complications are not recognized, and ST use is promoted to youth.[7,10]

Other Countries

Individual country surveys reported in the *WHO Report on the Global Tobacco Epidemic, 2011*[10,11] reveal the following prevalence rates:

- The 2009 Libyan STEPwise approach to Surveillance (STEPS) Survey showed that 2.2% of men, 0.1% of women, and 1.2% of total participants between the ages of 25 and 64 years were current users of smokeless tobacco.
- The Saudi Arabian STEPS Survey in 2004 showed that 1.3% of males and 0.5% of females between 15 and 64 years old were daily users of smokeless tobacco.
- In Tunisia, the National Survey for Morbidity and Care-Seeking (Enquête nationale morbidité et recours aux soins) in 2005–2006 showed that the prevalence of snuff use by people aged 35 to 70 years was 5.4% (8.6% among men, 2.2% among women).

Types of Products and Patterns of Use

As in other regions of the world, the production of ST reflects a combination of cultural practices, local preferences, and the availability of particular tobacco leaves and other ingredients. Products and usage patterns are also influenced by the practices brought by immigrants from their home countries—such as the large population of Asian workers, many from the Indian subcontinent, who have immigrated to some Gulf countries.

Nass (or naswar) and paan are the most commonly used ST products in Pakistan[6–9,12–14] and the United Arab Emirates (UAE).[15,16] Shammah is mostly used in Yemen[5] and Saudi Arabia,[17–19] and toombak is used in Sudan.[4]

Nass

Nass, also known as naswar or niswar depending on the region in which it is made, is used in many countries, notably Iran (where it is known as nass) and Pakistan (where it is commonly known as naswar). It is made mainly of tobacco, ash, cotton or sesame oil, water, and sometimes gum. Nass is processed by mixing dried tobacco leaves, slaked lime (aqueous calcium hydroxide paste), ash from tree bark, flavoring and coloring agents, and water. Nass users roll this mixture into balls to be placed in the

mouth for 10 to 15 minutes and chewed slowly.[20] Nass is produced in cottage industry settings and is occasionally custom-made.[21,22] It costs approximately US$1.79 for 50 grams (g) in Pakistan.

Paan and Tombol

Paan or betel quid, with or without tobacco, is used mainly in Pakistan. It is produced commercially or by vendors or prepared at home. Slaked lime (calcium hydroxide) and catechu (extract from the acacia tree) are smeared on a betel leaf, which is folded into a funnel shape to which tobacco, areca nut, and other ingredients are added. The tobacco used may be raw, sun dried, or roasted, and it is finely chopped, powdered, and scented. Alternatively, the tobacco may be also boiled, made into a paste, and scented with rosewater or perfume. After the betel leaf funnel is filled with the ingredients, the top of the funnel is folded over, resulting in a quid which is placed in the mouth, usually between the gum and cheek, and gently sucked and chewed. Paan is sometimes served in restaurants after meals.[23] Each piece typically costs between US$0.05 and US$0.45.[24,25]

A national product used in Yemen, tombol, has much of the same ingredients, with some variation in flavorings,[26] and is not always made with tobacco. Tombol is made from the tombol leaf (also known as betel leaf), fofal (areca nut), noura, slaked lime (calcium hydroxide), and catechu (Figure 11-4). Tombol leaf, which requires a hot, humid climate, is cultivated in the Hadramout area of southern Yemen. As an ST product, there are three types of tombol: (1) sweet (a sweetening agent, often coconut, is added to the basic components described above, with or without tobacco); (2) bitter (additives like clove oil, cardamom, and herbal medicine are used, with or without tobacco); and (3) tombol with toombak tobacco (a local type of tobacco), which is available in two varieties: socha, or dry, thin pieces of Yemeni tobacco (similar to Indian pattiwalla), and zarda, scented tobacco from India.[26] Tombol is mostly a custom-made product, therefore pricing information is not readily available.

Figure 11-4. Tombol and its preparations

Tombol leaves (betel leaves) | Tombol leaf with fofal (areca nut), khat (qat), and zarda | Tombol leaf with khat

Source: Photos courtesy of Mazen Abood Bin Thabit, University of Aden, 2011.

Some forms of tombol, such as those used in Yemen, contain khat (*Catha edulis*) (Ghazi Zaatari, unpublished results, 2013; Figure 11-4), a plant that has psychoactive properties.[27] Khat is used in East Africa, Yemen, and Ethiopia. In Yemen, approximately 80% of males and 30% of females chew khat on a regular basis.[28] Khat contains cathinone, an alkaloid with amphetamine-like stimulant properties,

which is purported to cause euphoria, excitement, increased energy, and loss of appetite.[27–29] Cathinone, like amphetamine, is a potent agent that causes norepinephrine and dopamine to be released in the body.[30] Khat is added to tombol by spreading it in powder form onto a betel leaf to which an alkaline agent (noura) is then added (Ghazi Zaatari, unpublished results, 2013). When an alkaline substance such as noura is added to tombol, it increases pH and converts a great fraction of the total nicotine to free nicotine, the form of nicotine that is more readily absorbed. Tombol containing only khat and tobacco without noura would contain less free nicotine (chapter 3).

Shammah

Shammah is made from powdered tobacco, slaked lime (calcium hydroxide), ash, oils, black pepper, and flavoring agents.[31] The tobacco leaves are sun dried and pulverized with bombosa (sodium carbonate), and the preparation is usually sold as a dry product. Shammah is placed between the cheek and gums or between the cheek and lips. Various types of shammah are available in the market: bajeli, haradi, sharaci, black shammah, and white shammah (Figure 11-5), but shammah is most frequently sold as a cottage or custom product, therefore pricing information is not readily available. Black shammah is prepared by mixing tobacco leaves with a solution of bombosa in water; it is sold as wet shammah.

Figure 11-5. Types of shammah

Black shammah

White shammah

Source: Photos courtesy of Mazen Abood Bin Thabit, University of Aden, 2011.

Toombak

Toombak,[32] used in Sudan as a national product, is made of sun-dried tobacco (wild *Nicotiana rustica*) (Figure 11-6) mixed with an aqueous solution of sodium bicarbonate called atrun. The mixture is kept in an airtight container for about two hours, after which it is ready for sale. Toombak is rolled into a ball, called saffa, weighing about 10 g. The saffa is dipped into the mouth; men preferentially hold it between the gum and the lip, but women, for aesthetic reasons, hold it between the gum and the cheek or under the tongue on the floor of the mouth. It is sucked slowly for 10 to 15 minutes; a few users may extend this to several hours. Men usually spit periodically, whereas women users typically swallow the saliva generated. Users usually rinse their mouths with water after the saffa is removed.[10] Occasionally toombak is also used nasally or placed behind the ear with transdermal effect. The price of 50 g of toombak is around US$0.22 (Ghazi Zaatari, unpublished results, 2013).

Figure 11-6. Toombak

Toombak tree

Dried toombak

Source: Photos courtesy of Ali Idris, Toombak and Smoking Research Center, 2011.

Toxicity and Nicotine Profiles of Products

Toxicity and nicotine profiles are only documented for nass and toombak.[32] Chemical analysis of nass revealed the following concentrations of the carcinogenic tobacco-specific nitrosamines (TSNAs):

- 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)—up to 309 nanograms per gram (ng/g) wet tobacco
- *N'*-nitrosonornicotine (NNN)—up to 545 ng/g wet tobacco
- *N'*-nitrosoanabasine (NAB)—up to 30 ng/g dry tobacco
- *N'*-nitrosoanatabine (NAT)—up to 300 ng/g dry tobacco.

Toombak has the highest levels of free nicotine and nicotine-derived TSNAs ever measured in tobacco products (free nicotine: 5.16–10.6 milligrams per gram [mg/g] wet weight) (TSNAs: NNN = as high as 368,000 ng/g wet weight, and NNK = up to 516,000 ng/g wet weight) (Table 11-6).

Table 11-6. Nicotine and nitrosamine levels in naswar (nass) and toombak

Product	pH	Total nicotine	Free nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet weight		ng/g wet weight			
Toombak	7.38–10.1	9.56–28.2	5.16–10.6	147,000–516,000	115,000–368,000	4,550–6,770	295,000–992,000
Naswar	8.76–9.14	10.5–14.2	8.84–13.2	29.4–309	363–545	8.56–104	478–1380

*Total TSNAs = Sum of NNK, NNN, NNAL (shown); NAT, NAB (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; NAT = *N'*-nitrosoanatabine; NAB = *N'*-nitrosoanabasine; mg/g = milligram per gram; ng/g = nanogram per gram; TSNAs = tobacco-specific nitrosamines.
Note: Data in this table are for select products and may not represent all products of this type. Data are expressed on a per gram basis for products analyzed as received. The amount absorbed depends on the amount of tobacco used.
Source: Stanfill 2011 (33).

A 2011 global surveillance report on oral tobacco products[33] confirmed that, compared to a variety of other global ST products, toombak is among the highest in nicotine concentration, which ranged from 9.56 to 28.2 mg/g in four different samples, and in concentrations of NNK (147,000–516,000 ng/g) and NNN (115,000–368,000 ng/g).

Naswar (nass) contains various toxic/carcinogenic substances, such as heavy metals, in addition to TSNAs. An assessment of the potential toxicity of 30 brands of naswar available in the Pakistani market[34] showed that the average values of all toxicants studied were above limits deemed allowable by the Agency for Toxic Substances and Disease Registry at the U.S. Centers for Disease Control and Prevention (CDC). For instance, the amounts of cadmium and lead in the products would be associated with a calculated lifetime cancer risk from 100,000 to 1,000,000 times higher than the minimum target range for potentially hazardous substances. Similarly, the level of arsenic in the products exceeded allowable standards, and the average minimum daily intakes of chromium and nickel were 4 to 5 times higher than the allowable limits.[34]

Health Problems Associated With Product Use

There are at least 30 carcinogens in ST products used globally (see chapter 3, Table 3-2). These products have been associated with increased risk of developing precancerous and cancerous lesions of the oral cavity, nasal cavity, and sinuses, and most commonly, squamous cell carcinoma[35] (Figure 11-7) (see chapter 4).

Cellular abnormalities and genomic alterations associated with use of the highly carcinogenic toombak have been repeatedly documented in studies in Sudan.[4,41–50] In Iran, studies have demonstrated an association between ST use and development of esophageal cancer.[51,52] Oral submucous fibrosis,[7] oral carcinoma,[8,9] and head and neck cancers[12] have been reported in Pakistan as being associated with chewing areca nut, nass, and paan.[8] In Saudi Arabia, studies have identified an association between the use of shammah and the incidence of oral and head and neck cancers.[17–19] High prevalence of oral cancer and other oral lesions was similarly reported among shammah users in Yemen.[31,53] Pancreatic cancer has been described in other regions as a risk associated with the use of ST,[35] although this observation is not made in reviewed reports for the Eastern Mediterranean Region. The risk of pancreatic cancer in association with ST use has not been studied in a systematic fashion in the region.

Although cancer risks associated with ST use have been the focus of many publications, ST use is also associated with several non-neoplastic oral complications, such as gingivitis, periodontitis, poor dental hygiene, dental caries, and sinusitis.[54]

An important factor in the assessment of health effects associated with ST products in this region is the cancer risk that is independently associated with some substances used as ingredients in these products, such as areca nut.[12] In addition to this cancer risk, areca nut use has been associated with oral submucous fibrosis.[13]

Figure 11-7. Health complications associated with toombak use in Sudan

Squamous cell carcinoma of the oral cavity represented by severe whitish discoloration of the thickened gingiva and tumor growth around the tooth to the right.

Squamous cell carcinoma of the lower lip, adjacent oral mucosa, and gingiva of the lower mandible.

Squamous cell carcinoma of the oral cavity extending to the cutaneous surface next to the right lower lip.

Squamous cell carcinoma of the left buccal mucosa that distorted the oral cavity and maxilla and shows a bulging mass of the left face.

Source: Photos courtesy of Ali Idris, Toombak and Smoking Research Center, 2011.

Marketing and Production Practices of Industry

In the Eastern Mediterranean Region, the production and marketing of ST products such as nass, paan, shammah, and toombak are primarily cottage industries (Figure 11-8) that are mainly centered in areas of tobacco farming. The ST industry relies on locally available resources both for producing ST products and for marketing and distributing them to retailers under brand names intended to attract customers in their areas. For example, vendors use names such as Sultan Elkayef (i.e., the one that masters the mind), Wad Amari (a reference to the person who introduced the plant to the area), and Alsanf (which means "the best brand"). Toombak in Sudan is sold in small metal containers called hookahs or in plastic bags called keece.

Figure 11-8. A local vendor of toombak in Sudan

Source: Photo courtesy of Ghazi Zaatari, American University of Beirut, 2011.

Some ST products brought in from the Indian subcontinent are marketed to the large immigrant Asian labor force in the Gulf region. In a few countries, such as the UAE, there are reports of health inspectors and police inspecting and shutting down illegal manufacturing of nass and paan.[15,16]

Current Policy and Interventions

Well-structured interventions and regulatory policies, as well as ST cessation and prevention programs, are not present in the Eastern Mediterranean Region. Only Bahrain and the UAE have introduced policies banning smokeless tobacco. In 2009 the government of Bahrain introduced strict antismoking regulations and banned the importation of chewable tobacco products.[55] Ajman Municipality in the UAE banned the sale, import, storage, and possession of chewing tobacco and prescribed heavy fines for violations of the new law.[16]

Eastern Mediterranean Region countries have not made use of taxation as part of a policy of tobacco control. Taxes on ST products and prices of all types of tobacco products are among the lowest in the world. In 1999, cigarettes in this region were taxed at 47% of their base price on average. The corresponding cigarette product prices were low, only approximately US$0.93 per pack, leaving room for potential tax increases. Product prices and likewise taxes in the region ranged from US$0.30 in Lebanon, where the tax was 19% of the retail price, to almost US$1.40 in Morocco, where the tax was 30% of the retail price. The UAE and Tunisia have the highest taxes, at 65% and 67% of retail price, respectively, for a corresponding rate of approximately US$1.10 and US$1.18 per pack. Since tobacco taxes as a total proportion of government taxes collected remains low (1%–2% in Syria, Lebanon, Egypt, and Kuwait; and 4% in Tunisia), countries in this region have the opportunity to increase tobacco taxes and introduce taxes specifically on ST products.[56]

Summary and Conclusions

Smokeless tobacco is still an under-investigated topic in the Eastern Mediterranean Region because most production and marketing are cottage industry activities. A lack of comprehensive surveillance and lack of updated data on ST use and its adverse health effects may limit the ability of governments to introduce regulatory policies and design programs to combat ST use in their countries.

The most frequently used products in the region include toombak, paan, shammah, and nass. Especially high prevalence of use has been documented in Sudan and Pakistan, but consumption is widespread across Yemen and other areas of the region as well. Prevalence is substantially higher among men than among women in the region, although women engage in the practice as well.

Specific toxicity profiles are available only for nass and toombak. Of these, toombak has been reported to have the highest levels of nicotine and TSNAs ever measured in tobacco products. Research has documented associations between the use of toombak, shammah, nass, and paan and precancerous abnormalities as well as oral cancer and head and neck cancer.

In the Eastern Mediterranean Region, production and marketing of ST products are centered in areas of tobacco farming and rely on locally available resources. Some ST products originating from the Indian subcontinent are marketed to the large immigrant Asian labor force in the Gulf region.

Well-structured interventions to prevent or promote cessation of ST use are lacking in the region. The price of ST products remains low, and countries have generally not made use of taxation as a tobacco control policy. The government of Bahrain banned the importation of chewable tobacco products in 2009, and a municipality in the UAE banned the sale, import, storage, and possession of chewing tobacco.

Based on the available information from this region and the experiences of other countries, Eastern Mediterranean Region governments may benefit from considering the following:

- Subjecting ST to the same regulation as cigarettes and other tobacco products, if possible, given the proliferation of cottage industries
- Requiring the display of visible health warnings on all tobacco products for those that are manufactured and, if possible, those from cottage industries
- Including ST in tobacco control efforts, culturally relevant prevention strategies, and culturally relevant cessation interventions
- Educating individuals about the risks of ST use, using appropriate channels of communication in their countries.

To further inform regulatory policies, research is needed that leads to greater understanding of ST use and documents risks and health effects of products specific to this region.

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Chapter 12

Smokeless Tobacco Use in the African Region

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Description of the Region

The African Region of the World Health Organization (WHO), as a geographic entity, refers to the area of the African continent that lies south of the Sahara, excluding the Sudan, South Sudan, and Somalia, but including Algeria and Mauritania. It covers a total area of about 30 million square kilometers.[1] The African Region consists of 46 countries[2] divided into 5 subregions: Western, Eastern, Southern, Central, and Northern. The population of the African Region was estimated at 839 million in mid-2010,[1] or 12.2% of the world's population, with a 2.5% rate of natural increase.[3] Table 12-1 displays land area and population information for 34 of these countries.[4] Rural Africans have the lowest level of accessibility in the developing world: less than 40% of rural Africans live within two kilometers of an all-season road.[5]

Of the 46 countries in the region, 41 had ratified the WHO Framework Convention on Tobacco Control (FCTC) as of September 2013.[6] The five countries that had not ratified the Convention as of 2012 are Malawi, Zimbabwe, Mozambique, Eritrea, and Ethiopia (Mozambique and Ethiopia have signed but not ratified). Malawi is one of the leading tobacco producers in the world, with an estimated yield of 208,105 metric tons in 2009[7]; tobacco is grown on about 3% of Malawi's total agricultural land.[7] South Africa is the largest and arguably the most lucrative cigarette market in the WHO African Region. Multinational tobacco companies are involved in the manufacture of both cigarettes and smokeless tobacco (ST) products in South Africa.

Table 12-1. Population and land area of selected countries in the African Region

Country	Area (km^2)	Population (thousands)
Algeria	2,364,533	35,468
Benin	112,025	8,850
Botswana	669,000	2,007
Burkina Faso	274,483	16,469
Cameroon	478,024	19,599
Cape Verde	4,033	496
Central Africa	628,714	4,401
Chad	1,247,444	11,227
Congo	336,917	4,043
Côte d'Ivoire	323,574	19,738
Democratic Republic of Congo	2,357,000	65,966
Gambia	11,294	1,728
Ghana	239,137	24,392
Guinea	243,463	9,982
Kenya	578,757	40,513
Lesotho	30,153	2,171
Liberia	110,944	3,994
Madagascar	591,829	20,714

Country	Area (km²)	Population (thousands)
Malawi	118,262	14,901
Mali	128,083	15,370
Mauritania	1,153,333	3,460
Namibia	761,000	2,283
Nigeria	926,450	158,423
Rwanda	26,362	10,624
Sao Tome and Principe	959,302	165
Seychelles	458	87
Sierra Leone	7,156	5,868
South Africa	1,222,756	50,133
Swaziland	17,441	1,186
Tanzania (United Republic of)	954,064	44,841
Togo	56,868	6,028
Uganda	240,468	33,425
Zambia	769,941	13,089
Zimbabwe	392,844	12,571
Total	**18,336,112**	**664,212**

Abbreviation: km = kilometer.
Source: United Nations 2011 (4).

Prevalence of Smokeless Tobacco Use

Use of ST products is common in some countries of the African Region, and various forms of products are used. Little information is available on prevalence of use in the region, and the data that are available tend to be dated and/or limited to small areas or subregions. Tables 12-2 and 12-3 present the prevalence data for each African Region country for which data are available, by the types of products used and the age of users, and Map 12-1 illustrates the available adult prevalence rates by country. Caution should be exercised when comparing the estimates from different surveys, because of the differences in sampling, questions asked, and definitions. The definition of current use varies. For example, some surveys define current use as any use within the past 30 days, but other surveys ask about different time periods; some surveys ask about daily use and use on some days, and still other surveys ask about "current" use without defining the term further.

The prevalence of ST use varies across countries and across geographic areas within countries. For example, national prevalence rates for adults in Nigeria are relatively low (Table 12-3), but higher rates have been found in a state in the northeastern geopolitical zone of Nigeria among people aged 15 and older (10.8% for males and 4.1% for females).[8]

Table 12-2. Percentage of adolescents aged 13–15 years who currently used smokeless tobacco in the African Region, from the Global Youth Tobacco Surveys, 2007–2009

Country	Year	Total (%)	Boys (%)	Girls (%)
Botswana	2008	11.3	11.3	11.4
Burkina Faso – Bobo Dioulasso	2009	13.2	12.1	14.0
Burkina Faso – Ouagadougou	2009	10.2	11.2	9.2
Cameroon – Yaounde	2008	5.1	5.4	4.4
Cameroon – outside Yaounde	2008	10.9	12.0	9.4
Central African Republic – Bangui	2008	15.4	21.9	8.0
Congo	2009	16.4	18.3	14.1
Côte d'Ivoire	2009	5.6	6.2	4.9
Democratic Republic of Congo – Kinshasa	2008	20.8	20.6	20.1
Democratic Republic of Congo – Lubumbashi	2008	17.8	18.3	16.4
Gambia – Banjul	2008	21.9	20.1	23.3
Lesotho	2008	14.4	14.7	13.6
Liberia – Monrovia	2008	8.3	9.0	6.6
Madagascar	2008	5.7	6.2	5.4
Malawi – Lilongwe	2009	11.0	10.3	11.7
Malawi – rest of country	2009	8.9	11.3	6.7
Namibia	2008	16.0	15.6	15.8
Rwanda	2008	7.4	8.3	6.0
Seychelles	2007	5.5	5.2	5.4
Sierra Leone – West urban	2008	17.3	13.6	18.8
Sierra Leone – West rural	2008	22.7	18.9	24.5
Swaziland	2009	5.4	6.0	5.0
Tanzania – Arusha	2008	6.2	6.9	5.5
Tanzania – Dar es Salaam	2008	4.6	4.6	4.3
Tanzania – Kilimanjaro	2008	5.7	5.6	5.7
Togo	2007	6.2	6.9	4.8
Uganda	2007	9.4	8.6	9.6
Zambia – Lusaka	2007	15.6	0.9	15.4
Zambia – Kafue	2007	16.7	17.0	16.5
Zambia – Chongwe and Luangwa	2007	14.1	15.3	13.2
Zimbabwe – Bulawayo	2008	5.4	7.5	3.5
Zimbabwe – Harare	2008	5.7	6.4	5.0
Zimbabwe – Manicarland	2008	7.6	8.3	6.3

Source: Global Youth Tobacco Surveys, 2007–2009 (50).

Table 12-3. Percentage of adults who currently used smokeless tobacco in the African Region, 2003–2010

Country	Year	Age Group (Years)	Total (%)	Men (%)	Women (%)
Algeria*	2010	15+	5.7	10.4	0.8
Benin†	2008	25–64	9.2	12.7	5.7
Cape Verde*	2007	25–64	4.6	3.5	5.8
Chad (subnational)*	2008	25–64	1.2	1.9	0.4
Ethiopia‡	2005	Men, 15–59; Women, 15–49	—	3.0	0.6
Gambia†	2010	25–64	1.1	0.8	1.4
Ghana‡	2008	Men, 15–59; Women, 15–49	—	0.9	0.2
Guinea (subnational)†	2009	15–64	1.4	1.4	1.5
Kenya‡	2008–2009	Men, 15–54; Women, 15–49	—	1.8	1.3
Lesotho‡	2009	Men, 15–54; Women, 15–49	—	1.3	9.1
Liberia‡	2007	15–49	—	2.3	2.4
Madagascar‡	2008–2009	Men, 15–59; Women, 15–49	—	22.6	19.6
Malawi†	2009	25–64	3.5	1.9	5.0
Mali (subnational)†	2007	15–64	2.7	5.0	1.2
Mauritania†	2006	15–64	9.0	5.7	28.3
Namibia‡	2006–2007	15–49	—	1.8	2.3
Nigeria‡	2008	Men, 15–59; Women, 15–49	—	3.2	0.5
Sao Tome and Principe†	2009	25–64	2.8	3.8	1.9
Sierra Leone‡	2008	Men, 15–59; Women, 15–49	—	1.3	4.7
South Africa*	2003	15+	—	2.4	10.9
Swaziland†	2007	25–64	1.6	2.6	0.8
Uganda‡	2006	Men, 15–54; Women, 15–49	—	3.9	2.6
Zambia‡	2007	Men, 15–59; Women, 15–49	—	0.2	1.2
Zimbabwe‡	2005–2006	Men, 15–54; Women, 15–49	—	1.9	0.5

*Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (51).
†WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (51).
‡Demographic and Health Surveys (52).

Map 12-1. Prevalence of smokeless tobacco use among adults in the World Health Organization's African Region

Note: A rate for males and females was not available for Ethiopia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Namibia, Nigeria, Sierra Leone, South Africa, Uganda, Zambia, or Zimbabwe. For each of these countries, a total figure was calculated by averaging the available male and female rate.
Sources: Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (51); WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (51); Demographic and Health Surveys (52).

Types of Products and Patterns of Use

Smokeless tobacco products available in the region include premade manufactured products as well as those produced by small cottage industries, and custom-made products for personal use or for sale by street vendors. These ST products are sniffed, chewed, sucked, or applied to the teeth and gums. Smokeless tobacco products are generally much cheaper than cigarettes[8,9] and are more widely used by people who are socioeconomically disadvantaged[8,10] and by older adults compared to younger adults.[8,11,12]

Snuff use is considered outmoded by many African people, thus it is not often practiced in public.[13] However, ST products such as snuff and areca nut with or without tobacco, previously popular only in a limited number of countries, are now being marketed heavily to specific target groups, including women, young people, and smokers.[14] Smokeless tobacco products are advertised to women, as an alternative to smoking in cultures where smoking by women is not socially acceptable; to young people, for whom flavored and milder-tasting "starter" products have been developed; and to smokers, for use where smoking is prohibited.[14] For those who are already tobacco dependent, snuff products are suggested as the most affordable and accessible way of getting sufficient nicotine.[15] Dual use of ST and cigarette smoking has been found to be common among South African adolescents in some parts of that country (55.2% of those who use ST are also smokers).[9] Similarly, data on adults from Nigeria suggest that as many as 21.1% of the surveyed ST users also smoked cigarettes.[8]

In Algeria, ST, especially moist snuff, has been consumed traditionally by the majority of men in all social groups. Locally, chemma or shammah is the term given to moist snuff, which is put directly on the gums or placed in paper and then placed in the mouth. Dry snuff is called neffa, which is taken in through the nose. Chemma, the most prevalent category of ST used, is available via both legal and illicit channels.[13]

In a number of West African countries, including northern Nigeria, Cameroon, Senegal, and Chad, a smokeless product locally known as taaba is widely consumed orally or by nasal inhalation. It is prepared from dry fermented tobacco pulverized to fine particles and mixed with natron (a mixture of sodium bicarbonate and sodium chloride). For oral consumption, a pinch of the product is placed between the lower gum and the lip, and the pinch is left in position for a few minutes to half an hour, until some active ingredients are absorbed. Taaba is also sometimes placed on the tongue and sucked. In several rural and urban areas of Nigeria, taaba is reportedly used because of its purported ability to "cure" certain medical ailments and because of its traditional place in social gatherings.[8]

Toombak imported from Sudan is also fairly common in Chad, in the West African region. Toombak is an oral snuff that is traditionally made by small local vendors in rural areas and transported to markets in the city for sale. Toombak is a custom-made blend of leaves of the *Nicotiana rustica* variety of tobacco mixed with sodium bicarbonate (baking soda) and stored for two hours or longer before sale.[16]

In Ghana, local snuff is prepared by mixing the dried tobacco leaf indigenous to the forested areas (*N. tabacum*) with chemicals such as saltpeter (potassium nitrate) and then grinding it into a fine powder. Dried tobacco leaves are also a form of ST, which users chew. After roasting the tobacco leaves, users traditionally dip the roasted tobacco into the fly ash of wood before inserting it between the

lower gum and lip.[17] To intensify the delivery of free nicotine, users add an alkaline agent (in this case, ash) as do other producers of tobacco products worldwide.[18] Snuff is consumed mostly by older adults in Ghana, but youth are reportedly becoming more interested in using it.[17] The increasing interest among youth is consistent with findings from the Global Youth Tobacco Survey (GYTS) from Ghana, which showed that 10.4% of youths surveyed reported using tobacco products other than cigarettes.[19] Further inquiries with those who conducted the survey suggest that these "other tobacco products" are predominantly snuff (Edith Wellington, personal communication, 2011).

In South Africa, snuff is applied nasally and orally, and tobacco is chewed. Historically, inhalation is the most common practice (about 75% of ST users sniff). Snuff use in South Africa is predominantly found among African women, who traditionally have low smoking rates.[12] In a qualitative study carried out in South Africa involving a focus group of black women, there was consensus among all participants that cigarettes and snuff were the types of tobacco most commonly used in the community.[20] However, snuff was considered women's tobacco, commonly used by older women and rarely used by men.[20] South African women of Indian descent mostly chew areca (betel) nut. Most users prefer only the nut, some the betel quid with or without tobacco, and some use both the nut and the quid.[21,22] Other ingredients may be added by the user to taste or based on traditional customs and usage.[21]

In South Africa and neighboring countries, including Lesotho, similarly prepared traditional homemade products and a limited range of premade products are used. Some traditional products are prepared by hand-mixing finely ground sun-dried tobacco leaf and ash (mokgako) from local plants, depending on plant availability and cultural preference. Mokgako is used as a condiment or flavor intensifier.[23–25] With regard to commercially manufactured products, since 2003 multinational tobacco companies such as British American Tobacco and Swedish Match have continually introduced various local brand equivalents of Swedish snus in test markets across South Africa, albeit with limited sales success to date.[26,27]

In Uganda, the use of gutka is said to be increasing among adolescents as a result of imports by the Indian community, although the use of ST among South Africans of Indian descent has declined to become almost insignificant. The dry snuff known as taaba is also consumed in Uganda, particularly by the Bakiga tribe and some other rural tribes, and primarily by middle-aged men and women. Taaba is mainly sniffed, but is occasionally held in the cheek. Fresh or dried tobacco leaves are also wrapped around magadi (sodium bicarbonate) and placed in the cheek until the desired effect is obtained.

In Tanzania, three types of ST products are used. Kuberi and ugoro (moist oral snuff) are used by indigenous people, and thinso (tobacco with areca nut, more widely known as gutka), which is used by migrants of Indian descent. Kuberi is the most popular product, followed by ugoro. Ugoro is either placed under the tongue or sniffed. Thinso is either placed in the cheek or chewed, together with areca nut, similar to the practice in India. Tobacco is imported from India in many flavors, but areca nut is grown locally. Use of areca nut with tobacco appears to be on the increase, especially among Asians in the country.[8]

From the limited data obtained from 10 countries covering almost half of the region's total population, it can be deduced that, in general, products and customs associated with ST use in different parts of Africa vary widely (Figure 12-1). There is a widespread perception that snuff possesses "medicinal" properties.[8,20,23,28] Medicinal uses that have been reported include relief from physical conditions such as headache, nose bleeds, sinus problems, and toothache. Reports of these beliefs highlight the importance of cultural sensitivity in the development of public health education interventions to reduce ST use in the region.

Figure 12-1. Snuff products used in some African countries

Two popular South African manufactured snuff brands in containers and traditional vendor/ individual-made snuff in plastic bags

New commercial snuff brand on the Algerian market, imported from Belgium

Snuff being prepared traditionally by women for a wedding ceremony in South Africa

Contents of a can of a manufactured moist snuff brand—Makla Bouhlel

Source: Photos courtesy of Olalekan Ayo-Yusuf, University of Pretoria, 2011.

Toxicity and Nicotine Profiles

Only limited data are available on the toxicity of ST products used in the region, but product testing suggests considerable variability in the toxicity and nicotine profiles of these products. Generally, the commercialized products tend to have lower levels of carcinogenic tobacco-specific nitrosamines (TSNAs) than traditional custom-made products, one exception being traditional products used in Nigeria, which contain notably lower levels of TSNAs than traditional products in Chad, Ghana, and South Africa, and even lower than the levels in the manufactured snus products on the South African market (Table 12-4).

Table 12-4. Toxicity and nicotine profiles of selected smokeless tobacco products used in the African Region

Country	Products (n)	Heavy metals (ppm)				BaP (ng/g)	TSNAs (ng/g)	pH	Free nicotine (mg/g) (% of total nicotine)
		Cr	Pb	Cd	Ni				
Sudan*	Toombak (4)						295,000–992,000	7.38–10.1	5.16 (18.3%)–10.6 (98.6%)
Ghana	Traditional snuff (5)	0.95–1.41		1.06–1.11					
South Africa	Traditional snuff (3)	9–84	6–8	1.1–1.5	25–87	4,550	20,500 (n = 1)	9.29	5.01 (94.8%)
	Commercial snuff (3)						1,710–4,670	9.15–10.1	1.16 (99.1%–13.8 (92.9%)
	Commercial snus (2)						1,720–5,850	6.48–7.02	0.47 (2.7%)–1.19 (8.9%)
Nigeria	Traditional snuff (1)						1,520	9.42	2.39 (96.1%)
	Commercial snuff (1)						2,420	9.02	6.72 (90.7%)

*Data on Sudanese toombak are presented here for comparison purposes.
Abbreviations: ppm = parts per million. Cr = chromium, Pb = lead, Cd = cadmium, Ni = nickel, BaP = benzo*(a)*pyrene, ng/g = nanograms per gram of tobacco, TSNAs = tobacco-specific nitrosamines, mg/g = milligrams per gram of tobacco.
Sources: For South Africa, Nigeria and Chad, data on pH, nicotine, and TSNA: Stanfill et al. 2011 (29); For Ghana, heavy metals data: Addo 2008 (17); for South Africa, heavy metals and BaP data: Keen 1973 (53).

Health Problems Associated With Product Use

An important consideration is that biologic effects of ST observed in Western countries may not be generalizable to Africa because of differences in the composition of ST products and cultural differences in patterns of use.[23]

In general, only limited data are available on the negative oral health effects of ST use in the region. In South Africa, where the highest pH values of any premade manufactured ST brands have been found,[29] snuff-dipping has been associated with oral keratotic lesions,[30] which were more severe with the higher-pH manufactured snuff brands than with traditional products.[23] Past studies have demonstrated that

Indian women in South Africa have the highest incidence of oral cancer, which has been associated with the use of areca nut with or without tobacco,[22,30] compared with women in any other population group in the country. Since about 1990, however, no large population studies have been carried out on oral cancer incidence among South Africans. As of 2005, in North Africa, snuff has been associated with a significant increase in the risk of nasopharyngeal cancer.[31]

In terms of reproductive outcomes, ST use in South Africa has been associated with significantly reduced gestational age, but not with low birth weight.[32] A study in the Democratic Republic of Congo suggested that as many as 41% of pregnant women had ever tried snuff, compared to 14% who had ever tried cigarettes.[33] Similarly, about 8% of pregnant women in Lesotho reported snuff use during pregnancy.[34] Such high rates of use by pregnant women indicate a need for further studies on the effect of ST on reproductive outcomes in the African Region. In addition, a 2009 study on a population of women in Côte d'Ivoire associated ST use with a precursor lesion for cervical cancer.[35]

Demographic and Health Survey data have suggested that South African nasal snuff is associated with an increased risk for chronic bronchitis and tuberculosis.[36] Consistent with this finding is a report from a study of lung function among snuff industry workers in Nigeria, which showed that chronic exposure to snuff dust was associated with impaired lung function which was worse depending on the length of exposure in the industry.[37] The impact of nasal application of ST on the already high burden of respiratory diseases such as tuberculosis in the African Region requires further investigation.

Heavy snuff use among South African women has been associated with significantly increased blood pressure to levels that increase the risk for cardiovascular diseases at a population level.[10] A small study from 1992 in Nigeria also demonstrated that snuff use was associated with increased systolic and diastolic pressure, although this effect was less pronounced when natron was not an ingredient in the snuff mixture.[38] These findings are consistent with results of a multicountry study that included ST users in Africa; this study showed that ST use was associated with a significantly increased risk of non-fatal myocardial infarction (MI).[39] However, according to a meta-analysis, heterogeneous results have been obtained for the role of ST in non-fatal MI, and this research suggests that the risk of fatal MI may be greater than the risk of non-fatal MI among ST users.[40]

Despite the popular belief that ST has "medicinal effects," a pilot study from South Africa on the antibacterial potential of ST found that the snuff products tested did not inhibit bacterial growth; the study instead demonstrated possible bacterial activities in both the commercial and non-commercial snuff products tested.[25]

Although few studies in the African Region have addressed the level of nicotine dependence associated with ST use, the nicotine profiles of some of the products studied suggest significant potential for nicotine dependence.[29] A previous South African qualitative study found that as many as 36% of women snuff users who reported having made an attempt to quit had no success, but about 67% of surveyed users wished to quit,[20] thus suggesting that snuff use is as difficult to quit as cigarette smoking. Another study among an elderly Nigerian population also reported that as many as 50% of those surveyed were diagnosed with "snuff tobacco dependence."[41]

Marketing and Production Practices of Industry

Production

Except in a few African Region countries where imported commercially manufactured ST products are available, most of the ST products used in the region are made by the users themselves or by small cottage industries. Traditional or custom-made brands are more commonly used in rural areas, whereas commercially manufactured brands are more common in urban areas.[42]

The biggest manufacturer of ST in Algeria is the Société Nationale des Tabacs et Allumettes (SNTA), a public entity with a market value share of 88% in 2009.[13] SNTA produces the leading brands Makla El Hilal and Nedjema. A private company, Bentchikou Tabacs Algérie, which accounts for the remaining market share, has gained ground since it entered the country in 2006 with its brands Naffa Africaine, Makla Ifriquia, and Makla Bouhlel (Figure 12-1). The national company SNTA had a monopoly on production before the appearance of this competitor, and it remains the category leader because consumers are used to its products. However, Bentchikou Tabacs Algérie, which imports its products from its headquarters in Belgium, is steadily gaining market share in Algeria.[13]

The two leading premade manufactured brands in South Africa, Taxi and Ntsu, were largely under the control of two small local manufacturers until 1999, when Swedish Match bought out the company that manufactures Taxi.[43] More recently, in 2009, Phillip Morris International paid approximately US$225 million (ZAR1.75 billion) to purchase Swedish Match South Africa.[44]

Products used in Nigeria, similar to products used in the rest of Africa, are largely locally made by cottage industries, but limited numbers of premade manufactured brands are also available. The most commonly found imported brand is Medicated Snuff 99, manufactured by Joseph & H. Wilson, which is based in the United Kingdom.

Distribution

In Algeria, news agents/tobacconists or kiosks remain the leading distribution channel, representing 67% of the sales volume in 2009. Tobacconists and kiosks are widely distributed across the country, and they offer the largest stock range. They distribute both legal and illegal products,[13] although illicit tobacco products may also be available from other street or local vendors.

Smokeless tobacco products in South Africa are sold mostly by street vendors, local convenience stores, or at kiosks, where they are displayed together with cigarettes, candy, and confections. More recently, South African snuff brands manufactured by Philip Morris International have become available on an Internet snuff sales website based in the United Kingdom. Custom-made or traditional snuff products are sold from plastic buckets in open markets in South Africa and Nigeria and are dispensed in spoon-sized portions that are transferred to plastic bags, as requested by the customer. In Nigeria, it is also possible to request a mixture of local products and imported products. Ugoro, wrapped in banana bark, is sold in Tanzania in open-air markets.

Marketing

Being primarily a cottage industry or custom-made product in this region, smokeless tobacco is not widely advertised. In Algeria, tobacco promotion is permitted at points of sale, but ST is not usually advertised, primarily because neither manufacturers nor retailers find it useful to create displays. In Tanzania, to market to adolescents, ST is often given a flavor or described as a type of nutrient supplement.[14] Larger industries such as British American Tobacco and Swedish Match attempted to introduce snus equivalents, particularly in South Africa, between 2001 and 2008, but have had limited success.[26,27] In this region, snus has also been promoted with health claims and for use in situations where smoking is not permitted (Figure 12-2), which may encourage dual use.

Previously confidential industry documents suggest that additives or flavorings may be added to mask the poor quality of some products or to target certain population groups, as indicated by the following quotes related to snuff manufacture in Nigeria and South Africa, respectively:

> *"Many snuff formulations are flavoured with added levels or top dressing flavours. … Top dressing flavours include menthol, peppermint oil, wintergreen, attar of roses and clove oil. I suggest a menthol and peppermint flavoured version might be appropriate for the Nigerian market as a significant proportion of your cigarettes are mentholated. The added flavour may also help to cover some of the product deficiencies (sic) that a connoisseur of classic European snuff might find in a simple domestic product."*
>
> (Letter from D. E. Creighton, British American Tobacco Company, to R. M. H. Duncan, Nigerian Tobacco Company, July 3, 1985)[45]

> *"One major point is that with our wet snuff there must be a noticeable ammonia nose to the product, all products have this distinct characteristic and [it] is sought after by the Black consumer in this country."*
>
> (Letter from G. A. S. Wingate-Pearse, United Tobacco/Tabak, to B. Louw, British American Tobacco Company, October 12, 1987)[46]

Figure 12-2. Snus information leaflets promoting situational use

Note: These leaflets are available at points of sale in South Africa.
Source: Photo courtesy of Olalekan Ayo-Yusuf, University of Pretoria, 2011.

Current Policy and Interventions

In general, no organized public health education programs or cessation programs for ST exist in the African Region. In Tanzania, the sale of ST was officially banned in 2006, although it has been suggested that more stringent monitoring and enforcement are needed.[14] In Algeria, ST containers are subject to the same legislation as the packaging of other tobacco products, which includes specified health warnings. However, cigarette packages have multiple "rotating" health warnings on their packages, which are required to cover 15% of the entire package, but these same requirements are not mandated for ST products.[47] The government does not regulate the marketing or distribution of ST products in Algeria, nor does it regulate Internet retailing and advertising of tobacco products. However, as a result of limited Internet penetration, the introduction of payment cards, and inadequate delivery systems, Internet sales do not exist in Algeria for any category of tobacco products.[13]

In the Democratic Republic of Congo, traditional snuff is more expensive than cigarettes: A portion of snuff (~2 grams [g]) costs about US$0.50, whereas a pack of cigarettes costs about US$2.00. In South Africa, excise tax is payable on cigarettes but not on ST or snuff products, therefore snuff is much less expensive than cigarettes in South Africa: A 20 g can of snuff typically costs ZAR5 (US$0.70), compared to ZAR27 (US$3.50) for a pack of 20 cigarettes. Traditional homemade snuff products are even cheaper. South African law, however, prohibits the sale of any tobacco products to minors (<18 years) and bans advertisement and promotion of all ST products as well as cigarettes. Furthermore, manufacturers of ST products are required by regulation to place the phrase "Causes cancer" on every can of snuff.[48]

Summary and Conclusions

The Demographic and Health Survey[52] conducted in many African countries provides an opportunity to study the prevalence and, in some instances, the health effects of these products. Prevalence of ST use varies widely across countries, with the national prevalence in Madagascar as high as 22.6% for men and 19.6% for women, whereas in Nigeria rates are as low as 3.2% for men and 0.5% for women, although other data have suggested that prevalence may be higher in certain areas of Nigeria such as the northeastern geopolitical zone.

Smokeless tobacco products in the African Region are consumed in a variety of ways (sniffed, chewed, sucked, or applied to teeth and gums) and for a variety of reasons, including the perception that snuff has medicinal properties. With a few exceptions, most products available in the region are produced by small cottage industries and sold by local vendors.

More studies are needed on the extent of use, toxicity profiles, and health effects of ST used in the region. Although available data are somewhat limited, the nicotine content and toxicity of ST products appear to vary widely in this region. There are a few exceptions, but for the most part, premade manufactured products tend to have lower levels of tobacco-specific nitrosamines than custom-made products.

Data on the health effects of ST products in this region are also quite limited; however, existing data from some parts of Africa suggest that these products are associated with increased risk of oral pathologies and elevated blood pressure. Nasal snuff use is associated with increased risks of nasopharyngeal cancer and respiratory disease. More information on the health effects of ST use may provide governments with much-needed incentives to take urgent action to curb the further spread of ST use and its health consequences.

Articles in the WHO FCTC should be considered for implementation for smokeless tobacco use. Few studies have assessed how effective graphic health warnings covering 50% of the package display area will be for ST, and this would be an area worth evaluating. Wherever it is clear that ST is a popular commercial product, the guidelines on Articles 9 and 10 of the Framework Convention, adopted by the Conference of Parties in 2010, could provide a legal basis for governments to consider banning the use of flavorings in these products in order to reduce their attractiveness to youth. African countries, many of which are parties to the WHO FCTC, could benefit from extending the other relevant sections of the Convention in order to control ST use, including implementation of the guidelines related to banning advertisements for such products (Article 13), educating the public (Article 12), and promoting tobacco use cessation (Article 14). Public education could include teaching local vendors and small-scale producers how to limit nitrosamine content through best practices in agronomics (such as by using *N. tabacum* plant species instead of *N. rustica,* which may reduce levels of carcinogens in some products). Parallel to these interventions, the public, including traditional health practitioners, could benefit from education about the harms of using ST, and all users should be encouraged to quit. As the WHO Study Group on Tobacco Product Regulation suggested, strict regulatory controls, including setting manufacturing standards, should be applied to commercial snuff manufacturers, starting with limiting the toxicant levels.[49]

Finally, considering this region's limited institutional and financial capacity for tobacco control research and for tobacco control in general, future efforts to document and monitor toxicity and the health effects of ST products in the region will require international collaboration, as envisaged in Articles 21 and 22 of the WHO FCTC.

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Chapter 13

Smokeless Tobacco Use in the South-East Asia Region

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Description of the Region

The South-East Asia Region of the World Health Organization (WHO) consists of 11 countries. Six of them are geographically located in South Asia: India, Bangladesh, Nepal, Bhutan, Sri Lanka, and the Maldives. Four are located in South-East Asia: Thailand, Myanmar, Indonesia, and Timor-Leste. The Democratic People's Republic of Korea (DPR Korea; North Korea) is also a part of this WHO Region.[1]

More than 1.8 billion people live in the South-East Asia countries.[2] Although countries in the South-East Asia Region comprise only 5% of the world's surface area, about 26% of the world's population live there.[3,4] Five countries account for nearly 96% of the total population of the South-East Asia Region: India, Indonesia, Bangladesh, Thailand, and Myanmar (Table 13-1). The annual average population growth rate of this region is roughly 1.4%, and about two-thirds to three-fourths of the population are rural, with the exception of DPR Korea, which is 60% urban.[2] Hence, large rural populations characterize the region. Some of the world's major tobacco producers are South-East Asia countries: India, Indonesia, Thailand, DPR Korea, and Bangladesh.[5]

Table 13-1. Population and land area of countries of the South-East Asia Region

Country	Area (km^2)	Population (thousands)
Bangladesh	143,942	148,692
Bhutan	48,400	726
Democratic People's Republic of Korea (North Korea)	120,525	24,346
India	3,283,147	1,224,614
Indonesia	1,903,738	239,871
Maldives	298	316
Myanmar	675,535	47,963
Nepal	146,858	29,959
Sri Lanka	65,597	20,860
Thailand	512,015	69,122
Timor-Leste	14,789	1,124
Total	**6,914,844**	**1,807,593**

Abbreviation: km = kilometer.
Source: United Nations 2011 (3).

Types of Products and Patterns of Use

This chapter will first describe the wide variety of smokeless tobacco (ST) products that are made and used in this region. Various ST products are chewed, sucked (dipped), applied to the gums and teeth, snuffed, or gargled. Products may be as simple and inexpensive as unmanufactured, loose flakes of tobacco leaves that are sold by weight and may be chewed with only slaked lime (calcium hydroxide) paste, or as complex as a paste made from boiled tobacco and spice flavorings (e.g., kiwam) and sold in small glass bottles.[6–9]

A common way of consuming chewing tobacco in the region is as an ingredient in betel quid. Use of betel quid is an ancient practice. Tobacco was added as an ingredient in the quid beginning around 1600, and it is now used in betel quid in many parts of South-East Asia. Betel quid is composed of pieces of areca nuts (from the *Areca catechu* palm), betel leaf from the *Piper betle L.* (*Piperaceae*) vine, aqueous slaked lime paste (calcium hydroxide, made from roasted limestone or seashells), and other minor ingredients such as catechu (for astringency), cardamom, and clove, according to the taste of the user. Some of these components are agricultural products (e.g., betel leaf, areca nut), and others are simple ingredients that could be cottage industry products (e.g., slaked lime). They are combined by vendors and users and made into fresh betel quids for immediate consumption. Historically, betel quid has been incorrectly believed to have beneficial medicinal properties.[10,11] The user who incorporates tobacco into it may not consider tobacco a harmful addition.[12]

Smokeless tobacco products of different kinds with different names are often incorporated into betel quid, although some are also used separately. The most common type of tobacco incorporated into betel quid is plain tobacco flakes (also called sada pata); sometimes flavored tobacco flakes such as zarda or khaini may be added. Snuff-type products, which tend to be applied to gums or teeth rather than chewed, are not used with betel quid. Although areca nut itself is mildly addictive, a betel quid user may not understand the much higher addictive potential of tobacco in the quid.[8]

In India, some products have been manufactured on an industrial scale since 1975. These commercially produced ST products, such as pan masala and gutka, are modeled after betel quid and contain many of the same ingredients but in a dried form and without fresh betel leaf. The manufactured products were designed to be easily carried and consumed anywhere at any time, unlike betel quid, which is highly perishable and inconvenient to carry because of its high moisture content. In addition to being dried and packaged in single-use doses, these manufactured products contain preservatives to lengthen their shelf life. They may also contain other ingredients, such as small pieces of areca nut, calcium hydroxide, catechu, sweeteners, perfumes, tobacco flakes and/or powder, and flavorings such as menthol, cardamom, and clove. Gutka always contains tobacco, but most brands of pan masala do not. Gutka and pan masala products frequently carry the same brand names, allowing manufacturers to circumvent laws banning tobacco advertisements since they are able to advertise a product that appears identical to tobacco-containing gutka.[6]

Each country in this region has its own set of ST products (see Appendix A: Description of Representative Products From Four Broad Categories of Smokeless Tobacco Products Used Globally, and Appendix B: Global Smokeless Tobacco Product Factsheets):

- Bangladesh: Products for chewing: sada pata, zarda, and khaini are used; for oral application: gul.[13]
- Bhutan: Products with various uses: tobacco leaf, snuff, khaini, surti or baba (zarda),[7] and gutka. Production and commercial imports are banned, but some products are smuggled.[14]
- India (the country with the widest product range):
  - Products for chewing: (1) Products made with unprocessed tobacco (sada pata): betel quid with tobacco, zarda, and khaini. (2) Products made with cured tobacco: gundi, kadapan, and flavored zarda. (3) Products containing areca nut: gutka, mawa, Mainpuri tobacco, and dohra. Some forms of khaini contain areca nut as well as tobacco.[15]
  - Products for oral application: Snuff products including mishri/masheri, bajjar, gudakhu, tapkeer, red toothpowder, kiwam, creamy snuff, and gul.
  - Other products or uses: Snuff used nasally, and tobacco water for gargling (tuibur).[6,12]
- Indonesia: Products for chewing: chewing tobacco as well as cut strands of tobacco chewed with betel quid[6,16]; also dried tobacco leaves rolled to the size of a thumb and inserted into the mouth between lips and teeth.[7]
- Maldives: Chewing tobacco with betel quid or areca nut; during the 1990s, chewing tobacco of unspecified nature was imported into the country in increasing quantities.[17]
- Myanmar: Products for chewing: tobacco mixed with honey, alcohol, or lemon juice (hnat hsey) which is usually chewed with betel quid; raw tobacco (most users of unmanufactured or "raw" tobacco incorporate it into betel quid); gutka and zarda from India are also available.[18] Snuff is used both orally and nasally.[6,19]
- Nepal: Products for chewing: betel quid with tobacco, khaini, zarda, surti, and gutka.[20]
- Sri Lanka: Products for chewing: Chewing tobacco (unmanufactured), mainly used in betel quid[21]; also Indian gutka.
- Thailand: Snuff tobacco used nasally and orally, chewing tobacco, betel quid with tobacco, and other ST products, all made in cottage industries.[22,23]
- Timor-Leste: Chewing tobacco.[24]

Wherever gutka is sold, generally pan masala without tobacco is also available—that is, in India, Bangladesh, Bhutan, Myanmar, Nepal, and Sri Lanka.

Prevalence of Smokeless Tobacco Use

Surveys of ST use employ varying methods, questions, and definitions, and for that reason caution should be exercised in comparing estimates of prevalence. Surveys' definitions of current use vary: Some surveys define it as any use within the past 30 days, while others ask about different time periods; some surveys ask about daily use and use on some days, and still other surveys ask about "current" use without defining the term further.

Current ST use among youth, typically defined as any use in the past 30 days, is as prevalent as smoking or more prevalent than smoking among adolescents in the South-East Asia Region.[25] Prevalence of ST use among youth aged 13–15 years varies across the region and by sex, as shown by data from the Global Youth Tobacco Survey (GYTS) for eight countries (Bangladesh, Bhutan, India, Indonesia, Myanmar, Nepal, Sri Lanka, and Thailand)[26] (Table 13-2). The prevalence of current ST use among boys ranges from 3.3% in Indonesia to 14.1% in Bhutan, and prevalence for girls ranges from 2.3% in Indonesia to 6.0% in India. In four of the countries, reported prevalence of current ST use for boys is more than twice that for girls. In Bangladesh, the prevalence of use among boys (5.8%, 95% confidence interval [CI]: 3.5–9.3) and girls (4.2%, 95% CI: 1.9–9.1) is not significantly different. Despite a national ban on the sale of all tobacco products,[9] the prevalence of ST use among boys and girls combined in Bhutan was 9.4%. India (9.0%) and Sri Lanka (6.8%) also reported high prevalence of ST use for boys and girls combined.

Table 13-2. Percentage of adolescents aged 13–15 years who currently used smokeless tobacco in the South-East Asia Region, from the Global Youth Tobacco Surveys, 2007–2009

Country	Year	Total (%)	Boys (%)	Girls (%)
Bangladesh	2007	4.9	5.8	4.2
Bhutan	2009	9.4	14.1	5.3
India	2009	9.0	11.1	6.0
Indonesia	2009	2.8	3.3	2.3
Myanmar	2007	6.5	10.3	2.7
Nepal	2007	6.1	8.8	2.9
Sri Lanka	2007	6.8	9.6	3.9
Thailand	2009	5.7	7.3	4.1

Source: Global Youth Tobacco Surveys, 2007–2009 (26).

National or subnational prevalence data on current use of ST are available for adults (people aged 15 years and older) in nine countries in the region for the years 2006–2010 (Table 13-3; Map 13-1).[27–29] Current use among adults is defined as use every day or on some days. For three countries (Bangladesh, India, and Thailand), reports of the Global Adult Tobacco Surveys (GATS) are available.[28] Data have been reported for Bhutan, Myanmar, and Sri Lanka in the *WHO Report on the Global Tobacco Epidemic, 2011* (GTCR) from the WHO STEPwise Approach to Surveillance surveys (WHO STEPS).[27] Data from the Demographic and Health Surveys (DHS)[29] have been reported for the Maldives and Timor-Leste, and data for Nepal are derived from the individual country survey reported in the GTCR.[20,27]

Table 13-3. Percentage of adults (≥15 years) who currently used smokeless tobacco in the South-East Asia Region, 2006–2010

Country	Year	Age group (years)	Total (%)	Men (%)	Women (%)
Bangladesh*	2009	15+	27.2	26.4	27.9
Bhutan† (subnational)	2007	25–74	19.4	21.1	17.3
India*	2009	15+	25.9	32.9	18.4
Maldives‡	2009	Men, 15–64; Women, 15–49	—	6.0	4.2
Myanmar†	2009	15–64	29.6	51.4	16.1
Nepal§	2008	15–64	18.6	31.2	4.6
Sri Lanka†	2006	15–64	15.8	24.9	6.9
Thailand*	2009	15+	3.9	1.3	6.3
Timor-Leste‡	2009–2010	15–49	—	2.5	1.9

*Global Adult Tobacco Survey, 2009 (28).
†WHO STEPS, 2006–2009 from: *WHO Report on the Global Tobacco Epidemic, 2011* (27).
‡Demographic and Health Surveys, 2009–2010 (29).
§Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (27).

Map 13-1. Prevalence of current smokeless tobacco use among adults in the World Health Organization's South-East Asia Region

Note: A rate for males and females combined was not available for Maldives and Timor-Leste. For each of these countries, a total figure was calculated by averaging the available male and female rate.
Sources: Global Adult Tobacco Survey, 2009 (28); WHO STEPS, 2006–2009 from: *WHO Report on the Global Tobacco Epidemic, 2011* (27); Demographic and Health Surveys, 2009–2010 (29); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (27).

Prevalence of current ST use among men in the South-East Asia Region is high, ranging between 24.9% and 51.4% in five of the countries, although in Thailand it is less than 2%. Among women, prevalence of current ST use is high in four countries—Bangladesh, Bhutan, India, and Myanmar—with a range from 16.1% in Myanmar to 27.9% in Bangladesh. In Bangladesh the prevalence of ST use among women (27.9%) is roughly equal to that among men (26.4%), a unique situation in the region. In India, 32.9% of men and 18.4% of women use smokeless tobacco. Prevalence is highest in the Central, Eastern, and Northeastern States. The highest prevalence of ST use among men (62%) is in Bihar; among women, the highest prevalence is 49% in Mizoram.[12]

The prevalence of ST use tends to be higher in rural areas in Bangladesh, India, and Thailand than in urban areas (which is also generally true for smoking).[12,13,22,28] In a study of tobacco users in Myanmar in 2004, reports of ST use were higher in metropolitan areas, where smoking prevalence was reported to be lower; reports of ST use were lower in the central plain, where smoking prevalence appears higher.[18]

Smokeless tobacco users aged 15 years and older in three countries in the South-East Asia Region (India, Bangladesh, and Myanmar) number close to 259 million. For the entire region, the estimated number of ST users aged 15 years and older is 268.6 million (see chapter 2). Rural users in Bangladesh and India make up around 80% of total ST users, reflecting the largely rural populations in these countries.[12,13]

Product preference information for India and Bangladesh, from 2009 GATS data,[12,13] is available for individuals aged 15 years and older. In India, tobacco with lime (khaini) appeared to be the most common form of ST used (11.6% of adults), followed in descending order by gutka (8.2%), betel quid with tobacco (6.2%), tobacco for oral application (4.7%), and other oral/nasal products that may contain tobacco (4.4%).[12] These findings demonstrate that the centuries-old practice of chewing betel quid with tobacco has become less prevalent than use of gutka, which is essentially a dry, commercially manufactured version of betel quid developed in the late 1960s.[8] Using betel quid with tobacco in India is still the most common practice in the Northeastern States and Odisha (formerly known as Orissa); elsewhere gutka has overtaken betel quid. The 2009 GATS data for Bangladesh showed that betel quid with tobacco was by far the most favored product, with a prevalence of 24.3%, followed by gul (5.3%), sada pata (1.8%), tobacco with lime (khoinee) (1.5%), and other products (1.4%).[13]

A large international study of betel quid use, the Asian Betel-Quid Consortium (ABC) study, captured data on ST use in parts of Nepal, Indonesia, and Sri Lanka in 2010.[30] The study found that prevalence of chewing betel quid with tobacco was comparatively high in central Nepal (men, 43.6%; women, 34.9%) and high among women in Indonesia (men, 10.4%; women, 31.7%), but generally low in Sri Lanka (men, 6.4%; women, 3.2%).

Data from the Myanmar Sentinel Prevalence Studies of Tobacco Use show that prevalence among men increased from 23.8% in 2001 to 31.8% in 2007; for the same years, prevalence among women increased from 8.0% to 12.1%[31] (Figure 13-1). Definitive data on trends in most countries are unavailable, because successive surveys with the same methodology have not yet been conducted.

Figure 13-1. Prevalence of current smokeless tobacco use among adults (≥15 years) in Myanmar, 2001, 2004, and 2007

Source: Ministry of Health (Myanmar) 2009 (31).

Comparing ST use with smoking in the countries of the South-East Asia Region, data from the GATS, WHO STEPS, and other surveys[12,13,19–22,27–29,32–34] reveal that, among men, smoking is the predominant mode of tobacco use in Indonesia, Thailand, Bangladesh, Sri Lanka, and Nepal, whereas ST use is the predominant practice in India and Myanmar (Figure 13-2). Smoking rates among women in the region remain low—mostly well under 15%. Smokeless tobacco use among women is generally more common than smoking, except in Nepal.[33] The National Family Health Survey conducted in India in 2005–2006 was the first survey to find that men had a higher rate of ST use than of smoking.[9]

Figure 13-2. Current smoking versus current smokeless tobacco use prevalence among men and women in six South-East Asia Region countries, 2006–2009

Source: World Health Organization, 2011 (33).

Information on the use of both smoked and ST products, or dual use, is available from the GATS for Bangladesh, India, and Thailand (Figure 13-3). In India, 15.4% of tobacco users—42.3 million people—use both smokeless and smoked tobacco. In Bangladesh, about one-fifth (22.4%) of male tobacco users are dual users, compared to approximately 19% in India and only 1% in Thailand. Among women tobacco users in Bangladesh, Thailand, and India, only 2.5%, 3.3%, and approximately 5%, respectively, both smoke and use smokeless tobacco.[12,13,22] In a cross-sectional study of women in a town in Nepal, tobacco smokers were twice as likely as non-smokers to chew tobacco ($p<0.0001$).[35]

Figure 13-3. Percent of dual use, smoking only, and smokeless tobacco use only among adult tobacco users, by sex and country, GATS 2009–2010

Abbreviation: GATS = Global Adult Tobacco Survey.
Sources: India: GATS, 2010 (12); Bangladesh: GATS, 2009 (13); Thailand: GATS, 2009 (22).

Toxicity and Nicotine Profiles of Products

Some types of ST products in the South-East Asia Region are characterized by high levels of tobacco-specific nitrosamines (TSNAs), including khaini and zarda, and some, such as gul powder, also have high levels of nicotine.[15,36] In addition, the use of areca nut with tobacco introduces other harmful constituents.[8] Table 13-4 includes the nicotine and nitrosamine levels of several regional products, including gul powder, zarda, gutka (both commercially manufactured and cottage industry products), and khaini.

Table 13-4. Nicotine and nitrosamine levels in selected regional products

Product	pH	Total nicotine	Free nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet weight		ng/g wet weight			
Gul Powder	8.79–9.22	33.4–34.1	29.1–31.0	1,330–1,370	5,190–8,020	590–630	13,400–17,100
Zarda	5.22–6.51	9.55–30.4	0.17–0.63	457–3,840	2,910–28,600	248–3,460	5,490–53,700
Gutka:							
Manufactured (India)	8.46–8.88	1.09–1.78	0.86–1.78	57.1–456	167–1,280	23.2–258	370–2,250
Cottage Industry (India)	7.43–8.61	0.91–4.20	0.19–3.33	7.1–375	154–18,600	10.8–1,030	264–23,900
Khaini	9.65–9.79	2.53–4.79	2.48–4.68	288–502	16,800–17,500	1,350–1,440	21,600–23,500

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown); *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNA = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (15).

Health Problems Associated With Product Use

A large body of published epidemiologic studies shows strong associations between ST use in the South-East Asia Region and several serious health consequences.

Cancer

Incidence of oral and pharyngeal cancers is high in the countries of this region compared to most of the world.[37] The high incidence rates for these cancers have been attributed in large part to ST and areca nut use, as well as to smoking products such as bidis, cheeroots, pipes, and cigars. Estimated incidence rates for oral cancers (lip and oral cavity) for the countries of the region are shown in Table 13-5.

Most of the epidemiologic studies on ST come from India and pertain to cancer. The International Agency for Research on Cancer (IARC) evaluated existing evidence, including evidence from the South-East Asia Region, on the carcinogenicity of ST and of betel quid with tobacco and declared the evidence "sufficient," meaning that a causal relation had been established between ST use and cancer, specifically of the oral cavity.[8–10] The evidence that betel quid with tobacco causes pharyngeal and esophageal cancers was also declared sufficient.[8] A few illustrative studies are mentioned below.

Table 13-5. Annual age-standardized incidence rate of lip and oral cavity cancers in South-East Asia Region countries: Estimates from GLOBOCAN, 2008

Country	Men		Women		Both	
	Cases	ASRW	Cases	ASRW	Cases	ASRW
Bangladesh	5,048	9.6	5,354	9.9	10,402	9.7
Bhutan	19	6.9	10	4.5	29	5.7
India	45,445	9.8	24,375	5.2	69,820	7.5
Indonesia	2,693	2.8	2,310	2.1	5,003	2.4
Maldives	23	24.5	7	8.2	30	16.5
Myanmar	1,001	5.1	908	3.9	1,909	4.5
Nepal	886	10.2	357	3.6	1,243	6.7
Sri Lanka	1,701	16.5	589	5.0	2,290	10.3
Thailand	2,038	5.8	2,360	5.8	4,398	5.9
Timor-Leste	9	3.1	7	2.2	16	2.6
Democratic People's Republic of Korea (North Korea)	138	1.1	122	0.8	260	0.9
Total for South-East Asia Region	**59,001**	**8.4**	**36,399**	**5.0**	**95,400**	**6.7**

Abbreviation: ASRW = Age-standardized incidence rate (for the world population) per 100,000 people.
Source: Ferlay et al. 2010 (37).

Oral Cancer

The first known hospital-based case-control study in India was reported by Orr in 1933.[38] In the mid-1960s several additional studies were conducted in South-East Asia Region countries, including a study in India and Sri Lanka by Hirayama.[8,39] The studies by both Orr and Hirayama found a dose–response relationship between chewing betel quid with tobacco and cancer.[10,38,39] A 2003 multicenter study from southern India found that chewers of betel quid with tobacco had a ninefold excess risk of oral cancer compared to never chewers (odds ratio [OR] = 9.27; 95% CI: 6.79–12.66), which was nearly four times higher odds than that for smokers.[40]

A review article from 1990 found that the peak age of occurrence of oral cancer was at least a decade earlier in India than in Western countries. In the 1980s, only 10% to 15% of people with oral cancer in India went to the hospital when their cancers were in localized stages, a delay that results in poor survival rates.[41]

In the South-East Asia Region only a few studies have investigated the use of ST without areca nut. Most notable was a large cross-sectional study from the mid-1960s in north-central India, which found that, compared to the risk for non-chewers of tobacco, the excess risk of oral cancer was three times greater for chewers of plain leaf tobacco and 22 times greater for users of areca nut mixed with tobacco, although the statistical significance of this finding was not reported.[42]

Pharyngeal Cancer

In a case-control study in central India, chewers of tobacco with traditional/local ingredients (such as lime or betel quid) had a ninefold higher risk of oropharyngeal cancer than non-chewers (OR = 9.0; 95% CI: 4.6–15.2).[43] In a study conducted in southern India, a stratified analysis showed that chewers of betel quid with tobacco who had never smoked or been alcohol drinkers had a nearly fourfold excess risk of pharyngeal cancer (OR = 3.7, 95% CI: 2.2–6.3).[40] Another study found that hypopharyngeal cancer may develop from chewing gutka, betel quid with tobacco, zarda, or mawa.[44]

Esophageal Cancer

A 1970s case-control study in Sri Lanka found an association between ST use and esophageal cancer.[45] A more recent (2001) case-control study in northeastern India found that users of dried tobacco leaf (chadha) had adjusted excess risks of esophageal cancer between three and five times higher than the risks for non-users ($p<0.001$, adjusted for tobacco smoking and alcohol drinking).[46] In a study in southern India, users of betel quid with tobacco who did not smoke or drink alcohol had a nearly sixfold excess risk of esophageal cancer (OR = 5.7, 95% CI: 3.5–9.4).[40]

Other Cancers

Some evidence from India supports associations between ST and other cancers. Evidence for stomach cancer in users of chewing tobacco, betel quid, and tuibur was found in one study in India's northeastern region.[47] Moreover, case-control studies have found evidence of associations between betel quid use and cervical and breast cancers.[48,49] Another study found evidence for an association between use of chewing tobacco and snuff and the development of penile cancer.[50]

Precancerous and Other Oral Conditions

Abnormal changes in the oral mucosa often precede the development of squamous cell carcinoma. Oral leukoplakia is the most common of these changes. It is generally associated with any form of tobacco use, including ST use and smoking.[51] Another condition is oral submucous fibrosis (OSF), a progressive disease in which the oral mucosa loses elasticity and develops fibrous bands that cause difficulty in opening the mouth. OSF can progress to cancer, although the malignant transformation rate of OSF is relatively low. It is also associated with chewing areca nut, which is often consumed with tobacco.[8]

Gutka chewing is also very strongly associated with the development of OSF. A review showed that five studies found a strong relationship between gutka chewing and OSF, including a dose–response relationship.[52] OSF appears earlier in pan masala and gutka users than in betel quid users. In one Indian study, OSF was diagnosed on average about 3 years after individuals had begun using pan masala or gutka, compared to roughly 9 years after initiation of betel quid use.[53] OSF was even found in teenagers.[54] Incidence of OSF has also increased. In the Indian state of Gujarat, from 1993–1994 to 2003–2004, incidence of OSF increased sixteenfold, and incidence of squamous cell carcinoma of the oral cavity increased by around 11%.[55]

A 2010 cross-sectional study of 1,029 adults in Sri Lanka showed the prevalence of oral disorders to be 11.3%, or 102 cases; 25 of these cases were OSF cases.[56]

Reproductive Outcomes

Use of ST during pregnancy can lead to adverse reproductive outcomes such as low birth weight, stillbirth, and pre-term birth, as has been demonstrated in numerous studies in India. A cohort study in Mumbai in 2004 found that women using ST had a 60% higher risk of having a low birth weight baby than non-users ($p<0.05$).[57] After adjustment for potential confounders, users also had a 2.6-times higher risk of stillbirth (95% CI: 1.4–4.8). A dose–response relationship was found between stillbirth and use of mishri, the most commonly used product in this cohort.[58] Other studies have noted that betel quid both with and without tobacco may be associated with adverse pregnancy outcomes such as reduced birth weight and pre-term birth.[8,9]

Cardiovascular Diseases

Information has been accumulating globally on the association between ST and cardiovascular disease. The international INTERHEART study showed an independent association between ST use and cardiovascular events such as acute myocardial infarction in different parts of the world, including India.[59] A similar association was shown in a study of randomly selected death records from a small town in Uttar Pradesh, India.[60]

Supporting the results on cardiovascular-related events and deaths, other studies show that cardiovascular risk factors are higher among ST users than non-users, as they are in smokers compared to non-smokers. For example, in a cross-sectional study in India, ST users had a nearly threefold higher risk of diastolic hypertension (OR = 2.7, 95% CI: 1.4–4.9) compared to people who did not use tobacco, adjusted for age, body mass index, exercise, and family history of high blood pressure.[61] In another study in India, tobacco chewers had a significantly higher ($p<0.001$) systolic blood pressure, diastolic blood pressure, and resting heart rate, as well as significantly higher levels of total cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides when compared to individuals in a control group matched on sex and age. Prevalence of these cardiovascular risk factors was similar among chewers and smokers.[62]

Overall Excess Mortality

The conclusion that ST contributes to premature death is supported by the results of a cohort study undertaken in Mumbai, where the most commonly used product was mishri (or masheri). Participants in this study were 99,244 individuals aged 35 years or older at baseline, with follow-up taking place on average at 5.5 years. The study found that the relative risks of premature death associated with ST use were significant for both women (25% higher risk) and men (16% higher risk).[63] See Table 13-6 for this study's data on all-cause mortality, by type of ST product.

Table 13-6. Relative risks for all-cause mortality by type of smokeless tobacco used, from the 1992–1999 Mumbai Cohort Study

Type of Smokeless Tobacco	Relative risk* (95% confidence interval)	
	Men	Women
Mishri	1.14 (0.97–1.33)	1.21 (1.10–1.34)
Mishri plus other smokeless tobacco†	1.18 (1.07–1.31)	1.36 (1.24–1.48)
Other smokeless tobacco†	1.24 (1.08–1.41)	1.37 (1.09–1.73)
Never tobacco use	1.0 (reference)	1.0 (reference)

*Age- and education-adjusted relative risk using Cox model.
†Other smokeless tobacco was generally tobacco with lime.
Source: Gupta et al. 2005 (63).

Dependency Issues

Tobacco addiction is a major health consequence of ST use. It is characterized by continued frequent use of ST and chronic exposure to all the other harmful effects of tobacco and its related conditions. Quit rates are very low in the region, as shown in the GATS in India, Bangladesh, and Thailand. The proportions of ever users of ST who had successfully quit as of 2009 were 7.8% in Bangladesh, 7.9% in India, and 21.8% in Thailand (quit ratios calculated from full GATS reports).[12,13,22]

One study in Myanmar found that tobacco users believed that quitting betel quid with tobacco is more difficult than quitting smoking.[18] Older intervention studies in India found that smokers who also use ST have the most difficulty of all.[64] The addictiveness of tobacco is the major factor responsible for sustaining the market, both for smoking and using smokeless tobacco.

Marketing and Production Practices of Industry

With its long tradition of use in the region, ST has economic importance even in countries where smoking predominates (Indonesia and Thailand), and its importance has been growing in several other countries (Bangladesh, Bhutan, India, Nepal, and Myanmar).

Production

Production figures on tobacco destined for smokeless use are available for India only: In 2002–2003, India produced about 84.9 thousand tons of tobacco to be used in making chewing tobacco products, and 6.4 thousand tons of tobacco to be used in snuff products, out of a total of 491.7 thousand tons of tobacco produced. Thus, 18.6% of tobacco produced was destined for making ST products.[65]

Most ST product manufacturers are cottage-based industries, though some are large factory operations. A few multinational corporations have also entered the market in the last 10 years. In 2001, Swedish Match launched the Click brand of snus in India, but the product was not accepted as well as expected, and after a few years it was discontinued.[66,67]

Cottage-based ST is sometimes packaged in small pouches like the manufactured, commercial products. Some products can be made or assembled by a vendor (such as mawa or betel quid with tobacco) on demand from users, or users can buy the ingredients from shops and assemble them (as in betel quid and tobacco) or process them (such as by roasting and powdering tobacco flakes to make mishri). In India, Bangladesh, Myanmar, and to an extent Indonesia, preparation of ST products was traditionally a cottage industry, but large manufacturers have entered the scene in more recent years with, for example, fire-cured snuff. In India since the early 1970s, and more rapidly since 1991 after the economy was liberalized, industrial-scale production of chewing tobacco products, especially gutka, increased. The cost of gutka was typically 1 to 2 Indian rupees (INR) (US$0.02–0.04), but it is now being purchased for up to INR 7 (US$0.13) for a small sachet.[68] Also since the early 1990s, India has seen a rise in industrial production of chewing tobacco, from INR 1.1 billion (US$36 million) in 1993–1994 to INR 6.7 billion (US$142 million) in 2000–2001, as demonstrated by excise collections.[69]

Marketing Practices

Smokeless tobacco products are made palatable by adding spices, areca nut, sweeteners, and scents. They are made attractive to consumers by colorful packaging, and this packaging is convenient as well. Since 1985, products have been sold in single-dose plastic sachets. Prices are low, with single-dose packages cheap enough that even schoolchildren can buy them (as mentioned above, from INR 2 to INR 7, or US$0.04–0.13 for a small sachet).[68]

Brand names are chosen to appeal to different social segments: names of resort areas (Shimla and Goa), appellatives (e.g., Sir, by which students usually address teachers), names with religious significance (Tulsi, meaning holy basil), and fun names (Chaini Khaini). Brand names for products not containing tobacco, such as most varieties of pan masala, are the same as those for products containing tobacco (gutka, khaini). This identical branding, both of tobacco and non-tobacco products and of smokeless and smoked tobacco products, is intended to boost the sales of the lesser known product. Godfrey Phillips (partly owned by Philip Morris) entered the chewing product market with a pan masala in 2010, stating that the company expected that its cigarette business would "provide the synergy to its chewing product."[70]

Identical branding of tobacco and non-tobacco products is also an attempt by manufacturers to circumvent India's ban on tobacco advertising, using the non-tobacco products as surrogates for the tobacco-containing products. Thus, advertising for the non-tobacco versions of the tobacco-containing products is considered indirect advertisement of those tobacco products.[71]

Advertisements for the non-tobacco products have different themes, such as a favorite elderly uncle, middle-aged parents, a couple in love, and a sexy young lady. These advertisements are seen on television, in outdoor media (such as on buses), and sometimes in newspapers.[71]

Distribution and Sales

A few brands of chewing tobacco, including gutka, are sold nationwide in India; others are sold regionally or locally. In the South-East Asia Region, ST products are normally sold through street vendors, kiosks, and grocery/convenience stores. At kiosks and street vendor stands they are sold along with smoking products, candies, and snacks.

Smokeless tobacco Internet sites appear to be targeted toward foreign buyers (e.g., http://www.Desismoke.com). Companies in Bangladesh, India, Indonesia, Nepal, and Sri Lanka advertise their chewing tobacco products on the Internet, and many trade websites display contact information for outlets in the region that sell ST, among other products (such as the manufacturer directory at http://www.Alibaba.com). On one major website, by far the largest number of exporters, 186, are located in India, whereas other individual South-East Asia Region countries have 7 at most.[72] Through this website, companies in India and Nepal are exporting gutka,[72] and India, Nepal, and Indonesia are exporting snuff.

India is one of the world's largest exporters of tobacco, exporting approximately 50% of its total tobacco production to other countries, according to the Directorate of Tobacco Development of the Government of India.[65] From 2000–2001 to 2009–2010, legal exports of chewing tobacco from India increased nearly 450%, from 1,953 tons to 8,725 tons.[73,74] The value of exported chewing tobacco products in 2009–2010 was around US$63.6 million. In addition to legal exports, some amount of ST is smuggled to other countries in South-East Asia, and possibly around the world.[75] During 2009–2010, India exported chewing tobacco products to more than 48 countries, and snuff to at least 6 countries. The countries to which India exported 11 tons or more of tobacco for chewing include: the United Arab Emirates, 4,477 tons; Saudi Arabia, 980 tons; Malaysia, 323 tons; the United States, 160 tons; and Kenya, 77 tons.[73] India also exported 85 tons of snuff products in 2009–2010, primarily to China, Tanzania, and the United States.

Smokeless tobacco products exported from India mainly cater to the South Asian diaspora, but use of South-East Asian ST products by local inhabitants in various countries has also been reported.[52]

Current Policy and Interventions

Prevention and Cessation Interventions

School-Based Interventions

School-based interventions can lead to successful primary prevention of tobacco use. Project MYTRI (Mobilizing Youth for Tobacco-Related Initiatives in India) aimed to decrease tobacco use/uptake by students in grades 6–9 in 32 urban schools in India. This culture-specific intervention, Indian in content and communication, addressed both smokeless and smoked forms of tobacco. Teachers were trained to assist with the program, and this teacher training was critically important to rigorous implementation of the program. Teacher training, a higher proportion of students participating in classroom discussions, and better peer-leader-student communication all helped to support the implementation of the program and lower children's reported susceptibility to chewing tobacco.[76] Project MYTRI was conducted in schools in Delhi and Chennai by HRIDAY-SHAN (Health Related Information Dissemination Amongst

Youth Student Health Action Network), a voluntary organization of health care professionals and social scientists.[76,77]

Policies that ban all tobacco use on school grounds are in place in federal schools run by India's central government, which are few in number,[78] but these bans are not implemented as widely in schools run by the states. A study in Bihar found that in federal schools, where there was a policy of no tobacco use, teachers' daily use of ST was significantly lower than in state schools (41.7% versus 14.1%, respectively).[79]

Although most children have become aware that smoking tobacco and using khaini and zarda are harmful to their health, they do not appear to recognize that gutka, an ST product commonly used among children, also causes many health problems.[80]

Community Interventions

A program of interventions was conducted in the 1970s and 1980s in three rural areas in India with 36,000 tobacco users aged 15 years and older (12,000 in each area).[64] The interventions included oral examinations by dentists at yearly intervals, followed by individual counseling by specially trained social scientists[81]; two documentary films viewed by groups of 20–25 participants, followed by discussion; and radio spots, newspaper articles, and posters. Interventions were followed up by small group "cessation camps," in which villagers trying to quit met with counselors, and detailed discussions were held daily to address difficulties in quitting until people felt confident of remaining abstinent on their own. These interactions were updated and informed by the progress of the intervention.[82] Quit rates obtained in these single-arm interventions (after 10 years: 15.1% for men and 18.4% for women chewers) were higher than those found in the no-intervention population (2.3% of men and 7.8% of women).[81] Another anti-tobacco community education program in rural India demonstrated similar results in the early 1990s: After 5 years, the use of ST decreased approximately 6% (from 16.4% to 10.8%; $p<0.0001$) among men in the intervention group compared with a 0%–1% decrease in control populations.[83]

Various voluntary organizations conduct anti-tobacco interventions from time to time in rural areas of the region, but they do not always evaluate the interventions or publish their findings, so the experiences are lost to the public health community. Nevertheless, published data show positive results, both in terms of cessation and reduction of tobacco use and in the regression of oral precancerous lesions.[81]

In 2003, Myanmar piloted a cessation intervention in 13 communities. Over 200 facilitators were trained to lead intervention activities, which varied across communities. Some of these activities included roundtable discussions, advocacy talks with community leaders, monthly meetings between facilitators and quitters, distribution of health education materials, and live entertainment education such as songs and plays performed at festivals. The impact of these cessation activities varied widely in different communities depending on the intensity of the interventions. Among smokers, 11% completely stopped smoking, but ST quit rates across the communities was not reported.[84]

Workplace Interventions

A workplace tobacco cessation program was conducted and evaluated at a chemical plant in Ratnagiri, a rural district of Maharashtra, India. Before the program, over 48% of the employees used tobacco, mostly in smokeless form, with little awareness of its health effects. Precancerous lesions were found in 40%, mainly in ST users.[85] The intervention consisted of awareness lectures, group discussions and individual counseling on how to quit, and an offer of pharmacotherapy (bupropion). Awareness programs were also arranged for family members and contract employees. Follow-up sessions were held every 6 to 8 weeks, and tobacco quit rates improved with each session, reaching 40% at the end of one year, which was verified through urine cotinine testing. Among employees who quit, many noticed that their oral lesions decreased in size.[86]

Evidence From Cessation Clinics

In 2002, India's Ministry of Health and Family Welfare and the WHO set up tobacco cessation clinics in hospitals and nongovernmental organization (NGO) settings in India. The original 13 clinics expanded to 19, and 34,741 participants were registered in the first 5 years. For 69% of the participants, behavioral strategies alone were used, and for the remaining 31%, pharmacotherapy was added, mainly bupropion and nicotine gum.[87,88] The results showed that at 6 weeks, 14% of the study participants had completely quit and 22% had reduced their tobacco intake by half. Results at 3, 6, and 9 months showed that younger male patients, users of smokeless forms of tobacco, and those receiving a combination of pharmacotherapy and behavioral counseling were more likely to reduce tobacco use.

Mass Media Campaigns

As a part of the National Cancer Control Programme, the Indian Council for Medical Research and All India Radio collaboratively conducted a mass media intervention on drugs, alcohol, and tobacco. Called Radio–DATES (for Drugs, Alcohol, and Tobacco Education), the intervention, consisting of 20-minute programs, was broadcast in 16 languages on 84 radio stations (of 104 existing stations at that time) once a week for 30 weeks.[89] To assess the impact and reach of this media campaign, community-based surveys were conducted in two rural communities where no organized tobacco control programs existed. After hearing the programs, about 6% of tobacco users quit in rural Karnataka and 4% quit in rural Goa. In Karnataka, 32% of potential listeners heard at least one episode on tobacco compared to 27% in Goa.[90]

Current Policy

All member states in the region except Indonesia have ratified the WHO FCTC.[91] As of January 2014, nine of the countries that have ratified have adopted comprehensive tobacco control laws.[33] (Timor-Leste has ratified the FCTC and as of December 2013 was in the process of passing national-scale legislation.) Table 13-7 summarizes the policies of these countries.

Bhutan has introduced the strongest tobacco restrictions of any country in the world. In addition to banning imports, Bhutan has banned exports, agricultural production, manufacture, and sale of tobacco and all tobacco products. Health warnings are required on tobacco brought in from another country for personal use.[92]

Implementation and enforcement are a huge challenge in the region for various reasons. In India specifically, a major obstacle to implementing tobacco control legislation has been fear of the economic consequences of job losses among the country's large number of tobacco workers (especially bidi workers). Other obstacles to successful and efficient implementation include a time lag to prioritize allocation of resources, interference from the organized tobacco industry, the informal nature of a large part of the industry, and high rates of use in large populations.

Table 13-7. Policy measures for controlling smokeless tobacco use in the South-East Asia Region

Countries	Ban on exports	Ban on imports	Ban on advertisement	Ban on sale to minors	Health warning for smokeless tobacco	Ban on sale within 100 yards/meters of a school
Bangladesh			✓		Yes	
Bhutan	✓	✓*	✓	✓	Yes†	N/A‡
Democratic People's Republic of Korea (North Korea)				✓		
India			✓	✓	Yes	✓
Indonesia						
Maldives			✓	✓	Yes§	
Myanmar			✓	✓	Yes§	✓
Nepal			✓	✓	Yes§	✓
Sri Lanka				✓	Yes§	
Thailand		✓	✓	✓	Yes	
Timor-Leste						

✓ = Ban applied.
*Bhutan allows limited import of tobacco products for personal consumption only.
†Health warnings are required on all imported tobacco products (added by the country of origin).
‡Bhutan banned sale of smokeless tobacco products in any location, therefore a specific ban on sale near schools does not apply.
§Health warnings are required on tobacco products by the national laws, but there is no specific rule for smokeless tobacco.
Abbreviation: N/A = not applicable.
Sources: Adapted from World Health Organization, 2011 (19); Bangladesh data from Campaign for Tobacco-Free Kids, 2013 (116).

Taxation

Unlike taxes on cigarettes, taxes on ST are low or nonexistent. In the South-East Asia Region, unmanufactured tobacco sold in loose form is often not taxed. Betel quid with tobacco, which is sold fresh by street vendors, is not taxed and has no warning labels. In 2008–2009, the government of Bangladesh recognized ST (mainly for chewing) as a manufacturing industry rather than a cottage industry and, under the 2011–2012 budget, Bangladesh taxed ST products for the first time.[93] In India, the ST industry, particularly the gutka industry, has grown tremendously in the last three decades. All manufacturers of tobacco products in India are expected to register with the government and pay excise taxes, but this is poorly enforced, and it is estimated that only one-fourth of the excise tax due on the gutka and pan masala industry is actually paid.[94] In 2008–2009, India collected INR 35 billion (US$632 million) in taxes on chewing tobacco.[95]

Bans on Public Use

Nepal banned the use of any tobacco product in all indoor public places in its Tobacco Control and Regulation Act, which came into force on August 7, 2011.[96,97]

Bans on Sale to Minors

Sale of ST to minors is prohibited in the countries with comprehensive laws (except Bangladesh). India, Myanmar, and Nepal are the only countries in the region that prohibit selling tobacco within 100 yards of educational institutions. In 2011 India, with the assistance of some NGOs, local governments, and courts, intensified enforcement of this ban.[98]

Health Warnings on Packages

India requires textual and pictorial health warnings for ST products sold domestically but not for exports. However, industry interference has caused a long delay in introducing pictorial warnings.[99,100] In Thailand, packages of shredded tobacco meant for roll-your-own cigarettes carry a warning about smoking, but no warning about using tobacco in smokeless form is required. In Bhutan, commercial importation of tobacco is banned, but health warnings are required on tobacco brought in from another country for personal use. Nepal passed legislation in 2011 requiring graphic warnings on all kinds of tobacco products.[101] In much of this region, unmanufactured, loose tobacco is also not advertised and does not display any warnings.[95]

Restrictions on Advertising

Bhutan, India, Maldives, Myanmar, Sri Lanka, and Thailand have prohibited advertisements for ST, but implementation is inadequate, mainly due to the indirect advertising shown on Indian television (that is, advertisements for non-tobacco products that are similar to tobacco products in various ways; see the discussion of indirect advertising in “Marketing Practices of Industry,” above). Bangladesh and DPR Korea have no restrictions on advertising of smokeless tobacco. Around 70% of adults in Bangladesh had noticed advertisements for ST as well as ST company sponsorships or promotions, according to the GATS (2009).[28,102] In India, a ban on direct advertisements is enforced, but indirect advertisements and

surrogate advertisements persist. Direct advertisement continues at points of sale, and 10.8% of adults have noticed point-of-sale advertisements or promotions of ST.[12]

Bans on Sale

Bhutan bans the sale of all forms of tobacco. In India, a 1992 amendment to the Drugs and Cosmetics Act of 1940 prohibited the manufacture, sale, and distribution of toothpastes and toothpowders containing tobacco (such as creamy snuff and red toothpowder), although several studies continue to find nicotine in some brands of dental care products.[103,104]

In India between 2001 and 2003, five states attempted to ban chewing tobacco (including gutka) and pan masala, but Goa is the only state that has managed to actively restrict the sale of chewing tobacco.[105] In 2004, after a group of manufacturers challenged the bans in Maharashtra and Andhra Pradesh, the Supreme Court of India ruled that state bans were unconstitutional because only the central government has the power to ban such items.[106]

Despite the early success in Goa, it would be another 7 years before the next state would ban ST products. The Food Safety and Standards Authority of India helped pave the way for states to ban gutka and other chewing tobaccos under Regulation 2.3.4 of the Food Safety and Standards Regulations, 2011, which prohibits any harmful ingredient, including nicotine and tobacco, from being added to food.[107–109] The Indian Supreme Court determined in 2004 that gutka was a "food product" and was thus covered under this regulation. The regulation authorizes state food commissioners to ban all gutka products throughout the country, although it was not widely enforced at first. In April 2012, Madhya Pradesh became the first state to implement the ban on gutka by invoking Regulation 2.3.4.[107,108,110] As of October 2013, all of India's states and union territories except Meghalaya and Lakshadweep have banned the sale of gutka.[111]

This ban has been enforced in varying degrees across India, and some states, such as Maharashtra and Manipur, have banned other types of ST including zarda and khaini.[111] While some states and union territories have been relatively successful in enforcing the ban on gutka, industry is also circumventing these bans by selling pan masala and tobacco in separate pouches.[109]

Import Bans

Thailand (1992) and Bhutan (2011) have banned the import of ST products. Thailand instituted this policy out of concern about the possibility of American and European ST products becoming widely used in the country. Thailand's ban on imports was supported by both the public health community and the state-owned Thailand Tobacco Monopoly.[23]

In 2009, Bhutanese school boys aged 13–15 years had the highest prevalence of ST use by young adolescents in the region.[26] Bhutan first introduced a ban on tobacco sales and imports in 2004, but implementation was weak, and a thriving black market for tobacco developed.[112–114] In 2010, Bhutan passed the Tobacco Control Act, which imposed harsher penalties and strengthened enforcement.[113,115] Now individuals may bring in small amounts of ST for personal use if they declare it and pay a duty.

Summary and Conclusions

Smokeless tobacco use is highly prevalent in the South-East Asia Region, especially when compared with other regions of the world, ranging from 25% to 51% in five countries (Bangladesh, India, Myanmar, Nepal, and Sri Lanka) compared to only 2% in Thailand. Specifically, governments in this region are faced with newer manufactured products such as pan masala and gutka, as well as brands of packaged chewing tobacco, which may pose dangers greater than those of traditional products such as betel quid and ordinary chewing tobacco. The cottage industry nature of some products complicates efforts to understand and regulate traditional products in the region.

Evidence from existing toxicity profiles indicates high levels of TSNAs in products such as khaini and zarda. Harmful constituents are found not only in tobacco, but also in areca nut, which is widely incorporated in ST products.

High incidence of oral cancer exists in several areas of the region, especially in India, and is partly attributed to the use of ST and areca nut products. Additional research illustrates other adverse health outcomes associated with these products, including negative reproductive outcomes and cardiovascular disease. Much of this research is based on data from India, however, and additional research on health outcomes from a variety of products across the region is necessary to fully understand the health impact of smokeless tobacco.

Government action is also required to curb illegal imports of ST from other countries within and outside the South-East Asia Region. In addition, advocacy campaigns to strengthen and enforce policies restricting ST and smoking are needed in most of the region's countries, but these efforts require more resources, both for the present and the long term. Several intervention programs, specifically school-based interventions, community interventions, and mass media campaigns, have been evaluated and shown to have some impact, but most of this work was conducted only in India. Policies to raise awareness of these interventions and increase the accessibility of cessation counseling with behavior therapy and pharmacotherapy are still needed in many other countries across the region.

The WHO FCTC has been ratified across South-East Asia, except by Indonesia, but enforcement of tobacco control policies is weak in the region. Taxes and health warnings are mostly nonexistent for ST products (specifically unmanufactured tobacco). Countries such as Bhutan, India, Maldives, Myanmar, Sri Lanka, and Thailand have banned ST advertising, but more work is needed to improve these efforts in the South-East Asia Region.

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Chapter 14

Smokeless Tobacco Use in the Western Pacific Region

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Description of the Region

The World Health Organization (WHO) Western Pacific Region extends from China and Mongolia in the north and west to New Zealand in the south and French Polynesia in the east. The region consists of 37 member states and areas, and today is home to over 1.6 billion people, nearly one-quarter of the world's population.[1]

The Western Pacific Region is characterized by great diversity and disparity. Both the most populous country (China, with approximately 1.3 billion people) and the least populated territory (Pitcairn Islands: population, less than 50) belong to this region[1,2] (see Table 14-1 for country land areas and populations). This region includes high-income countries as well as some of the world's lowest income countries. Over a thousand languages are spoken within the region, and most of the world's religions are represented. Ethnically, politically, economically, and socioculturally diverse, the Western Pacific Region simultaneously poses great challenges and offers substantive opportunities in tobacco control.

Table 14-1. Population and land area for selected Western Pacific Region countries

Country/Area*	Area (km^2)	Population (thousands)
Australia	7,422,667	22,268
Cambodia	181,256	14,138
China	9,580,964	1,341,335
Cook Islands†	236	11
Fiji	18,319	861
Macau	26	544
Malaysia	330,244	28,401
Micronesia, Federated States of	703	111
Mongolia	1,378,000	2,756
Northern Mariana Islands†	464	51
Palau†	459	21
Papua New Guinea	457,200	6,858
Philippines	299,875	93,261
Singapore	683	5,086
Solomon Islands	28,316	538
South Korea	99,554	48,184
Tuvalu†	26	11
Vanuatu	12,000	240
Vietnam	331,502	87,848
Total	**20,142,494**	**1,652,523**

*Unless otherwise indicated, data are from: *World Population Prospects: The 2010 Revision* (2).
†For data on Cook Islands, Northern Mariana Islands, Palau, and Tuvalu: *The World Factbook* (63).
Abbreviation: km = kilometer.

Within the Western Pacific Region, several subregional groupings exist, based primarily on political and trade alliances. These include the Association of South-East Asian Nations (ASEAN), the Pacific Islands Forum, and the Asia–Pacific Economic Cooperation (APEC) forum. Western Pacific Region countries also belong to associations with countries outside the region. For instance, American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, Palau, the Republic of the Marshall Islands, and the Federated States of Micronesia are linked to the United States through the Compact of Free Association,[3] whereas 14 countries within the Western Pacific, former colonies of the United Kingdom, are members of the British Commonwealth.[4]

Western Pacific countries are highly impacted by forces of economic globalization, and the high priority placed on international trade in the region presents both benefits and obstacles to effective tobacco control. For example, governments may be reluctant to impose trade restrictions on tobacco products, and this position, driven by economic rather than public health goals, could undermine tax policies and other measures to raise tobacco prices. For example, under the ASEAN Free Trade Agreement (AFTA), tobacco products made in ASEAN countries with at least 40% of the raw materials from the ASEAN subregion are subject to a tariff-reduction scheme mandated in the agreement, thus encouraging use of these products.[5] Moreover, the tobacco industry and its allies are quick to seize opportunities to expand their markets under the banner of globalization. In 2001, when China joined the World Trade Organization, the entry of foreign cigarette brands into the Chinese market was one of the key points negotiated by the major world economies with China. China, Japan, and Vietnam continue to hold a majority stake in their domestic tobacco industries, and in Cambodia, Laos, Vietnam, and the Philippines, tobacco agriculture and manufacturing provide jobs and funnel investment dollars to the local economies, making governments reluctant to enact legislation and policies to reduce tobacco consumption.[6]

The Western Pacific Region is the first—and to date, the only—WHO Region to achieve a 100% ratification rate for the WHO Framework Convention on Tobacco Control (FCTC). Globalization is facilitating the diffusion of ideas and examples of successful national tobacco control strategies throughout the Western Pacific and is mobilizing support for implementation of the FCTC.[7]

Prevalence of Smokeless Tobacco Use

Smoking remains the predominant form of tobacco consumption in the Western Pacific Region, which is home to one-third of the world's smokers.[8] It is estimated that two people in the region die every minute from a tobacco-related disease.[9] The Western Pacific has the largest number of male smokers and one of the highest rates of male smoking in the world, and the uptake of tobacco use by women and young people is steadily increasing.[8]

Prevalence data on the use of smokeless tobacco (ST) in the region are scarce. Based on available data, ST use is many orders of magnitude less prevalent than smoking. However, anecdotal reports indicate that commercial ST products produced by national and multinational tobacco companies are becoming more visible and that advertising for these products is increasing. Regrettably, at present no regional mechanism systematically tracks this trend. In addition, the practice of adding tobacco to the traditional

areca nut/betel quid has begun in certain areas, especially in the Pacific Islands, Cambodia, Vietnam, and the Philippines; available data on use of this form of ST are reviewed separately, below.

Because surveys use different sampling, methods, questions, and definitions, caution should be exercised in comparing prevalence information from different surveys as statistical tests were not conducted on these comparisons. In particular, the surveys' definition of current use varies: Some surveys define it as any use within the past 30 days, while other surveys ask about different time periods; some surveys ask about daily use and use on some days, and still other surveys ask about "current" use without defining the term further. For the Western Pacific region, current use by youth tends to be defined as any use in the past 30 days. For adults, some surveys define current use as use every day, while other surveys include use every day and use on some days in their definition of current use.

Regional Data: Youth

The Global Youth Tobacco Survey (GYTS) provides an overview of the magnitude of non-cigarette tobacco use among youth; this includes use of bidis, hookahs (i.e., waterpipes), and ST products.[10] In addition to cigarette smoking, almost all participating countries report other tobacco use by youth. Consumption of other tobacco products appears highest among the Pacific Island countries, where it equals or surpasses smoking prevalence.[10] GYTS data specifically on ST use is only available for four countries: Cook Islands, Macau, Malaysia, and South Korea (Table 14-2).

Table 14-2. Percentage of adolescents aged 13–15 years who currently used smokeless tobacco in the Western Pacific Region, from the Global Youth Tobacco Surveys, 2008–2010

Country	Year	Total (%)	Boys (%)	Girls (%)
Cook Islands	2008	8.7	10.5	7.3
Macau	2010	2.1	2.2	2.1
Malaysia	2009	4.0	4.5	3.2
South Korea	2008	6.2	7.2	5.0

Source: Global Youth Tobacco Survey, 2008–2010 (10).

Regional Data: Adults

Regional data on overall ST use among adults in the Western Pacific Region are scarce, representing a major gap in tobacco surveillance. Prevalence estimates on ST use have been reported for 8 of the 37 countries and areas in the region (Table 14-3; Map 14-1). Higher prevalence rates of current ST use among men than women in Australia, China, the Federated States of Micronesia, Mongolia, and the Philippines contrast sharply with the situation in Cambodia, Malaysia, and Vietnam, where female consumption markedly surpasses male use rates.[11]

Table 14-3. Percentage of adults who currently used smokeless tobacco in the Western Pacific Region, 2002–2010

Country	Year	Age group (years)	Total (%)	Men (%)	Women (%)
Australia*	2004	12+	0.6	0.8	0.4
Cambodia†	2010	15+	7.3	0.7	12.7
China‡	2009	15+	0.4	0.7	0.0
Malaysia†	2006	18+	0.6	0.5	3.1
Micronesia, Federated States of (subnational)§	2002	25–64	11.4	22.4	3.0
Mongolia§	2009	15–64	1.7	2.8	0.5
Philippines‡	2009	15+	1.9	2.7	1.2
Vietnam‡	2010	15+	1.3	0.3	2.3

*National Drug Strategy Household Survey (NDSHS) (64).
†Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (11).
‡Global Adult Tobacco Survey (65).
§WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (11).

Map 14-1. Prevalence of smokeless tobacco use among adults in the World Health Organization's Western Pacific Region

Sources: National Drug Strategy Household Survey (64); Individual country surveys from: *WHO Report on the Global Tobacco Epidemic, 2011* (11); Global Adult Tobacco Survey (65); WHO STEPS from: *WHO Report on the Global Tobacco Epidemic, 2011* (11).

Chewing Tobacco With Areca Nut/Betel Quid

The literature on ST use in the Western Pacific focuses primarily on chewing tobacco mixed with areca nut/betel quid. Historically, the use of areca nut/betel quid is well documented across South-East Asia and the Pacific, with evidence of areca nut use occurring during previous centuries in Guam, the Northern Mariana Islands, the Solomon Islands, and Cambodia.[12–14] However, use of areca nut/betel quid does not involve tobacco use in all cultures. For instance, almost 15% of men over the age of 18 in Taiwan[15] and 64.5%–82.7% of adults in Hunan province, China[16] chew areca nut/betel quid, but tobacco is not added to the quid. Likewise, users in island countries within Melanesia (Fiji, Papua New Guinea, Solomon Islands, Vanuatu) are unlikely to add tobacco to their chew.[17]

Where areca nut/betel quid is consumed with tobacco, national and subnational published studies indicate that prevalence and patterns of consumption vary both across and within countries. For instance, among Asian countries, older women are much more likely to chew tobacco with betel quid. In contrast, in the Micronesian islands, the use of areca nut/betel quid with tobacco is observed even among the very young, and males have higher consumption rates than females.[17]

Cambodia, Malaysia, and Vietnam

A national survey conducted in 2009 in Cambodia (n = 13,988) revealed current tobacco use prevalence rates of 49.0% among men and 20.5% among women, with men predominantly smoking cigarettes and women predominantly chewing tobacco as a component of betel quid. The likelihood of women using chewing tobacco increased markedly with age, lower income, rural residence, and less education. It is estimated that 43.4% of all older women (>48 years) and almost half of all rural women (48.0%) chewed tobacco at the time of the survey.[18] The higher consumption among older women seen in Cambodia parallels that seen in reports from Malaysia[19,20] and Vietnam.[21] In Malaysia, older women in indigenous groups use betel quid with tobacco at a particularly high rate. The most common reasons women gave for starting to use tobacco were "the influence of older relatives (31.9%), the need to alleviate morning sickness during pregnancy (17.0%), and the wish to experiment (13.9%)".[18] Rural women were more likely than urban women to believe that tobacco use would alleviate morning sickness (17.8% versus 7.5%, respectively).[18]

Palau

Ysaol and colleagues surveyed 1,110 Palauans in 1996 and reported that 55% of those aged 5–14 years and 86% of those aged 35–44 years chewed areca nut/betel quid. Eighty percent of users cut up cigarettes and added the tobacco to the betel quid, and 24% added other tobacco.[22] More recently, the Palau Youth Tobacco Surveys from 2001, 2005, and 2009 documented markedly elevated rates of chewing areca nut/betel quid with tobacco, although the prevalence appears to decrease over time. In 2009, 54% of high school youth reported current consumption of betel quid with tobacco, compared to 61% in 2005 and 68% in 2001. Among elementary school students, 37% reported current use of betel quid with tobacco, compared to 43% in 2005 and 54% in 2001. Approximately 1 in 10 of these elementary school students started using before the age of 9 years[23] (Roman Oseked, Palau Department of Health, personal communication, 2011).

Federated States of Micronesia

In Pohnpei, one of four states in the Federated States of Micronesia (FSM), a 2002 survey using the WHO STEPwise Approach to Surveillance (STEPS)[24] found that approximately 29.9% of adults reported chewing areca nut/betel quid at the time of the survey, with a significantly higher rate among men (43.5%±5.9) than among women (16.0%±3.0).[24] Overall, the highest proportions of areca nut/betel quid chewers were in the youngest age group, 25–34 years (67% of men, and 28% of women), with these proportions declining thereafter with increasing age. Over three-quarters of the survey participants who reported current daily use of chewing areca nut/betel quid added tobacco to the betel quid, and the percentages were similar across age groups and sexes.

The 2007 GYTS for Micronesia, the first national survey on youth tobacco use in the country, revealed that a greater percentage of males than females had ever tried smoking and currently smoked. (Table 14-4). Youth in the FSM were more likely to use other tobacco products than to smoke, and close to half of youth (52.6% of males and 43.5% of females) had ever used tobacco with betel quid.

Table 14-4. Youth tobacco consumption, Federated States of Micronesia, 2007

	Ever smoked cigarettes, even one or two puffs % (CI)	Ever smokers who began smoking before age 10 % (CI)	Current cigarette smokers % (CI)	Currently use other tobacco products % (CI)	Ever chewed areca nut % (CI)	Ever used tobacco with areca nut % (CI)
Boys	56.2 (49.7–62.6)	26.3 (21.8–31.3)	36.9 (29.9–44.5)	41.8 (34.6–49.3)	67.0 (60.4–73.7)	52.6 (46.0–59.1)
Girls	34.7 (29.9–39.7)	20.5 (14.9–27.5)	19.8 (15.9–24.5)	32.1 (27.3–37.4)	55.6 (49.9–61.3)	43.5 (40.1–47.0)
Total	45.6 (41.4–49.8)	24.3 (21.0–28.0)	28.3 (23.9–33.2)	37.0 (32.2–42.1)	61.4 (56.4–66.4)	47.6 (44.0–51.2)

Note: CI = confidence interval. Confidence interval is 95%.
Source: Global Youth Tobacco Survey (2007), as provided by Maryann Eperiam, Federated States of Micronesia Substance Abuse and Mental Health Program.

Guam

The prevalence of areca nut/betel quid consumption with tobacco is relatively low among youth in Guam, although there are indications that the practice may be increasing. In 2008, Guam's Department of Mental Health and Substance Abuse commissioned a telephone-based survey that employed randomized digit dialing and found that 6% of youth overall reported chewing betel quid, and 24% of ethnic Micronesian youth reported chewing betel quid regularly. Forty-four percent of young betel quid chewers mixed tobacco with their chew. Among adults, 17% were current users of betel quid, and three in five of these chewed it with tobacco.[25]

Commonwealth of the Northern Mariana Islands

A 2005 survey conducted on a convenience sample of 309 high school students on the island of Saipan in the Commonwealth of the Northern Mariana Islands (CNMI) revealed that 63.4% chewed areca nut/betel quid regularly, but no information was available regarding the addition of tobacco to the areca nut. Among these students, 24.9% were also smokers.[26] Twenty-four percent of adults participating in

the 2009 Behavioral Risk Factor Surveillance System (BRFSS) survey reported chewing areca nut/betel quid, and 68% of these reported adding tobacco to their chew.[27]

Prevalence of Using Other Types of Smokeless Tobacco

It is likely that other types of ST are used in the region, but data on prevalence are not readily available. Guam's 2008 randomized telephone survey revealed that 4% of youth respondents[25] and 5% of adult respondents[28] reported using other forms of tobacco such as snuff, dip, or chewing tobacco. The 2009 BRFSS survey in CNMI revealed a 14.5% prevalence of chewing tobacco and/or snuff use among adults.[27] Among CNMI high school students, 17.5% either chewed tobacco or used snuff.[26]

In Japan, the Swedish company Swedish Match initiated consumer testing for a brand of tobacco gum called "Firebreak" in 2003, and in 2006 the product was launched in Sweden[29]; however, specific data on the prevalence of use of this product could not be found. In Kiribati, young people are using a novel form of ST, mixing tobacco from cigarettes with immature green coconuts (Kireata Ruteru, personal communication, 2011).

Types of Smokeless Tobacco Products and Patterns of Use

Chewing areca nut/betel quid with tobacco (Figure 14-1) is the form of ST use in the Western Pacific for which the most data are available. These data show significant geographic variation, both within and among countries.

Figure 14-1. Areca nut being sold in markets in the Solomon Islands

Source: Photos courtesy of James Rarick, World Health Organization Western Pacific Regional Office, 2011.

Areca nut is chewed by itself or in combination with the leaf or fruit of a pepper plant (*Piper betle*) and lime powder, the mixture being popularly known as "betel quid." The commonly used phrase "betel nut" originated from the association of chewing areca nut with the *P. betle* leaf. In the Western Pacific, fresh nuts are consumed in both the fully ripe and unripe stages.[17] In Taiwan and Palau, unripe nuts are used in the betel quid. In Guam, changnga (white) areca nuts are preferred when immature and soft, whereas the ugam (red) variety is used when the fruit is at the fully mature and hard stage.[30,31]

The fine white lime powder (calcium oxide or quicklime) used in betel quid chewing is usually what remains after burning coral rock, sea coral, or shells.[31] This lime powder must be kept in sealed containers to stay dry. As an alternative, water may be added to produce slaked lime (calcium hydroxide) for use in the quid. The type of lime and the specific techniques used to reduce the source material vary by region. Builders' lime that is commercially produced may also be used.[32]

The areca nut, lime, and other ingredients may be wrapped in a fresh *P. betle* leaf, or the ingredients may be placed in the mouth separately. Tobacco (either loose tobacco or as a portion from a cigarette) and other flavorings (spices such as cardamom and even garlic) may be added to the betel quid to enhance the flavor and heighten the physiologic effects.[17] In some Micronesian islands, the quid is dipped in vodka before being consumed (Kerio Walliby, FSM Department of Health, personal communication, 2011). Unwrapped quid is preferred in Papua New Guinea and the Solomon Islands, whereas wrapped quids are more frequently encountered in Cambodia, Palau, and FSM. Quid preferences in Guam appear to be linked to ethnicity: Chamorros (the indigenous people of Guam) are more likely to chew the mature nut with *P. betle* leaf, but without lime or tobacco, and to swallow the nut/quid, whereas other Micronesians are more likely to chew fresh nuts with *P. betle* leaf, lime, and tobacco and to spit out the nut/quid.[33] Consumption of areca nut/betel quid with or without tobacco is often accompanied by smoking and alcohol use.[24]

The extensive literature on the cultural importance of areca nut/betel quid chewing in Asia–Pacific societies documents the long history of areca nut/betel quid consumption. Areca nut is believed to have medicinal uses—as an effective antiparasitic agent, a digestive aid, and an analgesic, among others.[31,34] Use is often culturally or socially ritualized, and usually reserved for older people and high-ranking members of the community. Interviews with key informants conducted by the Secretariat for the Pacific Community (SPC) in 2005 in several Pacific island countries highlighted the rising prevalence of areca nut/betel quid consumption among younger people and the increasing practice of adding tobacco to the quid.[17] Focus groups conducted among Chamorro and other Micronesian youth in Guam indicated that young people may initiate use in the mistaken belief that chewing tobacco with areca nut/betel quid is part of traditional Micronesian culture (Caleb Otto, Palau Department of Public Health, personal communication, 2011).

The growing popularity of chewing areca nut/betel quid with tobacco has spurred the emergence of local sales of areca nut and prepackaged betel quid as a cottage industry in several Asia–Pacific countries. For example, in Palau, it is possible to purchase premade quids from local vendors, and the ingredients for a quid are increasingly becoming available at convenience stores and neighborhood shops throughout Micronesia (Caleb Otto, personal communication, 2011). Because betel quid is largely sold through these local channels, average pricing information is not readily available.

Sales of areca nut have become a principal income generator, especially for people outside or on the fringes of the formal economy in countries such as Papua New Guinea and FSM. The 1996 Mapping Agricultural System in Papua New Guinea estimated that 1,227,234 people received income from local trade in areca nut in Papua New Guinea; the total income from areca nut was US$7,094,993, or 9.5% of the total income from agricultural products.[35] Domestic areca nut sales in FSM increased from approximately 18,000 lbs. sold in 1999 to about 500,000 lbs. sold in 2004.[36]

Sales and distribution of areca nut through exports also constitute a growing revenue source for governments. For example, in 2007, FSM earned over US$2.2 million from exporting areca nut to Guam, CNMI, and the Marshall Islands.[36] In addition, migration of Pacific Islanders to the United States, Australia, and New Zealand is creating demand for areca nut/betel quid in these countries, and consequently opening up new markets for exports. Internet sales are likewise increasing.[37] The extent of non-commercial export of areca nut/betel quid through the postal system or personal luggage is unknown as of this writing, although residents in Micronesia readily acknowledge that this occurs frequently.

Toxicity and Nicotine Profiles

Nine closely related alkaloids are responsible for the stimulant effect of areca nut. Alkaloid levels are highest in the unripe fruit, which may be why some cultures prefer the unripe nuts for consumption: They give a better "buzz."[30] The International Agency for Research in Cancer (IARC) considers areca nut a Group 1 carcinogen.[31] Arecoline, a major areca nut alkaloid, is considered the most important carcinogen in the areca nut. Areca nut extract (ANE) is highly cytotoxic and genotoxic to cultured human oral mucosal epithelial cells and fibroblasts (connective tissue cells). Researchers from Taiwan have published studies on the toxicologic profile of betel quid without tobacco.[38] However, toxicity information on the combination of areca nut/betel quid with tobacco as used in the Western Pacific represents a data gap for the region.

Health Problems Associated With Product Use

Data on health effects of chewing tobacco with areca nut/betel quid in the Western Pacific Region are minimal. Most studies concentrate on the effect of areca nut/betel quid, and health effects from the tobacco added to the quid are largely inferential in nature.

Oral Health Issues

In a 2005 study in Saipan, CNMI, high school students who reported regular areca nut/betel quid and tobacco use (both smoking and chewing) underwent oral examinations. Oral leukoplakia was found in 12.9% of the students; 8.8% had oral submucous fibrosis (OSF), and one-third of these already showed a restriction in mouth opening.[26] Ikeda and colleagues reported that the prevalence of leukoplakia in selected Cambodian populations was 2.2% among men and 0.6% among women.[39] Several studies have reported a particularly high prevalence of oral leukoplakia in Papua New Guinea (4.6%–17%), with the rate in the Papua New Guinea lowlands being among the highest in the world.[40–45] Although leukoplakia can result from multiple causes, regular use of areca nut/betel quid with tobacco in the study populations likely contributed to its prevalence in these groups.

Head and Neck Cancer

In 2004, the IARC linked the use of betel quid without tobacco to oral cancer, and use of betel quid with tobacco to head and neck cancers (see chapter 4).[31]

Cancer surveillance and cancer research are not well developed in many of the Pacific islands, but where studies exist, they demonstrate that head and neck malignancies occur at elevated rates in countries and areas where areca nut/betel quid consumption and tobacco and alcohol use are prevalent. The Guam Cancer Registry for 2003–2007 ranked oral cancer as 10th in cancer incidence for Guam, with ethnic Micronesians having the highest incidence rate[46] compared to indigenous Chamorros, Caucasians, or people of Filipino or other Asian descent. Micronesians living in Guam also have the highest prevalence of using chewing tobacco with areca nut/betel quid.[47] In Papua New Guinea in 1964, Atkinson and colleagues reported a disproportionately high incidence of oral cancer (17.8%), with a distinct geographic variation that closely matched areas of areca nut use.[42] A case-control study of cancer in Papua New Guinea in 2007 identified betel quid as an independent risk factor for the development of oral cancer.[48] Given the available data, it is challenging to separate out the effects of areca nut and/or betel quid alone, as well as concurrent smoking, from chewing tobacco on cancer incidence. This is an area for further research.

Reproductive Outcomes

In a 2008 study among native people in Taiwan, Yang and colleagues found that betel quid chewing during pregnancy was associated with lower birth weight and reduced birth length.[49] Ironically, one of the main reasons pregnant women chew areca nut/betel quid is to prevent morning sickness: 80% of the women thought that chewing areca nut/betel quid would not have any effect on the fetus.[50] Similarly, in Cambodia, almost one in five (17%) rural women started chewing tobacco as a component of betel quid to relieve morning sickness.[18] These findings highlight the critical need for educational outreach to avert the adverse reproductive outcomes of areca nut/betel quid and tobacco consumption.

Other Health Effects

The cardiovascular and pulmonary effects of areca nut/betel quid consumption and the cardiovascular effects of ST use are recognized in the global literature, but the regional data are minimal. Likewise, the association with diabetes[51] has not been studied extensively in the Western Pacific. The potential for facilitating the spread of communicable diseases, particularly tuberculosis, through the indiscriminate spitting of excess saliva, has been raised as an adverse health effect, but definitive data are lacking.

Marketing and Production Practices of Industry

At present, sales and marketing of areca nut/betel quid occur through small cottage vendors (Figure 14-2). However, in Guam, a community-based participatory research project on tobacco points of sale revealed that over 56% of manufactured tobacco retail outlets advertised tobacco products less than a foot from displays of candy and other items popular with children and youth[52] (Figure 14-3). These components can be purchased and used to prepare custom homemade ST products. Since areca nut and betel quid have been used historically for medicinal purposes, using these substances is seen as a cultural practice by some, limiting the need for extensive marketing outside of local channels. Furthermore, the sale and distribution of areca nut also contribute to government revenue sources, as described above, and therefore exports of these ST products, to meet the demands of migrants, have grown.

Figure 14-2. Pre-wrapped betel quids (areca nut, lime, tobacco, and betel leaf) on sale in a public market

Source: Photo courtesy of James Rarick, World Health Organization Western Pacific Regional Office, 2011.

Figure 14-3. Wrapped fresh betel quids sold alongside cigarette lighters and candy in a Guam store

Source: Photo courtesy of the Community Research for Action Team–Guam (CREATE–GUAM) project at the University of Guam Cancer Research Center, 2011.

In Taiwan, areca growing and the sale of betel quid are rapidly growing businesses and appear to parallel the expansion of the cigarette market. Although international tobacco companies have not begun marketing the product, Taiwanese betel quid producers have set up neon-lit roadside kiosks around the country, where scantily clad young women, known as "Betel Quid Barbies," sell betel quid and cigarettes to motorists.[15] Online and through other popular media, the "Betel Quid Barbie" has generated global interest as a sex symbol. This marketing strategy resembles cigarette promotions that associate the product with sexually suggestive messages and models.

Current Policy and Interventions

Existing measures to control ST use in the Western Pacific involve both supply- and demand-reduction strategies. Compared to policies and interventions to reduce smoking in this region, actions to control ST use in the Western Pacific are rudimentary.

Supply-Side Interventions

In 1986, the government of the Australian state of South Australia became the first government in the world to ban ST; the ban became national in 1991.[53] New Zealand has also banned smokeless tobacco.[54] Taiwan prohibits the manufacture of all types of ST products. Hong Kong, Japan, Singapore, and Taiwan also ban importation of ST products, but these bans have no impact on the consumption of areca nut/betel quid with tobacco because the tobacco used is often taken from cigarettes. In March 2010, the Marshall Islands became the first Pacific island country to ban importation, distribution, and sale of areca nut/betel quid, with violations punishable by a fine of up to US$100 and 30 days in jail.[55]

Unfortunately, the existing policy interventions are weak and lack consistency and comprehensiveness. For example, Australia's ban on all ST products contains a clause that allows personal users to seek a permit to import chewing tobacco and oral snuff in quantities less than 1.5 kilograms if the importer is over age 18 and can show that the tobacco products are only for personal use.[56] The ban on importation of areca nut in the Marshall Islands applies only to commercially imported nuts; individuals are permitted to bring in indefinite quantities of areca nuts for personal consumption, although lawmakers are considering closing this loophole in the law.[57]

Demand-Side Interventions

Because cultivation, sale, and distribution of areca nut/betel quid with tobacco most often occur as part of the informal economy, regulation through taxation (other than taxing cigarettes) is challenging. In 2008, the rate of taxation on cigarettes was relatively high—for example, the tax on a pack of cigarettes accounted for an average of US$1.46 of the pack's total cost of US$3.42 in this region.[58] As of 2012, demand-side interventions involve regulating consumption in public places, banning advertising and promotion, and enlarging cessation programs to include measures that address the use of areca nut/betel quid with tobacco. In FSM, CNMI, and Guam, chewing areca nut/betel quid with or without tobacco is prohibited in certain public places, such as hospitals. Both the University of Guam and Guam Community College are 100% tobacco-free campuses, and neither permits chewing tobacco within campus grounds.[59] Guam Community College also bans betel nut from its campus.[60] Hong Kong, Singapore, and Taiwan prohibit advertising and promotion of ST products.

In many countries, health systems are not optimally set up to take measures to prevent areca nut/betel quid and tobacco use, to screen and diagnose health consequences, or to assist chewers to quit. For instance, in the U.S.-affiliated Micronesian islands, where health care depends on external aid from the United States, health care guidelines and clinical practice standards are often patterned after U.S. mainland templates, and tobacco control is focused predominantly on smoking. This has led Pacific island stakeholders to note that tobacco control in Micronesia is not "Pacific'lly correct," in that it fails to consider the sociocultural and political context of the region as it relates to other forms of tobacco use.[61] Even in Western Pacific countries that have ratified the WHO FCTC, tobacco control remains skewed toward interventions that address smoking. The tobacco industry in Western Pacific countries has reacted to declining smoking rates by increasing its market share for ST products within the region. To complement gains made in smoking prevalence reduction, proactive ST interventions targeted to the various forms of ST use in the region are urgently needed.

In part, policy inconsistencies may stem from ambivalence regarding areca nut/betel quid use in contrast to tobacco use. This ambivalence arises partly from the long-held popular notion that chewing areca nut/betel quid is symbolic of cultural identity, and partly from a general lack of awareness of the negative effects of areca nut/betel quid chewing. However, the scientific evidence has irrefutably established the harmfulness of areca nut and betel quid without tobacco; the addition of tobacco magnifies the adverse health impacts. Thus, policy interventions to counter ST use in the Western Pacific should also address areca nut/betel quid use. This will require broad, sustained outreach to educate populations about the harmfulness of areca nut/betel quid use, and intensive social marketing to dissociate areca nut/betel quid consumption from notions of cultural belonging. It will also require reconsidering the promotion of areca nut as a cash crop, which will likely provoke similar arguments relating to trade and profit over health that the tobacco control community encountered during the inception and development of the WHO FCTC.

Summary and Conclusions

This overview highlights ST use as an emerging issue within the Western Pacific Region and pinpoints key gaps in information and knowledge that contribute to the lack of action to control the problem. Existing data are scarce and fail to provide an accurate and comprehensive picture of the magnitude of ST use and its attendant health, economic, and social consequences. Of the few countries that have ST data, prevalence rates among men vary from 0.3% in Vietnam to 22.4% in Micronesia, and among women, from 0% in China to 12.7% in Cambodia. Without an effective surveillance system, there is no reasonable way to gauge changes in prevalence over time within countries and across the region, and to measure the effectiveness of policy and program interventions.

Although areca nut is known to contain carcinogenic compounds, detailed toxicologic data are incomplete, with most of the studies conducted on areca nut and betel quid without tobacco. The inadequacy of quantitative information on prevalence, epidemiology, and impact is compounded by the insufficiency of qualitative data on the sociocultural aspects of chewing tobacco with areca nut/betel quid that are needed to develop population-based behavioral strategies. Addressing the multiple data gaps should be the first step toward developing an effective and coordinated response to controlling ST use in the Western Pacific.

Some countries, including Australia and New Zealand, have instituted bans on ST, and others, such as Taiwan, have specifically banned manufacturing and importation of ST products. Still others—Japan, Hong Kong, and Singapore—have banned the importation of ST products. However, these measures have no effect on the consumption of areca nut/betel quid with tobacco, because the tobacco used is often taken from cigarettes and other sources. Since areca nut/betel quid can have a cultural meaning and perceived medicinal benefits, education efforts may be necessary to supplement policy efforts and increase awareness of the harmful effects of these products.

As implementation of the WHO FCTC proceeds within the Western Pacific and smoking reductions accelerate, the urgency to address ST will grow.[9] Already the tobacco industry is redirecting its strategies to circumvent tobacco tax increases and smoke-free public laws by increasing its market share for smokeless products within the region. Interventions to address the unique forms of ST use in the Western Pacific are needed proactively to preserve and complement gains made in reducing smoking consumption.

The WHO Western Pacific Regional Office, in partnership with the region's countries and areas, initiated a process of assessment and dialogue that resulted in the *Review of Areca (Betel) Nut and Tobacco Use in the Pacific*,[17] which defined a comprehensive platform for action to address the trend toward increasing use of tobacco with areca nut/betel quid in the region. For four domains—social determinants, risk factors, immediate conditions, and end-stage disease, the platform called for actions in six areas: policies and legislation, education and advocacy, governance and local reinforcement, clinical services, surveillance and research, and partnerships and alliances.

The platform calls for a balanced, comprehensive mix of legislation and policies that incorporate both supply- and demand-reduction strategies, and steps governments can take to curb ST use and deal with its negative effects. It recommends the following:

- *Supply-side interventions:* restrictions on sales and importation of betel nut and ST products; prohibition of sales to minors; anti-smuggling policies; re-assessment of agricultural policies regarding promotion of betel nut; and
- *Demand-side interventions:* establishment of tobacco-free public places (schools, hospitals, etc.); inclusion of ST use within cessation approaches; extensive screening and monitoring for oral cancer and funding for cessation services.

The platform also recommends investments in surveillance and knowledge-management capacity building while fully exploring practical approaches, such as integrating questions on chewing tobacco with betel nut and other forms of ST use into the Global Tobacco Surveillance System and other existing surveillance mechanisms. Furthermore, this platform calls for health systems interventions to prevent ST use and include areca nut/betel quid use in tobacco cessation programs. It also calls for screening and diagnosis of health consequences to be incorporated into oral health, non-communicable disease control, and other related health programs. The *Review* also addresses public awareness, education, communication, and advocacy strategies, and working through alliances and partnerships. The Platform for Action has been built into the WHO Western Pacific Plan to operationalize the WHO FCTC,[62] which was adopted unanimously at the 61st Regional Committee Meeting in Malaysia in October 2010. These actions will go a long way toward addressing the gaps and challenges identified in this chapter.

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Chapter 15

Global Smokeless Tobacco Use: Future Research Needs and Policy Recommendations

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Report Highlights

Smokeless tobacco (ST) use is a global problem affecting an estimated 300 million people across about 70 low-, middle-, and high-income countries. All six World Health Organization (WHO) regions contain a substantial population of ST users, and almost all countries for which data are available report some level of ST use. In countries with the highest prevalence, most current users report daily use of smokeless tobacco. Smokeless tobacco use poses an extremely complex public health challenge, as product characteristics, patterns of use, health effects, marketing and production practices, and public health and policy responses vary widely between countries and regions.

Prevalence and Patterns of Smokeless Tobacco Use

Smokeless tobacco has a disproportionate impact in some countries and subpopulations. The majority of the world's adult ST users (89%, or approximately 268 million) live in low- and middle-income countries in South-East Asia. There are an estimated 220 million adult ST users in India alone, where overall adult prevalence is 26% (exceeding the prevalence of cigarette smoking), followed by Bangladesh with 28 million ST users (27%), and Myanmar with 11 million ST users (30%). Adult prevalence is high—10% or greater—in 11 countries (Bangladesh, Bhutan, India, Micronesia, Myanmar, Nepal, Norway, Sri Lanka, Sweden, Yemen, and Uzbekistan). Six of these 11 countries are located in the South-East Asia Region. The figures presented in this report represent only those countries for which data are available; data are lacking for some countries in each region.

Across countries at very different levels of economic development (high-income to low-income), ST use is generally higher among rural populations with lower education and lower socioeconomic status. In most countries ST use is more prevalent among men than women, but several countries reported high use of ST among both men and women. Eight countries (Bangladesh, Bhutan, Cambodia, India, Madagascar, Mauritania, Myanmar, and South Africa) reported prevalence of greater than 10% among adult women. In several countries in the African, South-East Asian, and Western Pacific Regions, prevalence of ST use among women significantly exceeded that of men. Some studies have found that women report initiating ST use during pregnancy because they believe it will alleviate symptoms of morning sickness,[1,2] and ST use during pregnancy has been associated with adverse reproductive outcomes, such as pre-term birth or fetal growth restriction. More research is needed to understand the factors that lead to high prevalence of ST use among women in these countries.

Smokeless tobacco use is also prevalent among youth in many countries. All 57 countries for which sufficient national data were available to be included in this volume (using Global Youth Tobacco Surveys [GYTS] of students aged 13–15 years) reported some ST use among youth, and 33 reported overall use greater than 5%. As with adults, ST use is generally higher among males than females, but ST use prevalence greater than 10% among girls was reported for several African countries (Botswana, Congo, Lesotho, and Namibia). In many regions, ST products are marketed and sold in ways that may appeal to youth, such as in publications with a high youth readership or displayed next to candies and snacks in street stalls and kiosks.

A high prevalence of ST use is also seen among some population subgroups even within countries where overall prevalence is low compared with cigarette smoking, particularly among native populations and recent immigrants. For example, while prevalence of ST use among Alaskan non-Native adults is similar to the U.S. average, prevalence among Alaska Native adults is three times greater. Similarly, in Brazil the use of the ST product rapé is rare among urban populations but more common among rural native populations. Immigrants from regions where ST use is prevalent may bring their practices with them. For example, the use of gutka or betel quid with tobacco has been found to be very common among first-generation immigrants from Bangladesh and India living in New York and London. And reports suggest that some youth, such as those in Venezuela and Micronesia, may view ST products as a means to express national identity or traditional culture.

Health Effects and Impact of Smokeless Tobacco Products

There is substantial evidence that ST products cause addiction, precancerous oral lesions, cancer of the oral cavity, esophageal and pancreatic cancer, and adverse reproductive outcomes, including stillbirth, pre-term birth, and low birth weight. Data from some countries have demonstrated a link between ST and increased risk of fatal myocardial infarction or stroke. All ST products contain chemicals known to cause harm, such as tobacco-specific nitrosamines (TSNAs) and polycyclic aromatic hydrocarbons (PAHs). In fact, a well-developed model describes the mechanistic pathway by which the TSNAs *N'*-nitrosonornicotine (NNN) and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) are metabolically activated and induce primary DNA lesions that may ultimately lead to cancer. Thus, all ST products are hazardous to use.

The impact of ST use is related to the disease risks associated with particular products, their prevalence, manner of use, and the underlying burden of disease (which may also be influenced by other risk factors). Currently available data are insufficient to support an estimate of the total global disease or mortality burden of ST use. Additionally, because smokeless tobacco use is a limited or relatively recent practice in many countries, particularly in higher income countries, research and data collection have lagged. However, estimates of attributable risk for countries where adequate data are available show wide variation in the attributable disease burden. For example, most studies from Sweden have not shown an association between ST use and oral cancer, but studies in India have shown very high relative risks (from 2 to 14) for oral cancer.[3] These differences may be due in part to differing levels of harmful constituents in the products. For example, reported levels of TSNAs in ST product samples from a variety of countries, and within the same country, vary by many orders of magnitude. One laboratory study comparing samples of products from India found that total TSNA content varied from 0.1 to 127.9 micrograms per gram (µg/g). Likewise, an analysis of U.S. moist snuff products showed a 70-fold difference in NNAL content across leading brands, whereas products in Sweden show less variation in TSNAs because they adhere to specific standards for TSNA levels.

In general, the greatest disease burden from ST use occurs in low- and middle-income countries where the highest relative risks have been recorded and the greatest numbers of users live. An example is India's high oral cancer rates[4]: It is estimated that more than 50% of oral cancers in India can be attributed to ST use.[5] In addition to high disease burden, low- and middle-income countries face a multi-pronged challenge: They are home to the most diverse array of products, some of which are extraordinarily high in toxicants, but their ability to regulate ST products and implement effective tobacco control measures is hampered by limited resources and the local, unorganized nature of tobacco manufacturing and retailing.

Diversity of Smokeless Tobacco Products

The term "smokeless tobacco" covers a large and extremely diverse group of products. They differ in color, appearance, consistency, packaging, and manner of use. They also vary in their mode of manufacture or preparation (premade vs. custom-made), in the scale of production (large-scale manufacturing, cottage industry, or individual vendor preparation), and in their ingredients (type of tobacco leaf, alkaline agents, flavorants, and other non-tobacco content, such as areca nut or tonka bean). The best estimates indicate that, by volume, 91.3% (648.2 billion tons) of ST worldwide (710.2 billion tons) is sold in traditional cottage industry markets.[6] Chapter 3 of this report proposes a method of categorizing ST products into four groups based on the addition of specific classes of ingredients, including alkaline agents, areca nut, and other active chemical or plant ingredients. Though this categorization may have some utility, the product-associated risks may vary greatly even within these categories.

Smokeless tobacco products also vary greatly in their chemical composition, with some products containing extremely high levels of carcinogens, nicotine, and free nicotine (the most rapidly absorbed form). For example, levels of TSNAs in ST products vary by as much as 400-fold.[7] A 2008 survey of 39 top-selling brands of U.S. moist snuff showed a more than fivefold variation in total nicotine levels and a more than 500-fold range in free nicotine.[8] Levels of toxicity, carcinogens, and free nicotine are influenced by a wide range of factors, including species of tobacco plant used, characteristics of the soil in which the tobacco was grown (e.g., the concentration of nitrite and certain metals), curing methods (air-cured vs. fire-cured), processing methods (pasteurized vs. fermented), addition of certain ingredients (tonka bean, areca nut, alkaline agents), and conditions under which the final products were stored. Based on research to date, steps could be taken to reduce the presence of carcinogens or other toxicants in ST products, including reduction or elimination of the use of fire-cured tobacco, improved prevention of microbial contamination, changes in fermentation, elimination of ingredients such as areca nut and tonka bean, and improvements in storage conditions.

Despite the enormous product diversity, some important common cross-product observations can be made. The practice of adding alkaline agents to boost nicotine delivery is commonly found in a number of traditional and manufactured ST products around the world (such as punk ash added to iqmik in Alaska, slaked lime added to khaini in India, or sodium bicarbonate added to toombak in Sudan). Adding flavorings (e.g., menthol, cocoa, licorice, rum, aniseed, cinnamon, clove) and sweeteners (e.g., molasses, honey, dextrose, sorbitol, fruit juices) is also a common practice and may make the product more appealing to youth and new users.[9] Additionally, there appears to be a growing emphasis on increased convenience and ease of use in the marketing of ST products in countries at different income

levels. Gutka, a dried, prepackaged version of the fresh betel quid traditionally mixed to order by a vendor or user, has become increasingly popular in India and is now a large-scale industry. At the same time, in high-income countries such as the United States, tobacco product manufacturers have packaged moist snuff in pouches that do not require spitting, marketing them to smokers as a discreet and convenient alternative for settings where they cannot smoke.

Marketing Strategies and Production Practices: The Evolving Market

Tobacco industry marketing strategies also show some common trends. Across high-, middle-, and low-income countries, tobacco product manufacturers utilize colorful packaging, suggestive names and slogans, cross-branding with non-tobacco products, price discounts, health or medicinal associations, and lifestyle marketing appeals to sell their products. In the United States, U.S. Smokeless Tobacco Company aggressively promoted low-nicotine products starting in the mid-1970s to young people in an attempt to graduate these new users to products containing higher amounts of nicotine as they become more nicotine dependent.[10] Longitudinal data provide evidence that switching from lower to higher nicotine products does occur among youthful snuff users.[11]

In middle- and low-income countries, marketing strategies may pose a particular challenge for tobacco control efforts by circumventing existing tobacco control measures, using the same brand names for their tobacco products as for non-tobacco products, and using packaging that appeals to youth. For example, manufacturers in India use the same brand names for their non-tobacco products as for tobacco-containing products in an effort to circumvent India's ban on tobacco product advertisements on television. Use of small single-use packaging makes products inexpensive and more easily available to youth and may dilute the impact of tobacco taxes. In addition, large-scale marketing campaigns are generally absent for traditional cottage industry products, but large multinational companies have entered markets in some low- and middle-income countries and have begun to produce some traditionally cottage industry products on a larger, commercial scale.

In high-income countries such as the United States, a number of manufacturers have introduced novel ST products, using new product formulations (e.g., reduced nitrosamines, dissolvable formulations, spitless pouches, new flavorings) and marketing practices (e.g., targeting current smokers and devising innovative packaging). These products and practices may appeal to new groups of users. For example, novel snus products have been marketed to smokers for use in settings where they cannot or do not want to smoke, using imagery that emphasizes trendiness, urbanity, freedom, and sophistication for both men and women. And U.S. cigarette manufacturers have introduced ST products with popular cigarette brand names such as Marlboro and Camel. These new marketing strategies raise concern because they may increase initiation, deter people from quitting smoking or other tobacco use, or result in dual use or use of multiple tobacco products.

Policy and Personal Level Interventions

In all regions, evidence-based interventions tailored to the prevention and cessation of ST use are limited. The available evidence suggests that school-based and community prevention programs can lead to short-term reduction in prevalence among youth, and that clinic and dental office interventions (involving multiple sessions and counselor support) can increase cessation among adults.

Pharmacotherapies, with the possible exception of varenicline, have not been found to be effective in improving cessation in ST users in the United States and Great Britain (chapter 7). In some regions, knowledge about the health effects of ST use is limited even among health professionals. The existing evidence for treatment programs comes largely from high-income countries, and data on smokeless tobacco quit rates are not available for most countries. Thus, there is a particular need to develop and test interventions targeted at low-income populations or countries where the burden of ST use is greatest.

A diverse range of programs and policies have been implemented in different countries and municipalities to address ST use; however, limited data are available to evaluate the impact of these interventions. Some countries and municipalities have banned entire classes of tobacco products, such as the ban on gutka sales imposed by some states and subregions in India. In many countries, a lower standard has been applied to ST products compared with cigarettes. For example, in many regions, even those where ST use is highly prevalent, policies and programs aimed at ST use prevention and cessation are generally weaker than those for smoked tobacco products: prices are lower, warning labels are weaker or nonexistent, surveillance is weaker, fewer resources are devoted to prevention and control programs, and fewer proven interventions are available. While restrictions on smoking in public places, even outdoors, have been vigorously pursued in many countries around the world, few efforts have been made to apply these rules to non-smoked tobacco products.

Overall Challenges: Smokeless Tobacco is a Complex Global Problem

Considering the magnitude and complexity of the smokeless tobacco problem (including industry marketing, trends and patterns of use, and a lack of effective interventions), the public health challenge of ST warrants far greater attention and action than it has so far received. According to Euromonitor International, the global market for both modern and traditional snuff products is projected to increase by 24 percentage points between 2011 and 2016, compared to only a projected 7 percentage point increase in the market for cigarettes.[12] Moreover, while the WHO Framework Convention on Tobacco Control (FCTC) applies to all tobacco products, many of the strategies developed under the Conference of Parties to date are focused on cigarettes, and no specific guidance has been developed regarding ST products.

The prevalence of ST use is particularly high in some low- and middle-income countries and among low-income populations. The major challenge that faces these countries is the limited data to help craft policies and programs. For example, data on pricing, tax structures, and sale of ST products are very limited, especially in those countries where ST use is most prevalent. Cottage industry production makes collection of taxes more challenging and probably less effective. Additionally, information on the cost of health care to treat ST-related diseases is extremely limited. This is a particularly significant gap in the data needed to inform the control of ST use.

While the public health burden falls disproportionately on low- and middle-income countries, the findings and gaps identified in this report have substantial public health importance for high-income countries as well. Countries with the largest populations of ST users include the United States, with 9 million users. Between 2005 and 2010, sales of moist snuff grew by US$2.04 billion following increased marketing of these products.[13] National surveys also suggest that between 2000 and 2010,

ST use in the United States rose among youth, particularly high school males.[14–16] The major challenges faced by the United States and possibly other high-income countries include the large number of different types of tobacco products that are emerging in the market. As noted previously, novel snus-type products using familiar cigarette brand names (Camel and Marlboro Snus) are being marketed to smokers for use in settings where they cannot smoke.[17,18] This trend may adversely impact smoking cessation efforts by encouraging dual use as an alternative to tobacco use cessation. Additionally, dual use of ST and cigarette smoking could have greater health risks than smoking alone.[19,20] Although cigarette smokers who permanently switched to exclusive ST use decreased their risk of some diseases specific to smoke exposure, those who quit tobacco use altogether lowered their mortality rates from lung cancer, coronary heart disease, and stroke more than those who switched to ST use, as indicated by the single study that examined this effect.[21]

Another challenge revolves around the smokeless tobacco harm-reduction debate. Some have suggested that ST products, particularly those low in nitrosamines, could act as harm-reduction agents for cigarette smokers, especially in high-income countries with lower disease burdens related to ST use. However, as this report suggests, the assessment of risks and benefits in such a strategy, particularly on a population level, is complex and uncertain. In almost all countries, ST products have widely varying levels of addictive potential and toxicity. Furthermore, available data do not allow for identifying specific levels of product constituents with quantifiable risk reductions. Additionally, no rigorous studies have demonstrated the effectiveness of an ST product for smoking cessation or as a complete substitution for cigarettes.

To summarize, ST use poses distinct public health challenges in different regions. In some low- and middle-income countries ST use is highly prevalent, it is associated with high disease risks, and the market is poorly regulated. In contrast, in some high-income nations, overall tobacco use has decreased, use of ST products is associated with markedly lower disease risks compared with smoking, and active tobacco control programs exist, but the types and products for sale are quickly proliferating and marketing of these products is expanding to new populations. While the promotion and use of ST products pose serious public health challenges across a wide spectrum of different environments, it is important to recognize that this is a complex problem and that solutions need to be tailored to the needs of each country.

Nevertheless, the complexity of this problem should not impede research, capacity building, and policy development and evaluation around smokeless tobacco. At the fifth session of the Conference of the Parties (COP5) to the WHO Framework Convention on Tobacco Control, held in November 2012, the Convention Secretariat provided a background report that emphasized the need to prioritize measures to specifically address ST use as part of the full implementation of the Framework Convention.[22] Some participants argued against making specific recommendations on ST given the wide variation in ST products around the world and different marketing dynamics and regulatory experience.[23] In the end, the COP requested additional information, including identifying and evaluating best practices in prevention and control of ST products and identifying research gaps and needs, before taking any action.[24] While deliberations continue in the global community, it is important to continue to build a global research and capacity-building agenda around smokeless tobacco.

Gaps and Research Needs

This volume has identified a number of research, capacity-building, and policy needs. This summary offers guidance to researchers, public health practitioners, and policymakers on addressing the public health impact of ST use around the world.

Surveillance and Monitoring

Ongoing, comprehensive surveillance is needed to assess the scope of ST use and changes in patterns of use, and to evaluate the impact of policies, interventions, and other steps that could be taken to address ST use. However, many countries lack data on ST use; where such data are collected, information on the use of specific products is very limited or unavailable. Moreover, in a product category that has changed and continues to change dramatically, particularly in recent years, existing survey data may not fully reflect the current situation. Surveillance and monitoring of trends in ST use should include information on populations and subpopulations of users, types of products, patterns and intensity of use, combined use of other tobacco products, and attitudes, beliefs, and perceptions about tobacco products. For example, the existing CDC-led Global Tobacco Surveillance System and WHO STEPS surveys could be expanded to provide greater coverage of ST, or in-depth analyses could be undertaken to document survey findings. Smaller targeted surveys are needed in order to assess the impact of novel products or rapid changes in use and to understand patterns among specific subgroups. Standardized measures of ST use and exposure, including quantity and frequency of use, are also needed. The WHO's Tobacco Questions for Surveys[25] provides a subset of basic questions that can be added to existing surveys, and this resource could be further expanded and tailored to specific products and regions. The new U.S. Surgeon General's 50th anniversary report, *The Health Consequences of Smoking—50 Years of Progress,* includes as one of its key recommendations the need to ensure that surveillance activities in the different countries monitor use of smokeless tobacco and combined use with other tobacco products.[26]

Products

Given the diversity of products and modes of manufacture around the world, a more comprehensive characterization of the properties of different products, their constituents, and methods of manufacture is needed. Where resources are available, biomarker studies to examine actual human uptake (absorption and excretion) of nicotine and toxicants as a result of active, secondhand, and fetal exposure to ST would be valuable. Additionally, attention should be given to non-tobacco products that are frequently used in conjunction with tobacco, such as areca nut. Further research is needed to develop standardized testing methods for diverse products. The laboratory standards being developed by the WHO Tobacco Laboratory Network for testing cigarettes could be expanded and adapted for ST products.

Health Effects

While there is a significant body of research on particular health effects of ST use in a few countries, the diversity of products, practices, and patterns of use precludes broad generalizations about health effects. Most studies of health effects have been conducted in Scandinavian countries, the United States, and India. Because of the diversity in toxicant and nicotine levels across ST products and patterns or use, applying results from one country to another country is problematic. Even within a country, ST products

can vary tremendously. Also, mixed results for some health outcomes and disease endpoints in some studies (such as in cardiovascular disease effects) and small numbers of participants in others suggest the need for further investigation. Across countries there is consensus on the adverse effects of nicotine on pregnancy, fetal brain and lung growth, and birth outcomes, such as pre-term birth and stillbirth. However, the effects of ST use on birth outcomes need further characterization, especially considering the high prevalence of ST use among some subgroups of women of reproductive age. In order to link specific types of products with particular health effects, studies are needed that link the constituent profile and biomarkers of exposure and biomarkers of effect to specific ST products with health consequences; establishing these links may be extremely challenging for custom-made and cottage industry products with little or no standardization. Studies should also investigate the health effects of other ingredients and combinations of ingredients frequently used in ST products, such as areca nut or tonka bean.

Economics and Marketing

Very little information is currently available on pricing and sales volume of ST products in many countries. While many studies have been conducted on the price elasticity of cigarettes, for example, comparable data for ST are very limited. Given the high prevalence of ST use in some low- and middle-income countries and among poor and rural populations, pricing information may be especially important for understanding patterns of use and developing effective public health interventions. Information on price, taxes, affordability, and trade should be collected routinely. Additionally, locally relevant data are needed to demonstrate the economic benefits of tobacco control measures, because some countries with active tobacco industries may seek to delay or defeat actions to reduce ST use out of concern for the potential impacts on national economies. Lastly, ongoing surveillance of tobacco industry marketing strategies is important, particularly following the implementation of new policies or regulations or the entrance of new multinational tobacco companies into the market.

Interventions

New interventions for ST use prevention and cessation should be developed and tested at both the population and individual levels along with their impact on use of combustibles, cessation, and relapse. Interventions tailored to ST users and to specific populations of users, taking into account cultural differences within and across regions, are needed. Effective interventions can be developed based on a clearer understanding of the factors associated with initiation and maintaining use, the reasons why some ST users want to quit, the barriers to quitting, and how best to disseminate treatments based on the resources of a particular region. Given that most of the current evidence base for effectiveness of interventions comes from high-income countries, development and evaluation of interventions for use in low- and middle-income countries and in diverse health care settings are needed.

Building Capacity

Enhancing surveillance and synthesis of data, pursuing a research agenda, and implementing new policies and interventions to address ST use will require increased scientific and public health capacity in low- and middle-income countries, particularly those that are confronted with high burdens of ST use. Increased in-country capacity to conduct tobacco control research is critical to the development and

implementation of effective interventions, as these interventions must be responsive to local populations and contexts. In addition, robust local capacity enhances the sustainability and adaptability of evidence-based policies and programs, as local researchers and institutions are well positioned to respond to changes in the tobacco control environment over time by generating new relevant knowledge to inform modifications or new approaches.

At the same time, greater capacity for communication and collaboration across countries is increasingly important. As tobacco use trends change, innovative policies and interventions are introduced in different countries, and the tobacco industry adopts new marketing strategies, an enormous "natural experiment" is under way that provides unique opportunities for research and evaluation. Making use of these opportunities will require coordinated surveillance, information sharing, and research efforts. The following recommendations, some of which have been described in Article 20 of the FCTC, are made to enhance collaboration and infrastructure development:

- Create regional information clearinghouses for ST that can be readily accessed electronically by people from all parts of the world. These clearinghouses can inform stakeholders within and outside a region about ST product characteristics, patterns of use, policies and other interventions that have been implemented, and the results of any research or evaluation conducted.
- Strengthen the infrastructure for networking, communication, and collaboration. One mechanism for facilitating this goal would be to develop a Web portal to serve as a repository and index to information on ST product characteristics, constituents and ingredients, manufacturing and promotion methods, product price, and packaging and marketing materials. This Web portal could also bring together the regional clearinghouses described above and provide a forum for discussion about research design, research results, and policies.
- Build collaborations among scientists, tobacco control advocates, and policymakers. These collaborations are critical for translating research into policy and ensuring that policy needs inform research studies. Collaborations across countries and regions are especially important to making comparisons between different products, environments, and interventions. Countries with more mature tobacco control programs can provide expertise and assistance to countries that are in earlier stages of implementing programs and policies.
- Develop innovative and sustainable approaches to build research capacity by better leveraging existing resources such as the Tobacco Laboratory Network, the Global Adult Tobacco Survey and Global Youth Tobacco Survey, and the Tobacco Harm Reduction Network. Research capacity can also be enhanced by attracting and training new researchers—especially those in middle- and low-income countries—and encouraging collaborations between new and experienced researchers.

Intervention and Policy Needs

Tobacco control policies, programs, and interventions applied to cigarettes and smoked tobacco products should be applied to ST products and enforced and monitored with equal strength, particularly in regions where the burden of ST use is high. Prevention and cessation of ST use should form an integral part of every comprehensive tobacco control effort. At the same time, ST products pose some distinct challenges compared with smoked products, and specific policy needs may vary across countries, depending on products, patterns of use, industry marketing, and the tobacco control environment. These recommendations are consistent with those made in the 2014 U.S. Surgeon General's Report.[26] In particular, the following measures for controlling ST products should be addressed:

- Effective interventions tailored specifically to ST users should be developed, evaluated, and implemented where appropriate, and support for further research in this area is needed. As of this writing, few studies have been conducted of interventions targeted to ST users, and pharmacotherapies used with cigarette smokers (with the possible exception of varenicline) have not generally been found effective with ST users. However, some community-wide prevention efforts (especially if they involve youth and parents) have shown success across countries of different income levels. The engagement of oral health professionals in recommending or providing ST cessation counseling has been shown to be effective in some countries and may be applicable to a variety of other communities and nations.
- Specific guidelines are needed to ensure that the FCTC requirements and MPOWER guidelines[27] can be and are appropriately applied by the Parties to ST products as well as cigarettes. For example, the FCTC binds Parties to ban or restrict sponsorship and marketing of tobacco products, prohibit sale to minors, and track and monitor illicit trade. Additional guidance can help ensure that the FCTC and other requirements are fully applied to a diverse array of ST products as well.
- In all regions, greater awareness is needed about ST use and its health effects, including education of health professionals, consumers (with particular attention to youth and women of childbearing age), policymakers, and community leaders. Dissemination of information about the toxicity of tobacco products may be particularly important in geographic areas where tobacco products are premade through cottage industries, or custom-made at home or at the point of sale. Greater awareness is also needed among policymakers, health professionals, and the public regarding the public health impact of ST use and changing patterns in industry marketing and consumer use.
- Product standards for ST need to be developed, implemented, and evaluated. Levels of known toxicants in ST products vary widely, as does the impact of storage and processing practices on toxicant levels. Feasible measures for reducing toxicant levels include reducing the use of *Nicotiana rustica*, limiting bacterial contamination that can promote nitrite formation, nitrosation and carcinogen formation, and requiring tobacco to be air-cured, pasteurized, and refrigerated. The WHO Study Group on Tobacco Product Regulation has recommended mandating upper limits on ST toxicants; this would include setting the upper limit of NNN plus NNK at 2 micrograms per gram of dry weight tobacco, and the upper limit for benzo[*a*]pyrene at 5 nanograms per gram of dry weight tobacco.

- Research is needed that can form the basis for establishing maximum levels of pH in ST products. Additives that increase pH in tobacco products boost the amount of free nicotine available for absorption, and products with higher free nicotine levels are more addictive.
- Some countries, such as the United States and Canada, have banned flavorings in cigarettes (except menthol), but they have placed no such limits on the use of flavorants in ST products. A variety of flavors and other additives are used to enhance the appeal of tobacco products and facilitate uptake.[9,28] A recent U.S. study showed that more ST users (who were seeking an intervention) had initiated with or switched to a mint-flavored ST product than non-flavored products.[29] Banning or limiting certain additives and flavorants may serve as an effective tool for reducing the attractiveness of ST, especially among youth and pregnant women.
- Stronger, more effective public health warnings are needed on ST products (as recommended in Article 11 of the FCTC). Many countries require health warning labels on ST packaging, but most of these labels contain only textual warnings and lack the graphic images that have been implemented for cigarette labels. For cigarettes, Article 11 of the FCTC recommends pictorial warning labels and mandates that health warnings cover at least 50% of the cigarette packet. These standards have not been uniformly applied to ST products.
- Increasing the price of ST products could be implemented, and increasing taxes on ST products (as recommended in Article 6 of the FCTC) is the simplest way to increase price. As noted in chapter 5, a WHO expert panel recommended that ST be taxed at "a level sufficient to act as a disincentive, and at least at the level at which cigarettes are taxed."[30,p.64] The same FCTC guidelines for taxing cigarettes could be applied to ST and all other tobacco products. These recommendations include an excise tax that makes up at least 70% of the retail price, with the use of specific excise tax being favored over ad valorem taxes. Having a more uniform tax structure across tobacco products would help curtail the practice of substituting less expensive tobacco products for more expensive ones, which would be of particular concern in countries where very toxic ST products may be less costly. Due to challenges inherent in tax collection in traditional markets, especially from small-scale local producers or sellers, taxation of tobacco leaves or a presumptive tax (a compounded levy per manufacturing machine) may be considered in countries with diverse ST products and markets. Earmarking a portion of ST tax revenues to fund ST prevention and cessation interventions, other tobacco control efforts, or public health in general could further increase the overall benefit of taxation.

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Appendix A

Description of Representative Products From Four Broad Categories of Smokeless Tobacco Products Used Globally

Description of Representative Products From Four Broad Categories of Smokeless Tobacco Products Used Globally

The smokeless tobacco products presented here are grouped into categories based on chemical composition as revealed by product packaging and chemical data that are presently available; this view of product composition is likely to change as additional data become available. This categorization does not indicate the safety or the addictive properties of a product, product type, or category, but is intended to highlight constituents of concern and may aid in further investigation and research. Some products (moist snuff, snus, rapé, etc.) can fit into additional categories based on their individual composition. Category 4 products, although similar in some ways to products in other categories, contain agents such as khat, caffeine, and coumarin, which warrant individual consideration.

Product name (other names)	Region*/country of use	Mode of use†	Production‡	Form/type of tobacco	Added ingredients
Category 1. Tobacco with little or no amounts of alkaline agents (generally <pH7)					
Gundi (kadapan)	SEAR: India	C, IN	Cottage	Tobacco (coarsely powdered)	Coriander seeds, other spices, and aromatic, resinous oils
Hogesoppu (leaf tobacco)	SEAR: India	C, IN	Cottage	Unprocessed tobacco bundled in long strands	
Kaddipudi	SEAR: India	C, IN	Cottage	Powdered sticks of raw tobacco stalks and petioles	Sometimes molasses and water
Kiwam (qiwam, kimam)	EMR: Pakistan SEAR: Nepal, India, Bangladesh	C, H, IN	Commercial	Tobacco (boiled)	Spices (cardamom, saffron, and/or aniseed), additives such as musk, and may contain silver flecks
Loose leaf	AMR: United States	C, H, S	Commercial	Tobacco leaves (air-cured)	Sugar and/or licorice and other sweeteners
Mishri (masheri, misri)	SEAR: India	A, D, S	Cottage; Custom	Tobacco (toasted, powdered)	
Moist snuff (low pH)	AFRO: South Africa AMR: United States, Canada, Mexico	H, S	Commercial	Tobacco (fermented, air- or fire-cured)	Flavorings (spices, essential oils, extracts), sweeteners, inorganic salts, humectants, preservatives
Neffa	AFR: Algeria EMR: Libya, Tunisia	N	Cottage; Custom	Tobacco (dry)	

Product name (other names)	Region*/country of use	Mode of use†	Production‡	Form/type of tobacco	Added ingredients
Nicotine chewing gum	WPR: Guam, Japan	C	Commercial	Tobacco (finely ground)	Chewing gum base, xylitol
Pattiwalla without lime	SEAR: India	C, IN	Cottage	Tobacco (sun-dried, flaked)	
Plug	AMR: United States	C, H, S	Commercial	Tobacco leaves	Licorice, sweeteners
Red toothpowder (lal dant manjan)	SEAR: India	A, D	Commercial	Tobacco (powdered)	Herbs, flavorings. Additional plant-related ingredients such as ginger, pepper, and camphor, among others, may be used.
Snus (low pH)	AFR: South Africa AMR: United States, Canada, Brazil EUR: Sweden, Norway, Finland, Denmark, Iceland	H	Commercial	Tobacco (heat-treated, pasteurized)	Sodium carbonate, moisturizers, salt (sodium chloride), sweeteners, flavorings, water
Tapkeer (bajjar, dry snuff)	SEAR: India	A, H, N	Custom	Tobacco (fermented, fire-cured)	Flavorings may be added.
Tobacco leaf	SEAR: India, Bangladesh, Myanmar, Bhutan	C, IN	Custom	Tobacco leaves (dry)	
Tumbaco	AFR: Congo	N	Cottage	Tobacco (dry)	
Twist	AMR: United States	C, H	Commercial	Tobacco (dark and air-cured leaf)	Tobacco leaf extracts and sometimes sweetener or flavorings
Watery tobacco	SEAR: Myanmar	G	Cottage	Tobacco	Water
Zarda	EMR: Yemen SEAR: India, Bangladesh, Myanmar, Nepal, Bhutan	C, IN	Commercial	Tobacco	Slaked lime or other alkaline agents, spices, vegetable dyes, and sometimes areca nut and/or silver flecks
Category 2. Tobacco with appreciable amounts of alkaline agents (>pH 7)					
Chimó	AMR: Venezuela, Columbia	H, S	Commercial; Cottage	Tobacco leaf	Baking soda (sodium bicarbonate), brown sugar, ashes from the Mamón tree (*Meliccoca bijuga*), and vanilla and anisette flavoring. Ingredients vary by region.
Creamy snuff	SEAR: India	A	Commercial	Tobacco	Clove oil, glycerin, spearmint, menthol, camphor, water

Product name (other names)	Region*/country of use	Mode of use†	Production‡	Form/type of tobacco	Added ingredients
Dissolvables	AMR: United States	DI, H, S	Commercial	Ground tobacco pressed into tablets, strips, or sticks	Binders, humectants, sweeteners, colorings, preservatives, alkaline agents, flavorings
Dry snuff	AFR: South Africa, Nigeria AMR: Canada, United States EUR: Germany	H, N, S	Commercial	Tobacco (fermented, fire-cured)	Flavoring, alkaline agents
Ghana traditional snuff (tawa)	AFR: Ghana	H, N	Cottage; Custom	Tobacco leaves (dry)	Saltpeter (potassium nitrate), ashes
Gudakhu/ Gudakha	SEAR: India	A, H	Commercial; Custom	Tobacco (powdered)	Molasses, red soil, slaked lime
Gul	SEAR: India, Bangladesh	A, D	Commercial	Pyrolysed tobacco leaves	Sugar or molasses, alkaline modifiers, and other unknown ingredients
Iqmik	AMR: United States (Alaska)	C	Custom	Tobacco	Tree fungus ash (also known as punk, araq, or buluq ash) or other ash derived from burning driftwood or willow bushes
Khaini	SEAR: India, Bangladesh, Nepal, Bhutan	S, H, C	Commercial; Custom	Tobacco	Slaked lime paste and sometimes areca nut
Maras	EUR: Turkey	A	Custom	Sun-dried tobacco	Ashes from oak, walnut, or grapevine
Moist snuff (high pH)	AFRO: South Africa AMR: United States, Canada, Mexico	H, S	Commercial	Tobacco (fermented, air- or fire-cured)	Flavorings (spices, essential oils, extracts), sweeteners, inorganic salts, humectants, preservatives
Nass (naswar)	AFR: South Africa EMR: Pakistan, Iran, Afghanistan, United Arab Emirates EUR: Turkmenistan	C, H, S	Cottage; Custom	Tobacco	Nass: ash, cotton or sesame oil, water, and sometimes lime or gum Naswar: slaked lime, ash, indigo (or other coloring agent), oil, water, and sometimes flavorings such as cardamom and menthol
Nasway (nasvay)	EUR: Uzbekistan, Kyrgyzstan	H, S	Cottage; Custom	Tobacco leaves (sun- and heat-dried)	Tobacco leaves, slaked lime, water, and sometimes ash from tree bark, butter or oil, flavorings, or coloring agents
Nigerian traditional snuff (taaba)	AFR: Nigeria, Cameroon, Senegal, Chad, Uganda	H, N, S	Cottage; Custom	Tobacco (dry, fermented)	Natron (a mixture of sodium bicarbonate and sodium chloride)

Product name (other names)	Region*/country of use	Mode of use†	Production‡	Form/type of tobacco	Added ingredients
Shammah	AFR: Algeria EMR: Saudi Arabia, Yemen	H, S	Cottage; Custom	Tobacco	Slaked lime, ash, black pepper, oil, flavorings, and bombosa (sodium carbonate)
Snus (high pH)	AFR: South Africa AMR: United States, Canada, Brazil EUR: Sweden, Norway, Finland, Denmark, Iceland	H	Commercial	Tobacco (heat-treated, pasteurized)	Sodium carbonate, moisturizers, salt (sodium chloride), sweeteners, flavorings, water
Tobacco water (tuiber)	SEAR: India	G, H	Cottage; Custom	Tobacco smoke	Water, alkaline agents
Toombak	EMR: Sudan	H, N, S	Cottage; Custom	Tobacco (fermented, sun-dried)	Atrun (sodium bicarbonate)
Traditional South African snuff (snuif)	AFRO: South Africa, Lesotho, Swaziland	N, S	Cottage; Custom	Tobacco leaf (sun-dried)	Ash from local plants (e.g., amaranthus, aloe vera leaves)
Category 3. Tobacco with various alkaline modifiers and areca nut					
Betel quid (paan)	EMR: Pakistan, United Arab Emirates SEAR: India, Sri Lanka, Bangladesh, Myanmar, Thailand, Indonesia, Nepal, Maldives WPR: Lao Democratic People's Republic, Palau, Cambodia, Malaysia, Vietnam, Federal States of Micronesia	C, H	Cottage; Custom	Tobacco. Other smokeless tobacco products may be used such as kiwam and zarda.	Areca nut, slaked lime, betel leaf, and often catechu. Other ingredients vary regionally: cardamom, saffron, cloves, aniseed, turmeric, mustard, sweeteners
Dohra	SEAR: India	C	Custom	Tobacco	Areca nut, slaked lime or other alkaline agents, and other ingredients such as catechu, peppermint, cardamom
Gutka	EMR: Pakistan SEAR: India, Bangladesh, Nepal, Myanmar, Sri Lanka	C, H	Commercial; Cottage	Tobacco	Areca nut, slaked lime or other alkaline agents, catechu, sweeteners, and flavorings
Kharra	SEAR: India	C	Cottage; Custom	Tobacco	Areca nut, lime, and catechu

Product name (other names)	Region*/country of use	Mode of use†	Production‡	Form/type of tobacco	Added ingredients
Mainpuri (kapoori)	SEAR: India	C, H, IN	Cottage; Custom	Tobacco	Slaked lime or other alkaline agents, areca nut, camphor, and other spices
Mawa	SEAR: India	C	Cottage; Custom	Tobacco	Slaked lime, areca nut
Tombol (bitter tombol)	EMR: Middle East	C, H	Custom	Tobacco	Areca nut (fofal), slaked lime, noura, betel leaf (tombol leaf), catechu, and flavorings such as clove oil, cardamom, or herbal medicine
Tombol (sweet tombol)	EMR: Yemen	C, H	Custom	Tobacco	Areca nut (fofal), slaked lime, noura, betel leaf (tombol leaf), catechu, and sweeteners such as coconut
Category 4. Tobacco with other plant material (tonka bean, cinnamon, clove, etc.) containing additional toxicants (coumarin, camphor, eugenol), stimulants (khat, caffeine), etc.					
Caffeinated moist snuff	AMR: United States	H	Commercial	Tobacco (fermented, air- or fire-cured)	Caffeine, flavorings (spices, essential oils, extracts), sweeteners, inorganic salts, humectants, preservatives, ginseng, B and C vitamins
Rapé and NuNu	AMR: Brazil	N	Cottage	Tobacco leaf (dried)	One or more ingredients: tonka bean, clove, cinnamon powder, camphor, Peruvian cocoa, cassava, ashes from select trees
Tombol with khat	EMR: Yemen	C, IN	Custom	Tobacco	Areca nut (fofal), slaked lime, noura, betel leaf (tombol leaf), catechu, and khat

*World Health Organization regions:
AFR: African Region
AMR: Region of the Americas
EMR: Eastern Mediterranean Region
EUR: European Region
SEAR: South-East Asia Region
WPR: Western Pacific Region

†Mode of use categories:
A = Applied to the teeth or gums
C = Chewed
D = Dentifrice (teeth cleaning)
DI = Dissolves in the mouth
G = Gargled
H = Held in mouth
IN = Ingredient in betel quid or other custom-made product
N = Nasal use
S = Sucked

‡Production category definitions:
Commercial: Product is commercially manufactured (large-scale, branded).
Cottage: Product is manufactured by local, small-scale industry (sometimes family-run business, not branded).
Custom: Product is prepared by a vendor or in the home.

Appendix B

Global Smokeless Tobacco Product Factsheets

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African Traditional Snuff Products

A wide range of smokeless tobacco products are used in the 46 countries that make up the WHO African Region. Smokeless tobacco products can take a variety of forms, are available commercially, and can be custom-made or manufactured in small factories. The products can be chewed, sniffed, sucked, or applied to teeth and gums. Several of the products are summarized here.

Photo courtesy of Olalekan Ayo-Yusuf, University of Pretoria

Product Types, Modes of Absorption, and Main Geographic Locations

Ghana traditional snuff (tawa)

This local dry snuff, often called "tawa," is prepared by mixing the dried tobacco leaf with some chemicals such as saltpeter (potassium nitrate) and grinding it into a fine powder. It may be held in the mouth or used nasally to induce sneezing to "lighten" the head; it may also be used as a depressant or stimulant.[1]

Neffa (naffa, tenfeha, nufha)

These are the names given to dry snuff that is used nasally in northern Africa. Neffa/naffa is used in Tunisia, Libya, and Algeria. Tenfeha is used in Morocco, and nufha in Algeria.[2]

Snuif

Snuif, the South African word for "snuff," is not a specific type of smokeless tobacco product. Snuif is both commercially and locally produced. Some brand names are Singleton (dry snuff), Taxi, and Ntsu (moist snuff). The custom-made traditional mix is prepared by hand-mixing finely ground sun-dried tobacco leaf with ash from local plants.[3]

Taaba

This type of smokeless product is used in a number of West African countries, including northern Nigeria, Cameroon, Senegal, Uganda, and Chad. It is locally produced from dry fermented tobacco that is pulverized and mixed with natron/atron (a naturally occurring mixture of sodium bicarbonate and sodium chloride). Taaba can be used nasally or sucked orally.

Prevalence and Demographics

Ghana traditional snuff (tawa)

Although no data are available specifically on the prevalence of use of traditional snuff, findings from the Global Youth Tobacco Survey (GYTS) in 2006 showed that 10.4% of youths in Ghana reported using "tobacco products other than cigarettes," including snuff.[4]

Neffa

Neffa is predominantly used by men. Although no data are available specifically on the prevalence of neffa use, in the Algerian provinces of Oran, Constantine, and Setif, youth prevalence of tobacco use other than cigarettes was 7.8–8.9%, according to the 2007 GYTS.[4]

Snuif

Snuif is the name given to snuff in South Africa. Its use is most common among women and people living in rural areas, as well as individuals who are older, black, or have less education and income.[5] A 2003 study in South Africa reported that 2.4% of men and 10.9% of women aged 15 years and older reported ever using any smokeless tobacco, including snuff.[6] The 2008 South African National Youth Risk Behavior Survey found that 12.1% of adolescents used smokeless tobacco in the past month.[7]

African Traditional Snuff Products

Taaba

No data are available specifically on the prevalence of dry snuff use, but the 2008 Nigeria Demographic and Health Survey found that 3.2% of adult men and 0.5% of adult women report using smokeless tobacco.[8] Although national prevalence data in Nigeria suggest relatively low use rates, 2007 data from a state in Nigeria's North-East geopolitical zone revealed smokeless tobacco use rates as high as 10.8% among men and 4.1% among women aged 15 years and older.[9] The 2008 GYTS in Nigeria found that youth prevalence of tobacco use other than cigarettes was between 13.1% and 23.3% in five states.[4] In Uganda in 2006–2007, the prevalence of any smokeless tobacco use among adults (age 15–54) was 3.9% for men and 2.6% for women,[8] and among adolescents (age 13–15), 8.6% for boys and 9.6% for girls.[4]

Chemical Measurements

Only limited data are available on the toxicity of smokeless tobacco products used in the region, but recent data suggest considerable variability in the toxicity and nicotine profiles of some of the products that have been tested. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Snuif, traditional snuff, South Africa	9.29	5.29	5.01	1,610	5,570	71.8	20,500
Traditional snuff, Nigeria	9.42	2.49	2.39	285	711	29.5	1,520

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino) 1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (10).

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For additional information on African traditional snuff products, please refer to Chapter 12: Smokeless Tobacco Use in the African Region.

Betel Quid
With Tobacco

Betel quid is commonly used in many countries in the Asia-Pacific region. It can be prepared in a variety of ways depending on the region, but usually contains areca nuts, slaked lime, and catechu (extract of the Acacia catechu tree) wrapped in a betel leaf. Betel quid itself is not a tobacco product, but tobacco is often added to it. Chewing betel quid without tobacco is an ancient practice in India; this product is known as "tambula" in Sanskrit.[1]

Photo courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinha

Common Names
Paan or pan (India), khilli paan (Bangladesh)

Brand Names
None

Main Geographic Locations (WHO Region: Country)
South-East Asia Region: India, Sri Lanka, Bangladesh, Myanmar, Thailand, Indonesia, Nepal, Maldives[2]; **Eastern Mediterranean Region:** Pakistan, United Arab Emirates[2,3]; **Western Pacific Region:** Lao Democratic People's Republic, Palau, Cambodia, Malaysia, Vietnam, Federal States of Micronesia[2,4]

Prevalence and Demographics
Prevalence and demographic profiles of betel quid chewers vary greatly by region. The Global Adult Tobacco Survey in India (2009–2010) shows that about 6.2% percent of all adults aged 15 years and older (7.5% of males and 4.9% of females) report using betel quid with tobacco in India,[5] and 24.3% of all Bangladeshis aged 15 years and older (23.5% of males and 25.2% of females) consume betel quid with tobacco.[6] The 2009–2010 Asian Betel–Quid Consortium study found that use of betel quid with tobacco among adults aged 15 and older ranges widely across several other South-East Asian countries: Prevalence is high in Nepal (males, 43.6%; females, 34.9%) and among women in Indonesia (31.7% among females, compared to 10.4% among males). Prevalence is moderate in Malaysia (males, 6.2%; females, 12.0%), and generally low in Sri Lanka (males, 6.4%; females, 3.2%).[7] In Myanmar in 2004, approximately 16.2% of adults aged 15 years and older (males, 27.8%; females, 4.4%) chewed betel quid with tobacco.[8]

Mode of Absorption
Oral (chewed, held in mouth)

Use Patterns
Different regions will use different types of tobacco in betel quid, such as sada pata (plain tobacco flakes) and zarda (flavored tobacco flakes) in Bangladesh and India,[1,6] kiwam (tobacco paste) in Pakistan and India,[1,2] and even half a cigarette in Palau.[4,9] In Indonesia, Vietnam, and Cambodia, users may use tobacco to clean their teeth after chewing betel quid rather than inserting it directly in the quid.[9,10] Some users swallow the juices produced from chewing betel quid.[2]

Main Ingredients
Tobacco, areca nut, slaked lime (calcium hydroxide) or other alkaline agents, betel leaf, and usually catechu (*Acacia catechu* tree extract). Additional ingredients vary regionally according to local preference, and can include cardamom, saffron, cloves, camphor, aniseed, turmeric, mustard, or sweeteners.[2,9]

Betel Quid

With Tobacco

Processing/Manufacturing

Cottage industry and custom-made: Betel quid is prepared by individual vendors for sale or assembled at home by individual users. Betel quid may be prepared in a variety of ways. Areca nut can be raw, boiled, roasted, fermented, or sun-dried. Tobacco may be used raw, sun-dried, or roasted, and then finely chopped or powdered. Alternatively, the tobacco may be boiled with molasses and made into a paste. The tobacco may then be perfumed or flavored. Slaked lime and sometimes catechu are smeared on a betel leaf, then the betel leaf is folded into a funnel shape, and tobacco, areca nut, and any other ingredients are added. The top of the funnel is folded over, resulting in a quid, which is placed in the mouth and chewed.[2,9]

Chemical Measurements

Published chemical data for betel quid are not available.

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For additional information on betel quid (paan), please refer to the following chapters: Chapter 10: Smokeless Tobacco Use in the European Region; Chapter 11: Smokeless Tobacco Use in the Eastern Mediterranean Region; Chapter 13: Smokeless Tobacco Use in the South-East Asia Region; and Chapter 14: Smokeless Tobacco Use in the Western Pacific Region.

Chimó

Chimó is a tobacco-based paste that was reportedly first used in South America in the early days of European colonization. In 1497, Amerigo Vespucci reported the use of a chewing tobacco mixed with ashes in the Caribbean.[1] According to a popular legend, the aboriginal chief Chimauchu was the first to use tobacco in the form of a paste, which today is called chimó.[1]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
None

Brand Names
El Tovareño, El Tigrito, El Sabroso, El Gran Búfalo, El Dragón, El Morichal, San Carleño

Main Geographic Locations (WHO Region: Country)
Region of the Americas: Venezuela, Colombia[2]

Prevalence and Demographics
Among adults in Venezuela in 2007, 1.5% of women and 6.2% of men were current users, and 3.1% of women and 15.4% of men reported ever using chimó.[3] The Venezuelan Global Youth Tobacco Survey (GYTS) was used to estimate tobacco-specific prevalence of smokeless use among students in grades 7–9. GYTS results for Venezuela nationally and for eight different states in the years 2000, 2004, and 2008 found that the prevalence of chimó use was not uniform among the states: It ranged from 3.8% to 20.7% for boys, and 2.0% to 6.6% for girls.[2] Prevalence rates of chimó use in Colombia are not available.

Mode of Absorption
Oral (sucked, held in mouth)

Use Pattern
A small amount of chimó is placed between the lip or cheek and the gum and left there for some time, usually 30 minutes. The mixture of chimó and saliva is spit out.[4]

Main Ingredients
Tobacco leaf, baking soda (sodium bicarbonate), brown sugar, ashes from the Mamón tree (Meliccoca bijuga), and vanilla and anisette flavoring. The ingredients vary according to the region.[4]

Processing/Manufacturing
Cottage industry and commercial: Chimó is usually produced by small family-operated factories, but commercial, industrial manufacturing of chimó is increasing in Venezuela. Tobacco leaves are first crushed and boiled for several hours or days, and then starch and fibers are removed. The remaining concentrated product (10 kilos of tobacco becomes one kilo of "basic" chimó paste) is a sticky, heavy, black liquid, which can be stored for maturation for up to 2 years. For maturation, it is placed in natural containers like "taparas" (dried fruit from the Tapara tree) or wrapped in banana leaves. The matured paste is seasoned with other ingredients (see "Main Ingredients"), and then packaged in small tins or candy-like wrapped cylinders.[4]

Chimó

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Chimó, Venezuela	6.98–9.40	5.29–30.1	1.32–27.4	310–2,600	318–4,260	14.9–1,330	954–9,390

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (5).

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For additional information on chimó products, please refer to Chapter 9: Smokeless Tobacco Use in the Region of the Americas.

Creamy Snuff

Creamy snuff is a tobacco-based paste sold in toothpaste-like tubes. It is often advertised as being antibacterial and healthy for teeth and gums, and it is used primarily by women.[1]

Photo courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinha

Common Names
Tobacco toothpaste

Brand Names
IPCO (*Asha Industries*), Dentobac (*Goran Pharma LTD*), Tona, Ganesh, Charotar, Musa Ka, Rehmat Khan, Chad Tara, Dulhan, Suraj, Asif Ka

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India[2]

Prevalence and Demographics
Creamy snuff is used primarily by women, but it also seems popular among children.[1,3] In 2004, one study in India reported that the prevalence of creamy snuff use among adolescents aged 13 to 15 years varied from 2% to 32% across 18 states.[4] Although no product-specific adult prevalence data are available, in 2009–2010 4.7% of all adults (3.3% of males and 6.3% of females) in India reported applying tobacco products, including creamy snuff, mishri, gul, or gudakhu, to their teeth and gums.[5]

Mode of Absorption
Oral (applied to teeth and gums, teeth cleaning)

Use Pattern
Creamy snuff is used to clean teeth like regular toothpaste. Some products' instructions recommend holding the paste in the mouth for a little while before rinsing.[1,3]

Main Ingredients
Tobacco, clove oil, glycerin, spearmint, menthol, camphor, water[3]

Processing/Manufacturing
Commercial: Creamy snuff is commercially manufactured and is marketed as a teeth cleaner (dentifrice).[3] Creamy snuff consists of finely ground tobacco mixed with aromatic substances, such as clove oil, glycerin, spearmint, menthol and camphor, salts, water, and other hydrating agents.[1,3] Additional information on the manufacturing of creamy snuff could not be located.

Creamy Snuff

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
Creamy Snuff, India	7.51–8.35	5.62–10.0	2.36–3.82	N/A	N/A	N/A	N/A

*All creamy snuff products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Gupta and Sreevidya 2004 (6).

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Dissolvable Tobacco

Dissolvable smokeless tobacco products were introduced in the United States in 2001. The first products, Ariva and Stonewall, dissolved completely during use, with no residual loose tobacco or tobacco-containing sachet to discard. In 2009, R.J. Reynolds Tobacco Company released Camel Orbs, Strips, and Sticks in a variety of formulations and flavors, all of which can fully dissolve in the mouth.[1] In 2011, Altria began test marketing new dissolvable products, Marlboro and Skoal Smokeless Tobacco Sticks, which are small toothpick-like sticks coated with tobacco, which are discarded after the coating dissolves.[2] In January 2013, the manufacture and sale of Ariva and Stonewall lozenges were discontinued.[3] Because dissolvables look like candy, there is concern that children will accidentally ingest them.[4]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Type	Description	Examples
Tablets	Tobacco compressed into a lozenge	Arriva, Camel Orbs, Stonewall
Strips	Tobacco pressed into a thin wafer-like dissolvable strip (somewhat like a breath strip)	Camel Strips
Sticks	Tobacco pressed into a long, thin dissolvable stick	Camel Sticks
Tobacco Sticks	Small toothpick-like stick coated with a semi-hard tobacco-containing mixture. All of this product dissolves in the mouth except the toothpick.	Marlboro Tobacco Sticks, Skoal Tobacco Sticks

Common Names
Dissolvables

Brand Names
Ariva, Stonewall *(Star Scientific)*; Camel Orbs, Camel Strips, Camel Sticks *(R.J. Reynolds)*; Marlboro Sticks *(Philip Morris)*; Skoal Sticks *(U.S. Smokeless Tobacco Company)*

Main Geographic Location (WHO Region: Country)
Region of the Americas: United States[5]

Prevalence and Demographics
A 2010 survey found that less than 1% (0.6%) of adults in the United States had tried dissolvables.[6] Dissolvable tobacco products are fairly new to the market, and as of 2011–2012, Camel, Marlboro, and Skoal dissolvable products were still being test marketed in select cities and were not nationally available.[2,5,7] As these products become more widely available, their use may become more widespread.

Mode of Absorption
Oral (sucked, held in mouth, dissolved)

Use Pattern
These products can dissolve in as few as 3 minutes (Camel Orbs) or as much as 30–60 minutes (Stonewall).[8] Tobacco sticks do not completely dissolve because the tobacco is coated onto a wooden toothpick that must be thrown away.

Main Ingredients
Tobacco, humectants, preservatives, flavors[9]

Dissolvable Tobacco

Processing/Manufacturing

Commercial: Dissolvable tobacco is commercially manufactured. Limited information is available on the specific processes used for manufacturing many of these products. To create tobacco tablets, tobacco is pasteurized and ground into fine powder, and the finely powdered tobacco is combined with flavors, such as mint and eucalyptus, and other additives that allow the tobacco to be compressed into tablet form and dissolved in the mouth.[10]

Chemical Measurements

These data are for select products and may not represent all products of this type. Data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
Tablets,‡ United States	6.92–8.10	3.03–6.85	0.37–1.65	69–280	61–214	—	536–736
Camel Sticks, United States	7.76	3.92	1.45	307	264	—	852
Camel Strips, United States	7.88	2.67	1.11	221	152	—	535

*All products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
‡Includes Camel Orbs, Ariva, and Stonewall.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stepanov et al. 2012 (11).

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For additional information on dissolvables, please refer to Chapter 9: Smokeless Tobacco Use in the Region of the Americas.

Dohra

Photo courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinh

Dohra is a wet mixture of tobacco and other ingredients such as areca nut, catechu, and flavors. Tobacco is frequently added to this mixture in the form of zarda, a smokeless tobacco product composed of flavored tobacco flakes. Dohra is commonly used in the Allahabad District of the Uttar Pradesh state in India, and in surrounding districts, such as Jaunpur and Pratapgarh.[1]

Common Names
None

Brand Names
None

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India (Uttar Pradesh)[2]

Prevalence and Demographics
It is estimated that more than 50% of people in the Jaunpur area of India use dohra.[2] There are no available data on nationally representative prevalence rates of dohra use in India.

Mode of Absorption
Oral (chewed)

Use Pattern
Users may buy the dohra spice mixture packet and tobacco packet separately and add the amount of tobacco they prefer.[1,2]

Main Ingredients
Tobacco, areca nut, and other ingredients such as catechu, slaked lime (calcium hydroxide), peppermint, cardamom[1,2]

Processing/Manufacturing
Custom-made: Dohra is produced by individual vendors for sale. It is sold either as a ready-made mixed tobacco product or in two packets, one containing tobacco (often zarda or surti) that is mixed with the contents of the second packet (areca nut, catechu, and other flavorings). Dohra is normally sold in a plastic bag with a rubber band tied around it.[2]

Chemical Measurements
No data available

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Dry Snuff

Two types of snuff are manufactured and used in the United States: moist snuff and dry (Scotch) snuff. Moist snuff is by far the most widely consumed type in the United States and Canada. It contains 20%–60% moisture and often is flavored with wintergreen or various fruit flavors. In contrast, dry snuff, a finely powdered tobacco product produced mainly from Kentucky and Tennessee fire-cured tobaccos, has a moisture content that is less than 10% by weight.[1] This factsheet describes only commercial dry snuff. Other types of dry snuff are used traditionally in many regions around the world (see the factsheets *Tapkheer and African Traditional Snuff Products* for more information).

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
Scotch snuff, snuff

Brand Names
Levi Garrett & Sons, Dental, Honest, Peach Sweet, Tube Rose, W.E. Garrett & Sons *(American Snuff Company)*; Silver Dollar *(Kretek International, Inc.)*

Main Geographic Locations (WHO Region: Country)
Region of the Americas: Canada, United States[1];
African Region: South Africa, Nigeria[2];
European Region: Germany[1]

Prevalence and Demographics
Use of dry snuff has declined over the last 100 years and is rare today. In 2012, the U.S. prevalence of smokeless tobacco use (including snuff and chewing tobacco) among those aged 12 years and older was 3.6% (7.1% of males and 0.4% of females).[3] Although no current prevalence data are available specifically for dry snuff use, sales of dry snuff comprised only 1.4% of all smokeless tobacco sales in the United States in 2009.[4] Prevalence data on dry snuff use in other countries are not available.

Mode of Absorption
Oral (sucked, held in mouth); **Nasal**

Use Pattern
Dry snuff is usually used orally, but it may also be inhaled into the nostrils.[1]

Main Ingredients
Tobacco (fire-cured, fermented), often flavored[1]

Processing/Manufacturing
Commercial: Dry snuff is commercially manufactured. Tobacco is fire-cured and then fermented and processed into a dry, powdered form; it may also be sweetened. The moisture content of the finished product is less than 10% by weight. It is packaged and sold in small metal or glass containers.[1]

Dry Snuff

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
Dry Snuff (5), United States	5.71–6.25	14.9–20.2	0.07–0.30	1,340–14,600	6,120–31,300	47–1,050	10,300–76,500
Dry Snuff (1), United States	5.41–7.96	4.70–24.84	0.03–3.13	—	—	—	—

*Dry snuff products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Sources: Lawler et al. 2013 (5); International Agency for Research on Cancer 2007, table 6 (1).

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For additional information on dry snuff, please refer to the following chapters: Chapter 9: Smokeless Tobacco Use in the Region of the Americas, and Chapter 12: Smokeless Tobacco Use in the African Region.

Gudakhu

Photo courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinha

Gudakhu (also spelled gudahku) is a paste-like product that is made from fine tobacco leaf dust and molasses (called *sheera*), red soil, and lime.[1,2] Gudakhu is predominantly used in India in the states of Bihar, Orissa, Uttar Pradesh, and Uttaranchal.[2] It may be used to clean teeth.[3,4]

Common Names
None

Brand Names
Natraj

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India[4]

Prevalence and Demographics
No recent information was located specifically on the use of gudakhu. Gudakhu is mainly used by women. Survey data from the 1970s found that 1% of men and 16% of women in eastern India (Jharkhand) used gudakhu.[2,4] In 2009–2010, 4.7% of all adults (3.3% of males and 6.3% of females) in India reported use of tobacco products that are applied to the teeth and gums, including gudakhu, snuff, mishri, or gul.[5]

Mode of Absorption
Oral (applied to teeth and gums, held in mouth)

Use Pattern
Gudakhu can be rubbed on the teeth and gums with a fingertip and may be left in the mouth. It is an addictive substance, with some people using it up to 20 times per day.[1]

Main Ingredients
Tobacco powder, molasses, red soil, lime, water[1,4]

Processing/Manufacturing
Commercial and custom-made: Gudakhu is available commercially, but can also be made by individuals for personal use. It can come in different types of packaging (both branded and unbranded) and is frequently carried in a metal container.[2] Additional information on manufacturing of gudakhu could not be located.

Chemical Measurements
No data available

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Gul

Gul is a pyrolysed (burned and decomposed), powdered tobacco product that is marketed in small tin cans or sachets under several different brand names. It is used as a dentifrice in India.[1]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
None

Brand Names
Shajadi Gul, Mujamal Hussain Musarraf Bahi Shahi Eagle, Md. Mustafa Asgar Ali Gul (Bangladesh), Chand, Tara Marka, and Gulbadan (India)

Main Geographic Locations (WHO Region: Country)
South-East Asia Region: India, Bangladesh[1]

Prevalence and Demographics
In 2009, 5.3% of adults (5.5% of males and 5.1% of females) in Bangladesh reported using gul.[2] In India, gul is popular among women,[3,4] and in 2004, 2–6% of adolescents in various regions of India reported using it.[5] There are no recent nationally representative statistics on the prevalence of gul use in India. In 2009–2010, 4.7% of all adults in India (3.3% of males and 6.3% of females) reported using oral tobacco, including gul, snuff, mishri, or gudakhu.[4]

Mode of Absorption
Oral (teeth cleaning, applied to teeth and gums)

Use Patterns
Gul is usually used to clean teeth. It is addictive and may be used several times a day.[1,3]

Main Ingredients
Pyrolysed (burned and decomposed) tobacco leaves, molasses, other unknown ingredients[3,6]

Processing/Manufacturing
Commercial: Gul is commercially manufactured[3] and sold in small tin cans.[6] Additional information on manufacturing of gul could not be located.

Gul

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
Gul Powder, Bangladesh	8.79–9.22	33.4–34.1	29.1–31.0	1,330–1,370	5,190–8,020	590–630	13,400–17,100

*Gul products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (7).

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For additional information on gul, please refer to Chapter 13: Smokeless Tobacco Use in the South-East Asia Region.

Gutka

(Pan Masala with Tobacco)

Gutka, or gutkha, is a dry, granular tobacco that is a commercially manufactured version of paan or betel quid with tobacco.[1] Unlike paan, gutka is relatively nonperishable and packaged in small single-use packets that are easy to carry and use "anytime, anywhere."[2] Advertising of tobacco products on radio and TV has been banned in India since 2004; however, pan masala, an identical product without tobacco but the same brand names, can be advertised, and these ads are often targeted at youth.[1] As of October 2013, almost all states and union territories in India have banned gutka, although it is unclear how well these bans will be enforced.[3,4]

Photo courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinha

Common Names

Pan masala. (The terms gutka and pan masala are sometimes used interchangeably, but gutka usually refers to the product with tobacco, and pan masala is the same product without tobacco.[5])

Brand Names

Manikchand, Moolchand, Tulsi, Shimla, Sikandar, Pan Parag, RMD, Sir, Shikhar, Dandia, Kuber, Wiz, Kesar, Club Class, Goa, Shanti Strong, Vimal, Zee, Mehak Silver, Silver, Kanchan

Packaging of some brands of gutka is often identical to packaging of pan masala (which does not contain tobacco), and companies may be using this identical packaging to circumvent India's 2004 ban on tobacco advertising.[1]

Main Geographic Locations (WHO Region: Country)

South-East Asia Region: India, Bangladesh, Nepal, Myanmar, Sri Lanka[2,6]; **Eastern Mediterranean Region:** Pakistan[5]

Prevalence and Demographics

In 2009–2010, 8.2% of all individuals in India aged 15 years and older (13.1% of males and 2.9% of females) reported chewing gutka.[5] Use of gutka is common among youth and young adults.[1,5,7,8] A number of surveys conducted in India have shown that pan masala and gutka are commonly chewed by children and adolescents.[5,9] Product-specific prevalence data are not available for the other countries where gutka is used.

Mode of Absorption

Oral (chewed, held in mouth)

Use Patterns

Gutka is held in the mouth and chewed. Saliva is generally spit out, but it is also sometimes swallowed.[6] These products are commonly used throughout the day.

Main Ingredients

Tobacco, areca nut, slaked lime (calcium hydroxide), catechu, and other condiments, sweeteners, and flavorings[6]

Processing/Manufacturing

Commercial and cottage industry: Gutka is generally commercially manufactured as a dry, relatively nonperishable preparation.[1] Gutka can also be a premade cottage product[10] that is packaged in nontraditional packaging (i.e., cellophane). Gutka is made from powdered tobacco, areca nut, lime, and catechu, with other condiments and sweeteners added for flavor.[2] Manufactured gutka is sold in small, brightly colored plastic and paper packets (sachets); plastic sachets were banned in India in March 2011.[11]

Gutka

(Pan Masala with Tobacco)

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Gutka,† Pakistan	8.20–8.54	0.16–2.08	0.12–1.08	11.6–208	45.4–913	7.02–53.5	83.9–1,560
Gutka,‡ India	8.46–8.88	1.09–2.33	0.86–1.78	57.1–456	167–1,280	23.2–258	370–2,250
Gutka,§ India	7.43–8.61	0.91–4.20	0.19–3.33	7.1–375	154–18,600	10.8–1,030	264–23,900

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown) and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
†These gutka products were manufactured both commercially and by cottage industry.
‡These gutka products were commercially manufactured.
§These gutka products were manufactured by cottage industry.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (10).

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For additional information on gutka, please refer to the following chapters: Chapter 10: Smokeless Tobacco Use in the European Region, and Chapter 13: Smokeless Tobacco Use in the South-East Asia Region.

Iqmik

Iqmik is a homemade chewing tobacco that consists of tobacco leaves combined with ash from burnt tree fungus or wood.[1,2,3] Iqmik is commonly used by Alaska Native people, particularly the Yup'ik and Cup'ik Eskimo people in western Alaska.[2,4] In contrast to American Indian customs, tobacco use does not have a spiritual significance for Alaska Natives.[1,2] Rather, it is a relatively recent phenomenon, dating back only about 150 years in Alaska, although tobacco use among other indigenous populations in North America dates back at least 2,000 years.[2,3] Some people in the Yukon–Kuskokwim region consider iqmik a healthier alternative to smoking tobacco because its ingredients are perceived as "natural."[1,2]

Photo courtesy of Caroline Renner, Alaska Native Medical Center

Common Names
Blackbull, dediguss

Brand Names
None

Main Geographic Location (WHO Region: Country)
Region of the Americas: United States (Alaska)[5]

Prevalence and Demographics
Iqmik is used by Alaska Natives, including youth of all ages.[1,2] Iqmik is used in western Alaska, although there are reports of similar smokeless tobacco mixtures being used by indigenous populations in Western Siberia, Yukon, Labrador, British Columbia Coast, and Nova Scotia.[2,4] Data from the 2004 to 2007 Behavioral Risk Factor Surveillance System (BRFSS) found that iqmik is used by 16% to 22% of Alaska Native adults in the western region of the state.[6,7] It has also been reported that iqmik is often used by pregnant women in western Alaska.[4]

Mode of Absorption
Oral (chewed)

Use Pattern
Users may pre-chew the iqmik and place it in a small box for later use by the maker or to share with others, including elders, children, and infants. Iqmik is believed by some to relieve babies' teething pain.[1,5]

Main Ingredients
Tobacco, tree fungus ash (also known as punk, araq, or buluq ash) or other ash derived from burning driftwood, alder bush, or willow bush; these woods are used because there are few trees along the coast of western Alaska.[2,4]

Processing/Manufacturing
Custom-made: Although the ingredients are available at grocery stores and retail outlets, iqmik is always prepared by the individual user or a family or community member to share. Fire- or air-cured tobacco leaves are mixed with punk fungus ash, which is generated by burning a woody fungus that grows on birch trees, or other woody ash if punk ash is unavailable.[1,2,5] The mixture can be prepared in several ways: by pre-chewing, stirring in a bowl with water, or even using a modern blender.[1,4] Iqmik is often stored in a commercial smokeless tobacco box or a small plastic container.[2,4]

Iqmik

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for the prepared iqmik. The amount absorbed will depend on the amount of product used.

Product Type	pH*	Total Nicotine mg/g wet wt	Free Nicotine mg/g wet wt	NNK ng/g wet wt	NNN ng/g wet wt	NNAL ng/g wet wt	Total TSNAs† ng/g wet wt
Iqmik with Air-Cured Tobacco,‡ United States (Alaska)	11.0	38.3	38.3	209	2,995	61	7,238
Iqmik with Fire-Cured Tobacco,‡ United States (Alaska)	11.0	38.9	38.9	473	2,400	11	7,191

*pH of the prepared ash/tobacco iqmik mixture; both willow and punk ash are pH 11.0.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
‡Cured tobacco includes the average of twist and leaf tobacco.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Hearn et al. 2013 (8).

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For additional information on iqmik, please refer to Chapter 9: Smokeless Tobacco Use in the Region of the Americas.

Khaini

Khaini (or khoinee in Bangladesh) is a flaky product made of sun-dried tobacco and slaked lime. Lime is often added to the tobacco just before use.[1] Khaini is used in India, Nepal, and Bangladesh.[2]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
Chada, chadha, sada, surti (in Nepal and neighboring parts of India)

Brand Names
Raja, Kuber, Wiz, Buddha Lal, Chaini, Raja Chap, Ansul Tobacco, Mirage, Ganesh Tobacco 701, Patta Chhap Tej Tobacco

Main Geographic Locations (WHO Region: Country)
South-East Asia Region: India, Bangladesh, Nepal, Bhutan[2]

Prevalence and Demographics
Among adults in India, khaini is the most commonly used type of smokeless tobacco. In 2009–2010, 11.6% of the Indian population over age 15 (18% of males and 4.7% of females) used khaini.[3] In 2009, in Bangladesh, 1.5% of all adults (1.9% of males and 1.2% of females) used khaini.[4] Product-specific prevalence rates were not available for the other countries where khaini is used.

Mode of Absorption
Oral (sucked, chewed, held in mouth)

Use Pattern
People may use khaini from 3 to 30 times a day. A regular khaini user may carry a double-ended metal container, one side of which is filled with sun-dried tobacco and the other slightly moistened slaked lime.[1,5]

Main Ingredients
Tobacco leaves, slaked lime (calcium hydroxide), and sometimes areca nut[2,6]

Processing/Manufacturing
Custom-made, cottage industry, and commercial: Khaini is usually prepared by the individual user from basic ingredients at the time of use, but commercially manufactured khaini is also available. To prepare khaini, users will use their thumbs to vigorously mix a small amount of dried tobacco leaves and slaked lime paste in the palm of the hand. Areca nut is sometimes added.[2] Additional information on the commercial manufacturing of khaini could not be located.

Khaini

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Khaini,† India	9.65–9.79	2.53–4.79	2.48–4.68	288–502	16,800–17,500	1,350–1,400	21,600–23,500

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
†All khaini products were commercially manufactured.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (6).

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For additional information on khaini, please refer to the following chapters: Chapter 10: Smokeless Tobacco Use in the European Region, and Chapter 13: Smokeless Tobacco Use in the South-East Asia Region.

Kiwam

Kiwam (also spelled qiwam, qimam, khiwam, kimam) is a tobacco paste that is made from boiled and flavored tobacco leaves. The paste may be formed into granules or pellets. Kiwam is frequently used as the tobacco ingredient in betel quid (paan).[1,2,3,4]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
None

Brand Names
Avon, Kashmiri, Nauratan, Raj Ratan, Pradip

Main Geographic Locations (WHO Region: Country)
South-East Asia Region: India, Bangladesh, Nepal[1,2]; **Eastern Mediterranean Region:** Pakistan[3]

Prevalence and Demographics
No data are available on the prevalence of kiwam use. In 2004, it was reported that kiwam is used among upper socioeconomic groups in India and Bangladesh.[1]

Mode of Absorption
Oral (chewed, held in mouth, chewed in betel quid)

Use Pattern
Kiwam may be used alone or inserted into a betel quid and chewed.[2] Additional information on patterns of kiwam use could not be located.

Main Ingredients
Tobacco, spices (cardamom, saffron, and/or aniseed), additives such as musk[1,2]

Processing/Manufacturing
Commercial: Kiwam is commercially manufactured. The stalks, stems, and veins of tobacco leaves are removed, and then the remaining leaves are boiled, soaked in water, and flavored with powdered spices and other additives.[1] Once the tobacco has softened and broken down, the resulting pulp is mashed, strained, and dried into a paste.[2] Kiwam may be sold as a paste or in granule or pellet form.[1,3]

Kiwam

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Kiwam,† India	—	—	—	100–1,030	2,500–8,950	160–1,860	5,430–22,200

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
†All kiwam products are commercially manufactured.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Tricker and Preussmann 1989 (5) (more recent data was not available).

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Loose Leaf Chew

Three types of chewing tobacco are used in North America: loose leaf, plug, and twist. Although loose leaf is the most common form in the United States, the use of chewing tobacco has declined over the past few decades and is now uncommon.[1,2]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
Chew, chaw, chewing tobacco, spit tobacco

Brand Names
Red Man, Granger, J.D.'s Blend *(Swedish Match North America)*; Levi Garrett, Morgan's, Taylor's Pride *(American Snuff Company)*; Beech-Nut, Our Pride, Stoker *(National Tobacco Company)*; Mail Pouch, Chattanooga Chew, Lancaster *(Swisher International)*

Main Geographic Location (WHO Region: Country)
Region of the Americas: United States[1]

Prevalence and Demographics
Product-specific prevalence rates are not available for any countries where loose leaf chew is used. In the United States, chewing tobaccos are primarily used by men and are more common in rural areas and the South and Midwest.[2] In 2012, the U.S. prevalence of past-month smokeless tobacco use (including loose leaf tobacco, snuff, and other smokeless products) for those aged 12 years and older was 3.6% (7.1% of males and 0.4% of females).[3] Although there are no statistics specifically on the prevalence of loose leaf tobacco use, sales of loose leaf chew represent 19.7% of smokeless tobacco sales in the United States.[4]

Mode of Absorption
Oral (chewed, sucked, held in mouth)

Use Patterns
A piece of tobacco 0.75 to 1 inch in diameter is either chewed or held in place. Saliva is usually spit out, but it can also be swallowed.[1]

Main Ingredients
Leaf tobacco, sugar, and/or licorice[1,5]

Processing/Manufacturing
Commercial: Loose leaf chew is commercially manufactured and usually sold in pouches. To manufacture loose leaf chew, loose cigar tobacco leaves are air-cured, stemmed, and cut or granulated to form small strips of shredded tobacco. Most brands are sweetened and flavored with sugar and licorice, accounting for loose leaf tobacco's high average sugar content (approximately 35% of its weight is sugar).[1,5]

Loose Leaf Chew

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
Loose Leaf (6), United States	5.64–5.98	4.87–7.04	0.03–0.06	238–306	942–2,830	20–90	1,550–4,100
Loose Leaf (1), United States	5.64–6.76	3.41–8.99	0.02–0.47	—	—	—	—

*All loose leaf products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Sources: Lawler et al. 2013 (6); International Agency for Research on Cancer 2007, table 5 (1).

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For additional information on loose leaf chew, please refer to Chapter 9: Smokeless Tobacco Use in the Region of the Americas.

Mainpuri

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Mainpuri is a mixture of tobacco, finely chopped areca nut, slaked lime, cloves, and camphor.[1,2,3] It has a short shelf life and is mainly sold in the northern part of India in the Mainpuri district and nearby areas.[1] Mainpuri was also sold in neighboring Pakistan, although it was banned in 2011.

Common Names
Kapoori

Brand Names
None

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India (Uttar Pradesh)[2]

Prevalence and Demographics
Mainpuri is a very popular tobacco preparation in the Mainpuri district and surrounding areas of Uttar Pradesh.[5] Recent data on the prevalence of mainpuri tobacco use in Uttar Pradesh or in India nationally are not available.

Mode of Absorption
Oral (chewed, chewed in betel quid, held in mouth)

Use Patterns
No information is available on use patterns.

Main Ingredients
Tobacco, slaked lime (calcium hydroxide), areca nut, camphor, cloves[1,2]

Processing/Manufacturing
Cottage industry and custom-made: Mainpuri is manufactured by small cottage industries and prepared by individual vendors for sale. It is prepared by thoroughly mixing together tobacco, slaked lime, finely cut areca nut, and powdered camphor and cloves.[3] Additional information on the preparation of mainpuri could not be located.

Mainpuri

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Mainpuri, Pakistan	7.65	1.28	0.38	6.05	106	25.9	219

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (4).

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Mawa

Mawa is a mixture of finely chopped ingredients consisting of areca nut shavings, slaked lime, and crushed sun-cured tobacco.[1,2] It is about 95% areca nut by weight and is used in South Asia.[1,3]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
None

Brand Names
None

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India[1]

Prevalence and Demographics
Mawa is popular among men and young people, particularly in Gujarat, India.[1,3] Between the 1970s and the 1990s, mawa chewing increased considerably in the Bhavnagar district and adjoining areas in Gujarat, particularly among young people. One survey in 1998 in this district found that 18.9% of men and 0.1% of women used mawa.[4] A study conducted in 2007–2008 in urban Jamnagar, Gujarat, found that approximately 21% of people aged 13 and older chewed mawa.[5] National data on the prevalence of mawa use in India are not available.

Mode of Absorption
Oral (chewed)

Use Pattern
Mawa is chewed for about 10 to 20 minutes[1] and may be used as many as 5 to 25 times per day.[3]

Main Ingredients
Tobacco, slaked lime, and areca nut[1]

Processing/Manufacturing
Cottage industry and custom-made: Mawa is prepared by individual vendors for sale or is homemade by individual users. The process of making mawa consists of sprinkling small pieces of sun-cured areca nut with slaked lime and adding tobacco flakes. The mixture is rubbed together to combine the ingredients. Mawa is about 95% areca nut by weight and is sold in cellophane wrappers.[3]

Mawa

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Mawa,† Pakistan	8.31	0.16	0.11	4.47	65.5	3.98	96

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
†Data is given for custom-made mawa.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (6).

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For additional information on mawa, please refer to Chapter 13: Smokeless Tobacco Use in the South-East Asia Region.

Mishri

Mishri (also known as masherior or misheri) is a dry, powdered tobacco product that is usually homemade or prepared by a vendor. Mishri is commonly believed to clean teeth.[1]

Photo courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinha

Common Names
None

Brand Names
None

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India[2,3]

Prevalence and Demographics
Mishri is predominantly used by women and is more common among lower socioeconomic groups.[4] Many users begin using mishri as children. While there are no national data or recent prevalence estimates, various studies of different regions from the 1970s to the present have estimated that mishri use in India has ranged between 17% and 44% of women and between 1% and 23% of men.[3,5,6,7] In 2009–2010, 5% of all individuals aged 15 years and over (3.3% of males and 6.3% of females) in India consumed oral tobacco including mishri, snuff, gul, or gudakhu.[8]

Mode of Absorption
Oral (sucked, applied to teeth and gums, teeth cleaning)[1]

Use Pattern
Mishri is rubbed on the teeth and gums, often for the purpose of cleaning the teeth. It is generally used twice a day, but users who become addicted may apply it more frequently or hold it in their mouths.[1,3,4]

Main Ingredients
Tobacco[1]

Processing/Manufacturing
Custom-made and cottage industry: Mishri is usually prepared at home by individual users, but it can also be prepared by vendors for sale and bought in the market under various names.[5] No other ingredients besides tobacco are used in the preparation of mishri. Tobacco is baked on a hot metal plate until it is toasted or partially burnt and is uniformly black. It is then powdered.[1]

Mishri

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine (9)	Free Nicotine (9)	NNK (10)	NNN (10)	NNAL	Total TSNAs
		mg/g wet wt		ng/g wet wt			
Mishri,* India	6.54	2.73	0.09	4,210	870	—	—

*Chemical measurements from both sources are for Shahin mishri.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Sources: Gupta and Sreevidya 2004 (9); Stepanov et al. 2005 (10).

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For additional information on mishri, please refer to Chapter 13: Smokeless Tobacco Use in the South-East Asia Region.

Moist Snuff
(Dip)

Moist snuff is a damp, finely ground tobacco product that is more commonly used in Western countries than elsewhere. Moist snuff, also referred to as dip, is the most common form of smokeless tobacco in the United States and Canada.[1,2] This factsheet only describes commercial moist snuff. Other types of moist snuff are used in many countries around the world.

Common Names
Dip, spit tobacco (sometimes called "chew," even though it is not chewing tobacco)

Brand Names
Copenhagen, Skoal, Red Seal, Husky *(U.S. Smokeless Tobacco Company)*, Grizzly, Kodiak *(American Snuff Company)*, Kayak, Redwood, Gold River, Silver Creek, Cooper, Silverado *(Swisher International)*, Red Man, Timber Wolf, Longhorn *(Swedish Match)*

Main Geographic Locations (WHO Region: Country)
Region of the Americas: United States, Canada,[1,2] Mexico[3]; **African Region:** South Africa[1,4]

Prevalence and Demographics
Moist snuff is the most commonly used form of smokeless tobacco in the United States, Canada, and Mexico.[1,2,3] In the United States, it is primarily used by young adult white men living in the South.[5] Although no statistics specifically on the prevalence of moist snuff use are available, sales of moist snuff represented 78.2% of U.S. smokeless tobacco sales in 2010.[6] The prevalence of smokeless tobacco use in the United States in 2012 was 3.6% among people age 12 and older (7.1% of males and 0.4% of females).[7] In Canada, smokeless tobacco use is low—1% of adult men use any type of smokeless tobacco[8]—and sales of moist snuff make up more than 80% of all smokeless tobacco sales.[2]

Mode of Absorption
Oral (held in mouth, sucked)

Use Pattern
Moist snuff is commonly used loose, but can also come in small, ready-to-use pouches. It is usually held in the mouth for about 30 minutes. Saliva is usually spit out, but it can be swallowed.[1]

Main Ingredients
Tobacco, flavorings, inorganic salts, humectants[1]

Processing/Manufacturing
Commercial: Moist snuff is commercially manufactured. Tobacco leaf, stems, and seeds are air- and/or fire-cured, then processed into fine particles ("fine cut") or strips ("long cut").[1] This process ferments the tobacco, which produces more cancer-causing nitrosamines than snus manufacturing[9] (snus is often considered a different type of moist snuff). Moist snuff has a moisture content of roughly 20–60% by weight and is available in a variety of flavors, such as mint and fruit flavors. The tobacco is usually sold loose, but can also be packaged in small, tea bag–like pouches called sachets.[1]

Moist Snuff
(Dip)

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
Moist Snuff (10), United States	5.54–8.62	4.42–25.03	0.01–7.81	382–9,950	2,204–42,554	21–1,412	4,874–90,024
Moist Snuff (1), United States	5.49–8.38	7.06–24.29	0.03–8.57	—	—	—	—

*Moist snuff products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Sources: Richter et al. 2008 (10); International Agency for Research on Cancer 2007, table 7 (1).

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For additional information on moist snuff, please refer to the following chapters: Chapter 9: Smokeless Tobacco Use in the Region of the Americas, and Chapter 12: Smokeless Tobacco Use in the African Region.

Nass

Nass (also known as naswar) is a multinational product made of locally grown tobacco, oil, an alkaline modifier such as ash or slaked lime, and other ingredients according to regional preference.[1,2] Nass/nasway is one of the most common types of smokeless tobacco used in Pakistan, the United Arab Emirates, Uzbekistan, and Kyrgyzstan.[1,3] In Uzbekistan and Kyrgyzstan, a product known as nasway contains the same main ingredients as nass. Although there is insufficient published information to determine if nass and nasway are the same product, for the purposes of this factsheet, they are assumed to be essentially the same.

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
Naswar (Pakistan); niswar (United Arab Emirates); nass (Iran); nasway, nasvay (Kyrgyzstan, Uzbekistan)

Brand Names
None

Main Geographic Locations (WHO Region: Country)
Eastern Mediterranean Region: Pakistan, Iran, Afghanistan, United Arab Emirates[1,4]; **African Region:** South Africa[1,4]; **European Region:** Turkmenistan, Kyrgyzstan, Uzbekistan[5,6]

Prevalence and Demographics
In Kyrgyzstan, according to a 2011 World Health Organization report, 3.4% of all adults (7.0% of men and 0.3% of women) use nasvay.[5] In Uzbekistan, in a 2002 survey of adults between the ages of 15 and 60, only 0.4% of women reported ever using nasway in their lifetime, compared to 37.9% of men. Thus, among men in Uzbekistan, using nasway is as common as cigarette smoking.[7] Studies in Turkmenistan in 1993 reported that 12% of adults used nass.[6]

Mode of Absorption
Oral (chewed, sucked, held in mouth)

Use Pattern
Nass is usually rolled into a ball and placed under the tongue or in the cheek.[1,4,8] It is held in the mouth and sucked for 10 to 15 minutes or may be chewed slowly.[2]

Main Ingredients
Nass: tobacco, ash, cotton or sesame oil, water, and sometimes lime or gum[2,9]
Naswar, niswar, nasway: tobacco, slaked lime (calcium hydroxide), ash, oil or butter, indigo or other coloring agent, water, and sometimes flavorings such as cardamom and menthol[1,2,4,7,8,9]

Processing/Manufacturing
Cottage industry and custom-made: Nass may be made domestically by individual users or prepared by local, small-scale cottage manufacturers.[4,9] Sun- and heat-dried tobacco leaves (often *N. rustica*), slaked lime, ash from tree bark, flavorings (e.g., cardamom and menthol), and coloring agents (e.g., indigo) are mixed together with a heavy wooden mallet. Water is added and the mixture is usually rolled into balls.[1,4] The product is then packed into small polyethylene bags for sale.[4]

Nass

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Naswar,† Pakistan	8.76–9.14	10.5–14.2	8.84–13.2	29.4–309	363–545	8.6–104	478–1,380
Nasway,† Uzbekistan	8.43	8.89	6.36	88.3	628	10.5	1,100

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
†Naswar/nasway products were produced by cottage industry.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (10).

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For additional information on nass/nasway, please refer to the following chapters: Chapter 10: Smokeless Tobacco Use in the European Region, and Chapter 11: Smokeless Tobacco Use in the Eastern Mediterranean Region.

Plug

Plug, one of three types of chewing tobacco sold in North America, is considered the oldest form of chewing tobacco. Plug tobacco is sweetened with sugar and licorice and pressed into a brick shape. It is sold as either "moist" or "firm" depending on the amount of moisture in the product.[1]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
Chew, chaw, chewing tobacco, spit tobacco

Brand Names
Red Man, Days Work, Apple, Brown, Natural Leaf, Union Standard, Tinsley, WNT (*Swedish Match North America*), Levi Garrett, Taylors Pride, Cannon Ball (*American Snuff Company*)

Main Geographic Location (WHO Region: Country)
Region of the Americas: United States[1]

Prevalence and Demographics
Chewing tobaccos are primarily used by men and are more commonly used in rural areas and in the Southern and Midwestern United States.[2] Plug use has declined over the past century and is rare today in most regions of the United States.[1] Although there are no recent statistics specifically on the prevalence of plug use, in 2010 sales of plug represented only 0.5% of all smokeless tobacco sales in the United States.[3]

Mode of Absorption
Oral (chewed, sucked, held in mouth)

Use Pattern
A piece of plug is cut off and chewed or held between the cheek and gum. Saliva is usually spit out, but it can also be swallowed.[1]

Main Ingredients
Burley and bright tobacco or cigar tobacco leaves, licorice, and sugar[1]

Processing/Manufacturing
Commercial: Plug is commercially manufactured. Heavier grades of tobacco leaves are picked from the top of the plant and stems are removed. The tobacco is immersed in a mixture of licorice and sugar, pressed into a plug, wrapped in fine tobacco leaves, and pressed into bricks or flat blocks. Moist plug tobacco has at least 15% moisture by weight, whereas firm plug has less than 15% moisture. Plug also has a high average sugar content (approximately 25% of its weight).[1]

Plug

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
Plug (4), United States	5.10–5.95	5.12–15.1	0.01–0.04	340–941	2,920–5,140	11–188	4,090–7,750
Plug (1), United States	5.07–5.95	6.18–20.43	0.02–0.08	—	—	—	—

*All loose leaf products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Sources: Lawler et al. 2013 (4); International Agency for Research on Cancer 2007, table 5 (1).

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Rapé

Rapé is a type of dry snuff used in Brazil. Aboriginal groups may mix it with ashes from particular trees and use it for medicinal purposes.[1] Rapé is usually inhaled through the nose.

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
None

Commercial Names
Moeda, Caratinga, Guarany

Main Geographic Location (WHO Region: Country)
Region of the Americas: Brazil[1]

Prevalence and Demographics
Published information on rapé is limited, and data on the prevalence of rapé use are not available. The 2001 Brazilian Global Adult Tobacco Survey found that about 0.4% of adults aged 15 years and older use any type of smokeless tobacco.[2] Anecdotal evidence suggests that rapé is primarily used in rural areas and small towns, or by aboriginals in the Amazon rainforest, where its use has cultural significance.

Mode of Absorption
Nasal

Use Pattern
Rapé is inhaled through the nose. Some aboriginal groups prepare their own rapé. The Kaxinawás Indians from Acre in Brazil prepare a half portion of rapé and half portion of ashes from wood, usually from the paricá tree (*Schizolobium amazonicum*). They consume rapé by having one person use a large "V"-shaped straw to blow the dust into their partner's nose. They may use it for medicinal purposes.[1]

Main Ingredients
Dried tobacco leaf, flavorings such as tonka bean (*Dipteryx odorata*), clove, cinnamon powder, and camphor, and in some cases, ashes from select trees

Processing/Manufacturing
Cottage industry and custom-made: Rapé is produced locally on small farms, in small tobacco industries, or by Indians. The dried tobacco leaf is ground and carefully toasted. Rapé is sometimes toasted with other ingredients such as spices, herbs, and ashes, and the toasted product is then sifted into a very fine dust.

Chemical Measurements
No data available

References

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For additional information on rapé, please refer to Chapter 9: Smokeless Tobacco Use in the Region of the Americas.

Red Toothpowder

Red toothpowder contains finely powdered tobacco, herbs, flavoring agents, and other ingredients.[1] It is red in color and is usually used in India to clean teeth.[1,2] In 1992, India banned the use of tobacco as an ingredient in dental products.[2,3] Brands of red toothpowder have stopped listing tobacco as an ingredient, but lab results show that some still contain tobacco and measureable amounts of nicotine.[2,3,4,5]

Photo courtesy of World Health Organization South-East Asia Regional Office and Dhirendra N. Sinha

Common Names
Lal dant manjan

Brand Names
Dabur, Baidhyanath

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India[1,2]

Prevalence and Demographics
Red toothpowder is used by men and women of all ages, as well as children.[2] There are no national statistics on the prevalence of use of red toothpowder by adults. The 2004 Global Youth Tobacco Survey, which surveys school students aged 13–15 years, found that reported prevalence of red toothpowder use ranged from 2% to 49% across various regions in India.[3]

Mode of Absorption
Oral (teeth cleaning)

Use Patterns
Red toothpowder is used to clean teeth (as a dentifrice).[1,2]

Main Ingredients
Fine red tobacco powder, herbs, flavorings.[1] Additional plant-related ingredients such as ginger, pepper, and camphor, among others, may be used.[6,7]

Processing/Manufacturing
Commercial: Red toothpowder is commercially manufactured and is often marketed as an herbal dental care product.[1] Additional information on the manufacturing of red toothpowder is not available.

Red Toothpowder

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Red Toothpowder,† India	5.75–6.71	4.47–5.09	0.03–0.21	—	—	—	—

*Study did not measure NNK, NNN, or NNAL TSNAs.
†All red toothpowder products were commercially manufactured.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Gupta and Sreevidya 2004 (5).

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Shammah

Shammah is a multinational smokeless tobacco product in powder or paste form, which can be either greenish-yellow ("white" shammah) or brownish-black ("black" shammah). It is made from powdered tobacco, slaked lime, ash, and black pepper and mainly used in Yemen, Saudi Arabia, and Algeria.[1]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
El-Shama, bajeli, haradi, sharaci, black shammah (Yemen); al-shammah (Saudi Arabia); chemma (Algeria)

Brand Names
None

Main Geographic Locations (WHO Region: Country)
Eastern Mediterranean Region: Saudi Arabia, Yemen[1,2,3]; **African Region:** Algeria[1,4]

Prevalence and Demographics
In Yemen in 2003, 10.7% of the population aged 10 years and older used shammah (15.1% of males and 6.2% of females).[2] Shammah was used by males and females of all ages, including adolescents. Shammah use increases with age and is more common in rural than urban areas.[2] In Algeria, shammah (or chemma) is commonly consumed by men across all social groups.[4] Information on prevalence of shammah use in Algeria and Saudi Arabia is not available.

Mode of Absorption
Oral (sucked, held in mouth)

Use Pattern
Shammah is placed between the gum and lower lip or cheek.[1,2] In Algeria, users may wrap shammah in paper before putting it in the mouth.[4]

Main Ingredients
Tobacco, slaked lime, ash, black pepper, oil, flavorings, bombosa (sodium carbonate)[1,2]

Processing/Manufacturing
Cottage industry and custom-made: Shammah is usually prepared by small cottage industries or by local individual vendors for sale. The tobacco leaves are sun dried, pulverized with bombosa (sodium carbonate), and combined with other ingredients such as slaked lime, ash, black pepper, oil, and other flavorings. Shammah can be sold as a wet or dry product. To prepare wet shammah, such as black shammah, a water solution of bombosa is used rather than the dry powder alone.

Shammah

Chemical Measurements

No data available

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For additional information on shammah, please refer to the following chapters: Chapter 11: Smokeless Tobacco Use in the Eastern Mediterranean Region, and Chapter 12: Smokeless Tobacco Use in the African Region.

Snus

Snus is a traditional Swedish smokeless tobacco product. It is made from moist, finely ground tobacco and usually contains lower levels of tobacco-specific *N*-nitrosamines (TSNAs) than most oral tobacco products because it is pasteurized rather than fermented.[1,2] Although the use of snus is spreading to other regions of the world, in 1992 the sale of snus was banned in all countries in the European Union (EU) except Sweden.[2]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
None

Brand Names
General, Catch, Ettan, Grovsnus, Göteborgs Rapé, Kronan *(Swedish Match)*; Lucky Strike, Pall Mall, du Maurier *(British American Tobacco)*; Camel *(R.J. Reynolds)*; Marlboro *(Philip Morris)*; Skoal *(U.S. Smokeless Tobacco Company)*; Knox, Skruf *(Imperial Tobacco)*, Tobaccorette

Main Geographic Locations (WHO Region: Country)
European Region: Sweden, Norway, Iceland, Finland, Denmark[3,4]; **Region of the Americas:** United States, Canada, Brazil[3]; **African Region:** South Africa[5]

Prevalence and Demographics
In Sweden in 2009, the prevalence of daily snus use among adults aged 16 years and older was 19% for males and 4% for females.[6] In Norway, which is not a member of the EU and therefore can legally sell snus, the prevalence of daily use in 2009 was 6% among adults aged 16 years and older (11% of males and 1% of females).[4] In 2010, 5.1% of U.S. adults aged 18 years and older had ever tried snus (8.5% of males and 2% of females), yet less than 1% currently used snus.[7] There is little information on prevalence of use in most of the other countries where snus is available. Although snus has been used in Europe's Nordic region for many years, it was only introduced relatively recently into the North American and South African markets, and therefore the prevalence of snus use may increase in these regions as this product becomes more widely available.[5,7]

Mode of Absorption
Oral (held in mouth)

Use Patterns
Snus can either be packaged into small, ready-to-use sachets or sold in loose tobacco form. One portion of snus is usually held in the mouth for 30 minutes or more and does not require chewing, sucking, or spitting. In Sweden the average user keeps snus in their mouth for 11 to 14 hours per day.[3]

Main Ingredients
Tobacco, moisturizers, sodium carbonate, salt (sodium chloride), sweeteners, flavorings[3,8]

Processing/Manufacturing
Commercial: Snus is commercially manufactured, but processing and manufacturing vary across regions and countries. In Sweden, finely ground air-cured tobacco is mixed with salts, water, and flavoring. Snus is similar to snuff, but snuff is fermented, which can increase the formation of TSNAs. Snus goes through a heat treatment process that pasteurizes the tobacco to kill off bacteria that aid in the formation of TSNAs.[2] During pre-sale storage, snus is kept cold to keep it "fresh" and to prevent more nitrosamines from forming.[9] However, variations in processing and manufacturing can produce variations in TSNAs.[3,8,9] Snus is either sold loose or portion packed in small tea bag-like pouches, or sachets. Snus comes in a variety of flavors.[3]

Snus

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs†
		mg/g wet wt		ng/g wet wt			
RJ Reynolds (10), United States	7.55–7.70	8.97–11.3	2.51–3.69	84–146	369–425	20–21	761–884
Swedish Match (8), Sweden	6.61–7.21	7.76–15.2	0.29–2.03	84.5–105	267–345	8.57–13.1	601–723
British American Tobacco (8), South Africa	6.48–7.02	13.4–17.2	0.47–1.19	171–275	925–1,440	18.6–30.4	1,720–2,700
Tobacco-rette (8), South Africa	6.56	15.0	0.49	1,340	2,950	84.2	5,850

*All snus products were commercially manufactured; manufacturer (associated products): RJ Reynolds (Camel snus); Swedish Match (General snus; Catch Peppermint snus); and British American Tobacco (Peter Stuyvesant snus; Lucky Strike snus).
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Sources: Stanfill et al. 2011 (8); Lawler et al. 2013 (10).

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For additional information on snus, please refer to the following chapters: Chapter 9: Smokeless Tobacco Use in the Region of the Americas; Chapter 10: Smokeless Tobacco Use in the European Region; and Chapter 12: Smokeless Tobacco Use in the African Region.

Tapkeer

Tapkeer (tapkir) is a form of dry powdered snuff that may be used for teeth cleaning. It is similar to other teeth-cleaning products such as mishri.[1]

Common Names
Bajjar (Gujarat, India)

Brand Names
None

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India[1]

Prevalence and Demographics
In Goa, Maharastra, Gujarat, and eastern India, tapkeer is widely used by people of lower socioeconomic status and is more commonly used by women than men.[1,2] Although there are no national or recent statistics specifically on tapkeer use, historical data indicate that 14% of women and 1% of men use tapkeer in Gujarat, India.[3] In 2009–2010, 4.7% of adults aged 15 and older (3.3% of males and 6.3% of females) reported using at least one type of applied oral tobacco product, including tapkeer, mishri, or gudakhu.[4]

Mode of Absorption
Oral (teeth cleaning, held in mouth), **Nasal**

Use Pattern
In India, tapkeer is rubbed on the teeth and gums to clean teeth. Because it is addictive, users tend to use it several times a day.[1,2]

Main Ingredients
Tobacco[1]

Processing/Manufacturing
Custom-made: In India, tapkeer is frequently prepared by individual users at home by roasting and then powdering the tobacco.[1]

Chemical Measurements
No data available

References

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Tobacco Leaf

Raw dried tobacco leaf may be chewed alone, but it is frequently used in betel quid in India, Bangladesh, and Myanmar.[1]

Common Names
Sada pata; chadha (Assam, India)

Brand Names
None

Main Geographic Locations (WHO Region: Country)
South-East Asia Region: India, Bangladesh, Myanmar, Bhutan[1,2]

Prevalence and Demographics
In Bangladesh in 2009, 1.8% of adults aged 15 and older chewed sada pata (plain tobacco flakes) alone (2% of males, 1.6% of females); this figure does not include adults who used tobacco leaf in betel quid.[3] National prevalence data on the use of tobacco leaf are not available for other countries. In Bangladesh and Myanmar, betel quid chewers of low socioeconomic status often put tobacco leaf in their quid.[1]

Mode of Absorption
Oral (chewed, chewed in betel quid or other custom-made product)

Use Pattern
In India, a regular user chews about a 15-cm piece of the tobacco leaf per day.[1]

Main Ingredients
Tobacco leaf[1]

Processing/Manufacturing
Custom-made: Raw tobacco leaf is usually dried and left unprocessed. It can be powdered, flaked, or sold in bundles of several long strands (about 115 cm long and 5 cm thick). A regular user consumes one 15-cm piece of the strand per day.[1]

Tobacco Leaf

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Tobacco Leaf, Bangladesh	5.92	19.7	0.15	21.7	165	24.5	574

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (4).

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For additional information on tobacco leaf, please refer to Chapter 13: Smokeless Tobacco Use in the South-East Asia Region.

Tobacco Water
(Tuibur)

Tobacco water (also known as tuibur) is tobacco smoke-infused water that is gargled or sipped. It is commonly used in northeastern India, and is called tuibur in Mizoram and hidakpha in Manipur. This product has been used since the 19th century.[1,2]

Common Names
Tuibur (Mizoram, India); hidakpha (Manipur, India)

Brand Names
None

Main Geographic Location (WHO Region: Country)
South-East Asia Region: India[3]

Prevalence and Demographics
In 2001, tuibur was used by 7.2% of adults aged 15 and older in the Aizawl district of Mizoram, and by 6.5% of adults in the Churachandpur district of Manipur.[4] The prevalence of use was similar among males and females.[1,2,4]

Mode of Absorption
Oral (gargled, held in mouth)

Use Pattern
Tuibur is either sipped from a bottle or through cotton soaked with tobacco water. It is retained in the mouth or gargled for 5 to 10 minutes before it is spit out. Although people may initially use tuibur to clean their teeth, many become addicted and will use the product up to 30 times per day.[2,4]

Main Ingredients
Tobacco smoke, water[2,3]

Processing/Manufacturing
Cottage industry and custom-made: Tuibur is produced by passing tobacco smoke through water and is sold in glass bottles.[1,4] Tuibur may be produced by small-scale industry or prepared at home for household use or sale.[4]

Chemical Measurements
No data available

References

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Tombol

Tombol is a mixture of tobacco and flavoring ingredients such as noura, slaked lime, areca nut, and catechu. It is used in Yemen and is very similar to betel quid (paan), which is used in southeast and western Asia.

Photo courtesy of Mazen Abood Bin Thabit, University of Aden

Common Names
None

Brand Names
None

Main Geographic Location (WHO Region: Country)
Eastern Mediterranean Region: Yemen

Prevalence and Demographics
No published information on the prevalence of tombol use is available.

Mode of Absorption
Oral (chewed, held in mouth)

Use Pattern
Tobacco and the other main ingredients are wrapped in a tombol leaf (betel leaf), placed in the mouth, and sucked and chewed. Powdered khat, a plant with psychoactive properties, may also be added.

Main Ingredients
Tobacco, areca nut (fofal), noura, slaked lime (calcium hydroxide), catechu (extract from the acacia tree), tombol leaf (betel leaf), and sometimes powdered khat (*Catha edulis*) or other flavoring ingredients.

Processing/Manufacturing
Custom-made: Tombol is prepared either by a vendor or by the user, who wraps the main ingredients (tobacco, areca nut, noura, slake lime, catechu) in a tombol leaf. There are three types of tombol: (1) Sweet—a sweetening agent, usually coconut, is added to the main ingredients; (2) bitter—additives like clove oil, cardamom, and herbal medicines are used; and (3) mixed with tobacco—tombol is often mixed with either dry, thin pieces of Yemeni tobacco, called socha (similar to Indian pattiwalla), or zarda, a scented tobacco from India.

Chemical Measurements
No data available

References
Published information on tombol could not be located.

For additional information on tombol, please refer to Chapter 11: Smokeless Tobacco Use in the Eastern Mediterranean Region.

Toombak

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Toombak is a type of moist tobacco commonly used in Sudan. It is made of sun-dried ground tobacco and a solution of baking soda (sodium bicarbonate) and water.[1] The word toombak can also be used to describe the native tobacco plant used to manufacture local snuff.[2]

Common Names
Sauté, sute, ammari, saood

Brand Names
El-Sanf (of high quality), Wad Amari (the name of the person who introduced toombak to Sudan), Sultan El-Khaif (the master which alters the mind)

Main Geographic Locations (WHO Region: Country)
Eastern Mediterranean Region: Sudan[1]; **African Region:** Chad

Prevalence and Demographics
No recent information is available on the use of toombak. Historically, toombak was commonly used by adult Sudanese men, particularly in rural areas. The most recent published statistics (1998) found that among adults age 18 and older in the northern region of Sudan, 34% of Sudanese men and 2.5% of women use toombak.[3] The prevalence of toombak use increases with age for both men and women and is more common in rural than urban areas.[3]

Mode of Absorption
Oral (held in mouth, sucked, used as ingredient in tombol), **Nasal**

Use Pattern
A small portion of the toombak, weighing about 10 grams, is rolled into a ball called a saffa. It is sucked slowly for 10 to 15 minutes, The saliva that is produced is then spit out by men or swallowed by women, because it is considered socially unacceptable for women to use toombak.[1,2] Users usually rinse their mouths with water after the saffa is removed. A regular user may use toombak as many as 10 to 20 times per day.[2]

Main Ingredients
Tobacco (*N. rustica*), baking soda (sodium bicarbonate, locally called atrun or natron), water[1,2,4]

Processing/Manufacturing
Cottage industry and custom-made: Toombak tobacco leaves (*N. rustica*) are harvested and left in small heaps in a field to dry for about 45 days (sun-curing). The leaves are then tied into bundles, sprinkled with water, and stored for a few of weeks at 30 to 45° C (85–110° F) to allow fermentation. The leaves are then ground into course particles by toombak mills and aged for up to a year or more in burlap sacks.[1,2] Vendors prepare ready-made toombak by gradually adding baking soda (sodium bicarbonate) to the tobacco until the mixture is approximately four parts tobacco to one part baking soda. The resulting toombak is then placed in an airtight container for about 2 hours prior to sale.[1,2,4] While toombak is not commercially manufactured, vendors display commercial names at their shops as trademarks.

In addition to selling ready-made toombak, vendors may sell dry toombak leaves and baking soda separately so that customers can prepare their own toombak.[4]

Toombak

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Toombak, Sudan	7.38–10.1	9.56–28.2	5.16–10.6	14,700–516,000	115,000–368,000	4,550–6,770	295,000–992,000

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (5).

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For additional information on toombak, please refer to Chapter 11: Smokeless Tobacco Use in the Eastern Mediterranean Region.

Twist

Twist, also called roll, is chewing tobacco that is twisted into rope-like strands and braided. It was popular in the United States in the late 1800s, but use of chewing tobacco began to decline with the expansion of the cigarette industry in 1918.[1] Twist is rarely used today, and sales of twist make up less than 1.0% of all smokeless tobacco sales in the United States.[2]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
Chew, chaw, chewing tobacco

Brand Names
Moore's Red Leaf, Cumberland, Mammoth Cave, Cotton Boll, Kentucky, Warren County, Rough Country (*American Snuff Company*)

Main Geographic Location (WHO Region: Country)
Region of the Americas: United States[1]

Prevalence and Demographics
Twist use has declined over the past century and is rare today. Although statistics specifically on the prevalence of twist use are not available, 2009 sales of twist made up 0.4% of all smokeless tobacco sales in the United States.[2]

Mode of Absorption
Oral (chewed, held in mouth)

Use Pattern
Users typically cut off a piece, place it in the mouth, and chew. Saliva is usually spit out, but it can also be swallowed.[3]

Main Ingredients
Tobacco, tobacco leaf extract, and sometimes sweetener or flavorings[1]

Processing/Manufacturing
Commercial: Twist is handmade by commercial manufacturers. Air-cured or fire-cured burley tobacco leaf is treated with a tar-like tobacco leaf extract and sometimes sweeteners and other flavorings. The tobacco is then twisted into rope-like strands that are dried. The final product is a pliable, but dry, rope. Twist is sold by the piece in varying sizes, depending on the number of leaves in the twist.[1,3]

Twist

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type	pH	Total Nicotine	Free Nicotine	NNK	NNN	NNAL	Total TSNAs*
		mg/g wet wt		ng/g wet wt			
Twist,† United States	4.73–5.77	21.6–40.1	0.02–0.22	309–556	828–2,460	n.d.‡–104	2,590–4,950

*Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
†Twist products were commercially manufactured.
‡n.d. = not detectable.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Lawler et al. 2013 (4).

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For additional information on twist, please refer to Chapter 9: Smokeless Tobacco Use in the Region of the Americas.

Zarda

Zarda is a flaky mixture of tobacco, lime, spices, and vegetable dyes. It is frequently chewed with chopped areca nut or used as an ingredient in paan. Zarda is commonly used in South-East Asia and in countries to which people from this region have emigrated.[1]

Photo courtesy of Clifford Watson, Centers for Disease Control and Prevention

Common Names
Dokta (West Bengal, India)

Brand Names
Baba, Baghban Zafrani Zarda, Ratna Zafrani Patti, Gopal *(India)*; Zahoor Zafrani Patti, Raja Jani Zafrani Patti, Sunbrand Zafrani Banarasi Patti, Shahzadi Zafrani Patti, Najma Zaffran Patti *(Pakistan)*; Dulal Mishti, Hakim Puri, Bat One Baba, Bullet, Surma *(Bangladesh)*

Main Geographic Locations (WHO Region: Country)
South-East Asia Region: India, Bangladesh, Myanmar, Nepal, Bhutan[1]; **Eastern Mediterranean Region:** Yemen[1]

Prevalence and Demographics
In India, Bangladesh, Myanmar, and Nepal, zarda is frequently used as an ingredient in paan (betel quid), particularly among middle to upper socioeconomic groups.[2] Although specific prevalence rates for zarda use are not available, the prevalence of smokeless tobacco use is high in these South-East Asian countries, and zarda use is common.[1,2] Between 2007 and 2010, the adult prevalence rate of current smokeless tobacco use ranged from 18.6% to 29.6% in India, Bangladesh,[3] Myanmar, Nepal, and Bhutan.[4]

Mode of Absorption
Oral (chewed, chewed in paan or tombol)

Use Patterns
Zarda may be chewed by itself, but it is usually chewed with chopped areca nuts and spices. In South-East Asia it is often used in paan, and in Yemen it is used in tombol.[1,2,5,6]

Main Ingredients
Tobacco, lime, spices, vegetable dyes, and sometimes areca nut and/or silver flecks[1,5]

Processing/Manufacturing
Commercial: Zarda is commercially manufactured but is usually used in user- or vendor-made paan.[5,6] Zarda is processed by boiling broken up tobacco leaves with lime and spices until the water evaporates. It is then dried and colored with vegetable dyes.[1,2] Zarda is sold in small packets or tins.[2]

Zarda

Chemical Measurements

These data are for select products and may not represent all products of this type. These data are expressed on a per gram basis for products analyzed as received. The amount absorbed will depend on the amount of product used.

Product Type*	pH	Total Nicotine (mg/g wet wt)	Free Nicotine (mg/g wet wt)	NNK (ng/g wet wt)	NNN (ng/g wet wt)	NNAL (ng/g wet wt)	Total TSNAs† (ng/g wet wt)
Zarda (wet),‡ Bangladesh	6.51	21.3	0.63	3,840	28,600	3,460	53,700
Zarda (dry), Bangladesh	6.28	9.55	0.17	457	4,280	248	9,120
Zarda, India	5.22	30.43	0.05	829	2,910	390	5,490

*All zarda products were commercially manufactured.
†Total TSNAs represent the sum of NNK, NNN, and NNAL (shown), and *N'*-nitrosoanatabine and *N'*-nitrosoanabasine (not shown).
‡This product contains areca nut.
Abbreviations: NNK = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; NNN = *N'*-nitrosonornicotine; NNAL = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; TSNAs = tobacco-specific nitrosamines; mg/g = milligram per gram; ng/g = nanogram per gram.
Source: Stanfill et al. 2011 (7).

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For additional information on zarda, please refer to the following chapters: Chapter 10: Smokeless Tobacco Use in the European Region, and Chapter 13: Smokeless Tobacco Use in the South-East Asia Region.

Glossary

Glossary

Term	Definition
Ad valorem	Tax charged as a percentage of the value of a product.
Adducts	Carcinogenic metabolites bound covalently to DNA.
Air-curing (of tobacco)	Involves placing tobacco stalks on wooden staves that are hung in a well-ventilated barn. Used to make loose leaf and twist chewing tobaccos and is often mixed with fire-cured tobacco to make moist snuff.
Aldehydes	Organic compounds that contain a formyl group (R-CHO). Found in some smokeless tobacco products as a result of fire-curing. The International Agency for Research on Cancer classifies the aldehyde formaldehyde as carcinogenic in humans (Group 1), and by acetaldehyde as a possible carcinogen (Group 2B).
Alkaline modifiers	Chemicals added to tobacco that include agents such as sodium bicarbonate, ammonium bicarbonate, various metallic carbonates (e.g., calcium, magnesium, sodium, ammonium), and slaked lime (calcium hydroxide). Addition of alkaline agents to tobacco boosts pH and increases the percentage of nicotine present as free nicotine.
Alkaloids	Naturally occurring nitrogen compounds that are produced by a large variety of organisms, including bacteria, fungi, plants, and animals. Tobacco alkaloids are key chemical precursors in the formation of tobacco-specific nitrosamines.
Anabasine	Alkaloid generally found in *Nicotiana glauca* at higher levels than in other tobacco species (*N. tabacum* or *N. rustica*). Present in trace amounts in tobacco smoke and can be used as an indicator of a person's exposure to tobacco smoke. Thought to contribute to the toxicity of *N. glauca*.
Anatabine	Alkaloid found in *Nicotiana tabacum* and other tobacco species. Present in tobacco products and tobacco smoke and absorbed in the human body after tobacco use.
Areca nut	Seed of the areca palm (*Areca catechu*), which grows in much of the tropical Pacific, Asia, and parts of east Africa. Commonly referred to as betel nut, as it is often chewed wrapped in betel leaves. Areca nut is classified as a Group 1 carcinogen to humans by the International Agency for Research on Cancer.
Arecoline	Areca nut alkaloid that is the primary active ingredient responsible for central nervous system effects.
Atherogenesis	Formation of atheromatous lesions in the arterial walls.
Attributable risk	Proportion of a disease that can be attributed to a causal risk factor.
Betel quid	A custom-made preparation that includes areca nut combined with other ingredients, such as tobacco, catechu, alkaline agents, and spices, all wrapped in a piper betel leaf. Also known as paan.
Catechu	An extract of *Acacia* used variously as a food additive, astringent, tannin, and dye. Commonly found in smokeless tobacco products from South-East Asia.
Cessation (of tobacco)	Process of quitting tobacco use.
Chemical additives	Chemicals—such as sweeteners, flavor chemicals, whiteners, alkaline agents, moisteners, binders, and preservatives—added to products to improve taste, enhance appearance, or alter other product characteristics, such as pH, texture, or shelf life.

Term	Definition
Chemosensory effects	Response of senses to chemical stimuli.
Chewing tobacco	A type of smokeless tobacco that presents as long strands of loose leaves, plugs, or twists of tobacco. The pieces are chewed or placed between the cheek and gum or teeth.
Conference of Parties	The governing body of the Framework Convention on Tobacco Control, World Health Organization, comprising all parties to the convention or countries that have signed the treaty.
Cotinine	A metabolite of nicotine used as an exposure biomarker of nicotine intake.
Cottage industry	A small-scale industry producing custom-made products at home, in market stalls, or in shops for commercial sale.
Cottage-made products	Products that are homemade or are produced by a small-scale industry. These products may lack packaging that displays brand name, graphics, and product description.
Cross-price elasticity	The sensitivity of consumers to price or tax changes of a related good. For example, an 0.8 cross-price elasticity between cigarettes and smokeless tobacco (ST) means that a 10% increase in the price of cigarettes will yield an 8% increase in the consumption of ST.
Current users	People who used any smokeless tobacco product either daily or occasionally in the 30 days preceding a survey.
Custom-made smokeless tobacco products	Smokeless tobacco products that are handmade by the user, a relative, or a vendor according to user preferences. These products are made of cured tobacco or a premade tobacco product (e.g., zarda) combined with one or more ingredients, such as ashes, alkaline agents, areca nut, spices, catechu, or other plant materials. These products lack commercial packaging and may be placed in commonly available materials such as newspaper, cellophane, paper bags, etc., after they are made.
Daily users	People who use smokeless tobacco products on a daily basis.
Dissolvables	Smokeless tobacco that is completely dissolved during use, with no residual loose tobacco or sachet to discard. Tobacco-coated toothpicks are considered dissolvables because the tobacco portion fully dissolves from the toothpick, which is discarded (See Appendix B.)
Dose–response relationship	Increased risk of a disease with increasing levels of exposure.
Dual use	Use of two or more tobacco products by one person.
Erythroplakia	Red-colored oral mucosal lesions that have a high risk of developing cancer.
Ever users	People who have tried smokeless tobacco at least once in their lifetimes.
Excise tax	Similar to sales taxes, internal taxes that can change the price of smokeless tobacco (ST) products relative to other consumer goods and can make ST products less affordable for the consumer.
Fermentation	A sugar-metabolizing process, facilitated by microorganisms, generally thought to enhance product taste. Used to produce products such as moist and dry snuff as well as toombak. During fermentation, microbes proliferate, and nitrite is produced if nitrite-producing organisms are present. Accumulated nitrite then reacts with tobacco alkaloids to produce tobacco-specific nitrosamines.

Term	Definition
Fire-curing method	Involves hanging tobacco in a large enclosed area where it is exposed to smoke from hardwood fires that continuously burn or smolder. Used in the production of plug chewing tobacco, moist and dry snuff, and tobacco used to make iqmik. Causes chemical changes in the tobacco leaf, and contaminates the tobacco with smoke-related chemicals such as polycyclic aromatic hydrocarbons, phenols, and volatile aldehydes.
Flue-curing method	Involves hanging tobacco in an enclosed structure connected to an external heat source without exposing it directly to smoke. Used in making chewing tobacco.
Free nicotine	Fraction of the total nicotine that is unprotonated (neutrally charged). This uncharged form of nicotine more readily passes through oral membranes and into the bloodstream. Free nicotine is calculated using total nicotine and pH values for the tobacco product. See also *Total nicotine*.
Graduation strategy	Theory that the availability of products spanning a wide pH range can make it easier for smokeless tobacco users to move on to products delivering increasingly higher nicotine levels.
Gul	See the Gul factsheet (Appendix B).
Gutka	See the Gutka factsheet (Appendix B).
Harm reduction	Decreased risks of illness or injury.
High-income countries	Countries with a gross national income per capita, as calculated using the World Bank Atlas method, of US$12,616 or more.
Humectants	Chemicals, including glycerol, glycerin, and propylene glycol, added to smokeless tobacco products to preserve product moisture content.
Inferior good	A good that is consumed in decreasing quantities as a consumer's income increases.
Khaini	See the Khaini factsheet (Appendix B).
Khat	A plant (*Catha edulis*) that contains cathinone, an alkaloid with amphetamine-like stimulant properties that are purported to cause euphoria, excitement, and a loss of appetite.
Kiwam	See the Kiwam factsheet (Appendix B).
Leukoplakia	White or grayish-white oral mucosal lesions that have the potential to develop cancers.
Low birthweight	Infants with a birthweight at the lower extreme of the normal birthweight distribution.
Low-income countries	Sometimes referred to as developing economies, with US$1,035 or less gross national income per capita.
Manufactured products	Products made in factories or large production facilities for commercial sale.
Middle-income countries	Sometimes referred to as developing economies—lower middle income = US$1,036–$4,085 gross national income (GNI) per capita; upper middle income = US$4,086–$12,615 GNI per capita.
Mitogenesis	Cell proliferation.

Term	Definition
Modern markets	Characterized by the presence of multinational corporations and the predominance of standardized, commercially produced smokeless tobacco products.
Moist snuff	See the Moist Snuff factsheet (Appendix B).
Moisture content	The percentage of water in a tobacco product.
Niche Tobacco Product Directory	A website containing a wide variety of tobacco product information.
Nitrate	A nitrogen-containing ion (NO_3^-) commonly found in soil and fertilizers. These ions are absorbed and metabolized by tobacco plants as they grow. When plants are harvested, nitrate remains in plant tissues and can subsequently be converted to nitrite (NO_2^-) by certain microbes. The International Agency for Research on Cancer has classified nitrate as a Group 2A agent (probable human carcinogen), because it can contribute to the formation of nitroso compounds in the human body after ingestion.
Nitrite	A nitrogen-containing ion (NO_2^-) generated by microorganisms capable of converting nitrate to nitrite; this process begins once the tobacco leaf begins to dry during curing. Once nitrite is produced, it can react with tobacco alkaloids to generate tobacco-specific nitrosamines in a chemical process called nitrosation. The International Agency for Research on Cancer has classified nitrite as a Group 2A agent (probable human carcinogen) that can contribute to the formation of nitroso compounds in the human body after ingestion.
Nitrosation	Chemical reaction in which nitrite reacts with compounds such as tobacco alkaloids and other secondary/tertiary amines to form various nitrosamines.
Nitroso compounds	Organic compounds containing an N=O group. N-nitroso compounds are of concern in tobacco products because several of these compounds are known or potential carcinogens.
Normal good	A good that is consumed in larger quantities as a consumer's income increases.
Nornicotine	An alkaloid found in the tobacco plant that is a precursor to the carcinogen *N'*-nitrosonornicotine, which is produced during the curing and processing of tobacco.
Odds ratio	A measure describing the strength of association or dependence between two data values.
Oral mucosal lesions	Abnormality of the oral mucosa that can progress to cancer.
Oral submucous fibrosis	Progressive disease in which the oral mucosa loses elasticity and develops fibrous bands that cause difficulty in opening the mouth. Can progress to cancer and is associated with chewing areca nut, which is most often consumed with tobacco.
Organic compounds	Members of a large class of gaseous, liquid, or solid chemical compounds whose molecules contain carbon.
Pan masala	A mixture of areca nut, spices, flavorings, and other ingredients.
Periodontal disease	A disease affecting one or more of the periodontal (gum) tissues in the mouth.
pH	Measure of the acidity or basicity of a product. It impacts the amount of free nicotine in smokeless tobacco products. Higher pH results in a greater percentage of nicotine being converted to free nicotine.

Term	Definition
Phenols	A class of aromatic organic compound formed when wood or sawdust is burned during the fire-curing of tobacco.
Polycyclic aromatic hydrocarbons	Potent atmospheric pollutants that are produced as byproducts of fuel burning (fossil or biomass); ten polycyclic aromatic hydrocarbon compounds found thus far in smokeless tobacco have been designated by the International Agency for Research on Cancer as carcinogens or potential carcinogens.
Porronca	Smokeless tobacco products used by indigenous Brazilians.
Portioned pouches	Packets of smokeless tobacco containing specific measured amounts—for example, snus.
Prevalence	Proportion of a population found to have a condition. Calculated by comparing the number of people found to have the condition with the total number of people studied or surveyed.
Protonated nicotine	A charged form of nicotine that is more slowly released from tobacco and tends to be more slowly absorbed into the bloodstream. This is the predominant form present in most unprocessed tobaccos.
Pyridine-N-glucuronide metabolites	Can be used as biomarkers to provide realistic and direct assessments of a person's exposure to certain tobacco-specific nitrosamines.
Quit ratio	Number of former smokeless tobacco users divided by the number of people who have ever used smokeless tobacco daily.
Sada pata	Plain tobacco flakes.
Slaked lime	Calcium hydroxide. Addition of alkaline agents to tobacco boosts pH and increases the percentage of nicotine present as free nicotine.
Smokeless tobacco	Includes a large variety of products containing tobacco mixed with chemical, plant, and/or other constituents. These products are not smoked, but are used orally or nasally. Oral tobacco can be chewed, sucked, applied to the teeth or gums (e.g., topical toothpaste or powder), dissolved in the mouth, or gargled. Nasal tobacco is finely ground so that it can be inhaled and absorbed through mucus membranes.
Snuff	See the Snuff factsheet (Appendix B).
Snus	See the Snus factsheet (Appendix B).
Sun-curing method	Process of drying tobacco leaves in the sun, which is often used in making toombak, gutka, maras, khaini, and nass/naswar, and for some tobaccos used in betel quid.
Sweeteners	Chemicals added to smokeless tobacco products to make them more palatable. Includes honey, molasses, saccharin, brown sugar, sugar, and xylitol.
Tobacco-specific nitrosamines	Carcinogens that are formed from nicotine and related compounds by nitrosation during processes such as curing and fermentation, in which tobacco products are made. These compounds are specifically found in tobacco products.
Tonka bean	A seed from *Dipteryx odorata* that contains a high level of coumarin, a liver toxicant. This seed is added to some smokeless tobacco products.
Total nicotine	The amount of nicotine in a product regardless of its ionic form (di-protonated, mono-protonated, and unprotonated).

Term	Definition
Traditional smokeless tobacco markets	Less concentrated markets that trade a large variety of products made under loosely defined standards (which would include cottage products and custom-made products).
Traditional smokeless tobacco products	Custom-made tobacco products produced by small-scale cottage industries. Can also refer to smokeless products that are well established in a particular region.
Unprotonated nicotine	This neutrally charged form of nicotine, commonly referred to as "free" nicotine, is usually more quickly released form tobacco during product use than protonated nicotine. Free nicotine is also absorbed more quickly into the body tissues for distribution throughout the body.
Verrucous hyperplasia	Histopathologically diagnosed abnormality of the oral mucosa.
Zarda	See the Zarda factsheet (Appendix B).

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