

SMOKING AND TOBACCO CONTROL

MONOGRAPHS

1

**Strategies
To Control
Tobacco Use
In the United
States:
a blueprint for public health
action in the 1990's**

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

National Institutes of Health

National Cancer Institute



Joseph W. Cullen, Ph.D.
1936-1990

The Smoking and Tobacco Control Monographs are dedicated to the memory of Joseph W. Cullen, former Deputy Director of the Division of Cancer Prevention and Control and architect of the National Cancer Institute's Smoking and Tobacco Control Program (STCP). Through his innovative leadership, the STCP has now established itself as the world's premier organization in the field of smoking and tobacco use control. Dr. Cullen was an inspiration to all who knew him, representing public service at its best. His untimely death in November 1990 represents a loss to us all, but most important, a loss to the public health of this country.

Peter G. Greenwald, M.D., Dr. P.H.
Director
Division of Cancer Prevention and Control
National Cancer Institute
November 1991

Strategies To Control Tobacco Use In the United States: a blueprint for public health action in the 1990's

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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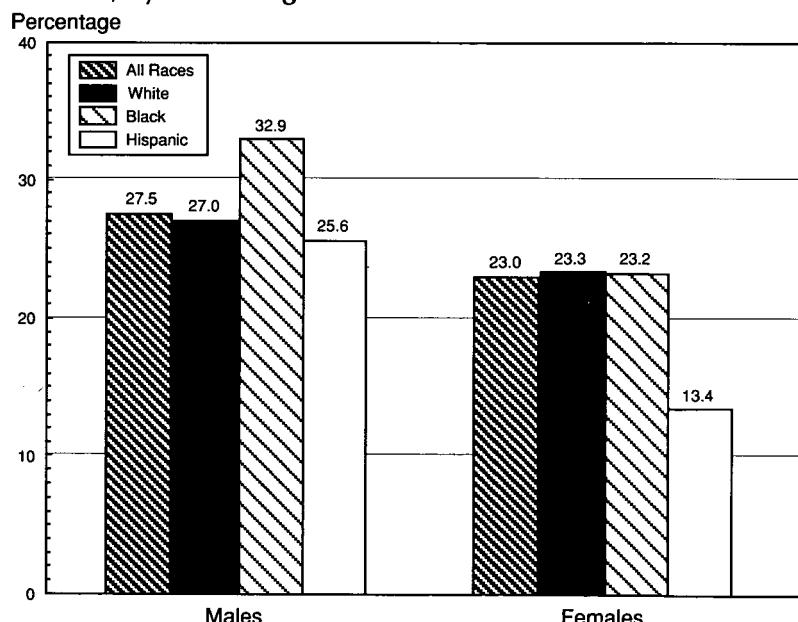
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Foreword

Of all the U.S. Public Health Service agencies, the National Cancer Institute (NCI) has perhaps the longest history of involvement in the battle against the health consequences of smoking. During the early 1950's, when the first studies to link smoking with increased lung cancer risks were published, the Institute included smoking as part of its research agenda.

In 1955, NCI epidemiologists Haenszel, Shimkin, and Miller conducted the first large-scale national survey to assess patterns of tobacco use among adults in the United States. Theirs was a landmark study in many ways, not the least of which was its momentum against the prevailing indifference—and even hostility—in the medical community with regard to inferences that smoking harmed people. That study clearly defined the extent of the smoking problem in American society; nearly 60 percent of men and 28 percent of women were classified as current smokers at the time of interview. Since that time, substantial progress has been made in reducing smoking prevalence. Today, only about 25 percent of adult Americans report that they are cigarette smokers.

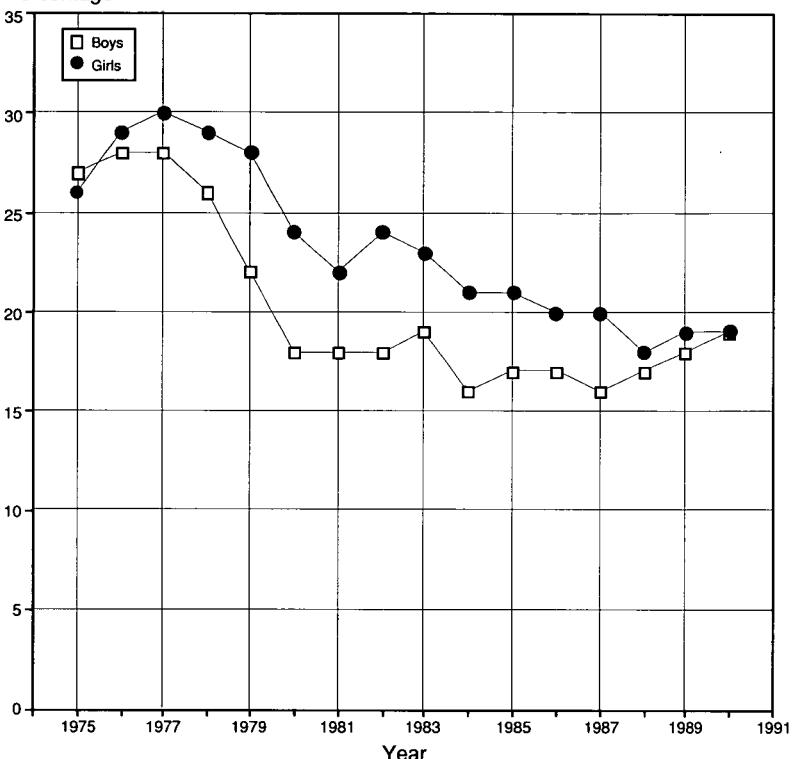
Figure 1
Percentage of adults (age 18 and older) who are current smokers, by race and gender



Source: Current Population Survey, 1989.

Figure 2
Percentage of high school seniors reporting daily cigarette smoking

Percentage



Source: University of Michigan

Nevertheless, nearly 50 million of our citizens are still using cigarettes regularly; and, sadly, the percentage of women who smoke is about the same now as was reported 35 years ago. Indeed, as a direct consequence of smoking, the age-adjusted death rate from lung cancer among women has increased by a staggering 420 percent during this same period. Further, smoking among black men is 20 percent higher than that reported by whites, and black men have the highest lung cancer mortality rate of any demographic group in the United States.

Even more discouraging, smoking among our children has not declined appreciably over the last decade, despite the continuing efforts of public health officials (Figure 2). Approximately 3,000 teenagers take up the habit each day.

The reasons for these developments should not be too surprising, as detailed in this monograph (see Chapter 1). Smoking is a pervasive social problem of gigantic proportions. Last year alone, this Nation consumed 527 billion cigarettes, or

2,828 cigarettes for every person 18 and over, smokers and nonsmokers alike (see Chapter 3). Cigarettes represent a unique class of commercial product in that they are life-threatening when used as intended by the manufacturer.

While this Institute spent \$47 million last year to develop and disseminate effective smoking intervention technologies, the major cigarette manufacturers spent \$3.6 billion in an effort to convince people that smoking is necessary for social acceptance, that it makes one attractive to the opposite sex, and that it enhances self-image. Over the past 4 years alone, expenditures for all cigarette advertising and promotional activities have increased nearly 50 percent and, increasingly, they appear to be targeting youth.

Perhaps the most criticized campaign of recent years was the introduction, in 1988, of the "smooth character" cartoon, Joe the Camel (Figure 3). In 1989, RJR Nabisco ran a particularly outrageous four-page ad in youth-oriented *Rolling Stone* magazine, in which dating advice was offered for young men. On the first page of the ad is a cartoon of a beautiful woman

Figure 3
The "smooth character"



asking if the male teen is "bored? lonely? restless?" Inside, the "smooth character" gives "foolproof dating advice" for impressing someone at the beach:

Run into the water, grab someone and drag her back to the shore, as if you've saved her from drowning. *The more she kicks and screams, the better* [emphasis added].

While the tone and slant of this advice constitute an insulting provocation to the women of our country, perhaps equally troubling is the information on the back page of the ad: "How to get a FREE pack even if you don't like to redeem coupons." The suggestion: Just ask "your best friend" or "a kind looking stranger" to redeem the coupon for you.

Who is really the target of such an advertisement? Certainly, the camel cartoon character could not have much appeal for an adult. And how many people would feel compelled to ask "a kind looking stranger" to redeem a coupon for free merchandise—unless, of course, they were underage?

No doubt the success of the "smooth character" campaign is one reason that RJR Nabisco more than tripled its advertising expenditures for Camel cigarettes. In the wake of Joe the Camel's popularity, Brown & Williamson Tobacco Corp. has begun test marketing of a penguin cartoon character to promote Kool cigarettes in billboards, magazines, and store displays. It is not difficult to imagine what impact such large-scale, youth-oriented promotions may have on the sale of these brands to teenagers. Unfortunately, by the time we resolve this question, millions of our young people already will have become addicted to cigarettes. While the economic costs to our future program of health care delivery will be staggering, the future human costs are beyond reckoning.

As public health officials, we must devise effective strategies to counter such seductive promotions, and we will not shy away from this mission. Yet, for every \$1 that NCI spends on research to combat smoking, the tobacco industry spends \$80 to promote the addiction. Where the cigarette manufacturers can offer free packs of cigarettes, cigarette lighters, and premiums such as attractive clothing, we can offer only warnings about the dangers of smoking and advice about how to quit.

As health professionals, we need to understand that smoking is not only an individual's problem, but also a societal problem—"a social carcinogen," as one prominent researcher characterized it. Also, it is a problem that can not be left solely to Government to solve. It will require the combined efforts of

all of us to achieve a tobacco-free society. I call upon the entire medical and public health community to become involved in the fight against this Nation's number one public health menace—cigarette smoking.

Samuel Broder, M.D.
Director,
National Cancer Institute

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Preface

In the months immediately after January 1964, when Surgeon General Luther Terry released the first official Government report on smoking and health, cigarette consumption in the United States declined significantly. It was only the second time since the turn of the century that publicity about the hazards of smoking had produced a reduction in cigarette use. At that time, many leaders in the medical and public health arena assumed that, by providing the public with straightforward information about the dangers of smoking, they could discourage large numbers of people from using cigarettes.

While the expected change in behavior did occur, it was far more limited than had been hoped—a reflection of the difficulty that individuals often experience when they attempt to alter a complex behavior such as smoking, especially one we now know to be addictive.

The recognition that information alone would not eliminate tobacco use shifted the focus to strategies directed to the individual. This focus presumed, erroneously as it turned out, that the major determinants of smoking behavior were centered within the individual rather than sociologic in nature. Subsequent research and natural observation clearly demonstrated that behavior change correlated with changes occurring in the smoker's social and economic environment. This recognition has led to the adoption of public health strategies that now address the smoker's larger social environment while simultaneously offering programs of assistance for the individual.

This volume provides a summary of what we have learned over nearly 40 years of the public health effort against smoking—from the early trial-and-error health information campaigns of the 1960's to the NCI's science-based ASSIST project (the American Stop Smoking Intervention Study for Cancer Prevention), which began in the fall of 1991. *Strategies To Control Tobacco Use in the United States: A Blueprint for Public Health Action in the 1990's* presents a historical accounting of these efforts as well as the reasons why comprehensive smoking control strategies are now needed to address the smoker's total environment and reduce smoking prevalence significantly over the next decade.

An important finding discussed in this monograph is how different populations were affected by and responded to the early 1950's media coverage about the dangers of smoking, in

contrast to the effects of more intensive and sustained efforts in the late 1960's (see Figures 8, 9, and 10 in Chapter 1). During the latter period, the Federal Communications Commission ruled that cigarette advertising was subject to the Fairness Doctrine, and it required that all radio and television stations provide significant air time for health organizations to counter commercial ads with messages against smoking.

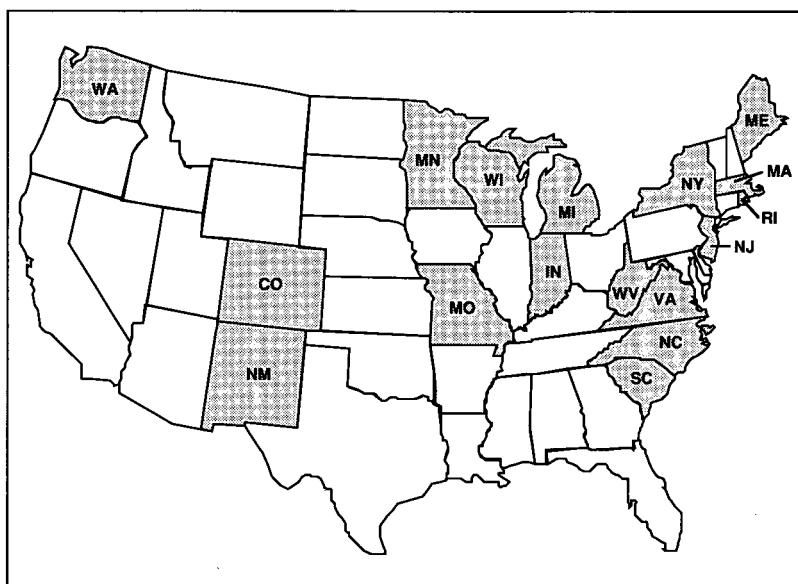
While the data show clearly that only white male smokers reacted to the first wave of public information in the 1950's—most likely because all of the early studies linking smoking and lung cancer were conducted with white males—the counteradvertising campaigns of the late sixties produced a greater level of smoking cessation across all major demographic groups. The TV and radio messages against smoking at that time employed broader themes and issues and thereby appealed to a more diverse audience. Further, the counter-advertising campaigns under the Fairness Doctrine used far-reaching electronic media—primarily television, while the public information of the middle 1950's had relied more heavily on print media.

The lessons gained from such natural experiments and from our contextual understanding of social factors that have influenced smoking in this century (see Figure 1, Chapter 5) are strong complements to our knowledge of what works—from the more than 100 controlled intervention trials sponsored by NCI in the 1980's.

Throughout the first 10 years of its existence, NCI's Smoking and Tobacco Control Program has operated under the philosophy that research, in and of itself, is not capable of producing large-scale national change in smoking prevalence rates. It was recognized from the outset that there must be a concerted effort to systematically and comprehensively apply the knowledge gained from the intervention trials. Thus, from its inception, the STCP has continually used information from such studies to plan the next steps for implementation of a national strategy to significantly reduce smoking in the 1990's.

The current state of the art in combating tobacco use combines multiple environmental changes with multiple programs directed to individuals in different stages of the smoking initiation and cessation process (see Figures 14 and 15, Chapter 1). This strategy recognizes that no single approach is best for all individuals, that no one intervention channel is capable of effectively reaching all smokers (or, in the case of children, potential smokers), and that no single time is best for individual smokers to make an attempt to quit. Comprehensive strategies for smoking control are characterized by

Figure 1
ASSIST states



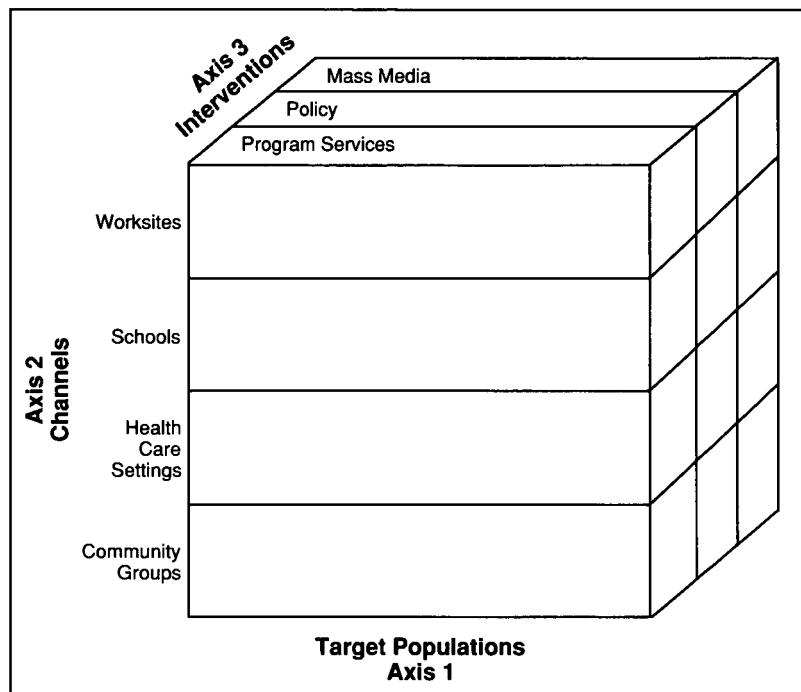
the delivery of persistent and inescapable messages to quit, or to not start smoking, coupled with continuously available support for individual cessation attempts, all provided through multiple channels and reinforced by environmental incentives for nonsmokers.

This strategy has provided the scientific foundation for the largest, most comprehensive smoking control project ever undertaken—the American Stop Smoking Intervention Study for Cancer Prevention. ASSIST is a large demonstration project designed to significantly reduce smoking prevalence in 17 states (Figure 1). Its primary objective is to reduce smoking prevalence to 15 percent or less by the year 2000.

The ASSIST framework incorporates a three-axis model, consisting of target populations, intervention channels, and interventions (Figure 2). The model organizes the multiple and diverse activities of a comprehensive smoking control initiative:

- **Target populations** (axis 1) can include youth, ethnic minorities, blue-collar workers, individuals with less education, women, or other populations with relatively high smoking prevalence.
- **Channels** (axis 2) are the organizational structures or mechanisms by which specific intervention activities will reach the target populations. In ASSIST, four major channels are envisioned as the primary means for contact with smokers and potential smokers.

Figure 2
ASSIST conceptual framework



- **Interventions** (axis 3) are the instruments for producing change, both for the individual and in the larger community environment that will effect broader behavior change in target populations. In ASSIST, interventions will take the form of direct contacts with individuals and groups through a variety of program services, while media and tobacco control policies are expected to create broader social change and increase the demand for program services.

More than 90 million Americans will be directly affected by ASSIST over the life of the project. If ASSIST project goals are achieved, it will result in 4.5 million adults' quitting smoking and prevent 2 million children from ever taking up the habit. More important, a successful ASSIST project will have prevented nearly 1.2 million premature smoking-related deaths, including more than 400,000 deaths from lung cancer.

Claudia Baquet, M.D.
Associate Director
Cancer Control Sciences
Program
National Cancer Institute

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- Chapter 1,* "The Scientific Rationale for Comprehensive, Community-Based, Smoking Control Strategies"—**David M. Burns**, M.D., Professor of Medicine, University of California, San Diego, San Diego, California.
- Chapter 2,* "Evolution of Smoking Control Strategies"—**Jerome Schwartz**, Ph.D., Health Care Consultants, Davis, California; **Beti Thompson**, Ph.D., Fred Hutchinson Cancer Research Center, Seattle, Washington.
- Chapter 3,* "Smoking Prevalence and Lung Cancer Death Rates"—**H. Dennis Tolley**, Ph.D., Department of Statistics, Brigham Young University, Provo, Utah; **Lori Crane**, Ph.D., Jonsson Comprehensive Cancer Center, University of California, Los Angeles, Los Angeles, California; **Nikki Shipley**, M.S., Jonsson Comprehensive Cancer Center, University of California, Los Angeles, Los Angeles, California.

- Chapter 4,* "Approaches Directed to the Individual"—**Elizabeth Edmundson**, Ph.D., The University of Texas Health Science Center at Houston, Houston, Texas; **Alfred McAlister**, Ph.D., Center for Health Promotion Research and Development, School of Public Health, The University of Texas Health Science Center at Houston, Houston, Texas; **David Murray**, Ph.D., Division of Epidemiology, School of Public Health, University of Minnesota, Minneapolis, Minnesota; **Cheryl Perry**, Ph.D., Division of Epidemiology, School of Public Health, University of Minnesota, Minneapolis, Minnesota; **Edward Lichtenstein**, Ph.D., Oregon Research Institute, Eugene, Oregon.
- Chapter 5,* "Approaches Directed to the Social Environment"—**K. Michael Cummings**, Ph.D., M.P.H., Department of Cancer Control and Epidemiology, Roswell Park Memorial Institute, Buffalo, New York; **Russell Sciandra**, Ph.D., Roswell Park Memorial Institute, Buffalo, New York; **Julia Carol**, Americans for Nonsmokers' Rights, Berkeley, California; **Susan Burgess**, Americans for Nonsmokers' Rights, Berkeley, California; **Joe B. Tye**, M.B.A., President, Stop Teenage Addiction to Tobacco, and Chief Operating Officer, Baystate Medical Center, Springfield, Massachusetts; **Robert Flewelling**, Ph.D., Research Health Analyst, Center for Social Research and Policy Analysis, Research Triangle Institute, Research Triangle Park, North Carolina.
- Chapter 6,* "Interdependence and Synergy Among Smoking Control Activities" — **Beti Thompson**, Ph.D., Fred Hutchinson Cancer Research Center, Seattle, Washington; **Enid Fallick Hunkeler**, M.A., Division of Research, Kaiser Permanente Medical Program, Oakland, California; **Lois Biener**, Ph.D., Center for Survey Research, University of Massachusetts, Boston, Massachusetts; **Carole Tracy Orleans**, Ph.D., Fox Chase Cancer Center, Cheltenham, Pennsylvania; **Eliseo J. Pérez-Stable**, M.D., School of Medicine, University of California, San Francisco, San Francisco, California.

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Ronald M. Davis, Deputy Director, Michigan State Department of Health, and former Director, Office on Smoking and Health, Centers for Disease Control, Rockville, Maryland

Karen Deasy, M.P.H.A., Associate Director for Policy, Office on Smoking and Health, Centers for Disease Control, Rockville, Maryland

Michael P. Eriksen, Sc.D., Assistant Professor of Cancer Prevention and Director, Behavioral Research Program, Department of Cancer Prevention and Control, The University of Texas, M.D. Anderson Cancer Center, Houston, Texas

Richard I. Evans, Ph.D., Director, Social Psychology/Behavioral Medicine Research and Graduate Training Group, Department of Psychology, University of Houston, Houston, Texas

Michael Fiore, M.D., M.P.H., Director, Tobacco Research and Intervention Program, University of Wisconsin-Madison Medical School, Madison, Wisconsin

Greg Getz, Ph.D., Research Coordinator, Social Psychology/Behavioral Medicine, Research and Graduate Training Group, University of Houston, Houston, Texas

Gary Giovino, Ph.D., Acting Chief, Epidemiology Branch, Office on Smoking and Health, Centers for Disease Control, Rockville, Maryland

Thomas J. Glynn, Ph.D., Chief, Prevention and Control Extramural Research Branch, Division of Cancer Prevention and Control, National Cancer Institute, Bethesda, Maryland

Nancy Gordon, Sc.D., Division of Research, Kaiser Permanente, Oakland, California

Edward Guadagnoli, Ph.D., Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts

Jan L. Hitchcock, Ph.D., Foundation for Blood Research,
Scarborough, Maine

Lynn T. Kozlowski, Ph.D., Professor of Biobehavioral Health,
The Pennsylvania State University, University Park,
Pennsylvania

Marc Manley, M.D., Medical Officer, Division of Cancer Prevention and Control, National Cancer Institute, Bethesda, Maryland

Alfred C. Marcus, Ph.D., Director of Public Health Research, AMC Cancer Research Institute, Denver, Colorado

Stephen E. Marcus, Ph.D., Office on Smoking and Health, Centers for Disease Control, Rockville, Maryland

Sarah McGraw, Ph.D., Senior Research Scientist, New England Research Institute, Inc., Watertown, Massachusetts

Terry F. Pechacek, Ph.D., Expert, Division of Cancer Prevention and Control, National Cancer Institute, Bethesda, Maryland

John Pierce, Ph.D., University of California, San Diego, San Diego, California

Bettye Raines, B.S., Administrator, Social Psychology/Behavioral Medicine, Research and Graduate Training Group, University of Houston, Houston, Texas

Rose Mary Romano, M.A., Chief, Public Information Branch, Office on Smoking and Health, Centers for Disease Control, Rockville, Maryland

Steven P. Schinke, Ph.D., Professor, Columbia University School of Social Work, New York, New York

Saul Schiffman, Ph.D., Associate Professor, Director, Clinical Psychology Center, University of Pittsburgh, Pittsburgh, Pennsylvania

Jesse Steinfeld, M.D., Surgeon General of the United States 1969 to 1973, San Diego, California

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R.O.W. Sciences, Inc.	Richard H. Amacher, Project Manager
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	Patricia Perry, Administrative Assistant
	Myrtle Peters, Administrative Assistant
	Dori Steele, Copy Editor
	Barbara Shine, Medical Writer/Editor
	Steven Stocker, Science Writer
	Francis X. Sullivan, Editor
	Donna Tharpe, Copy Editor
	Sonia Van Putten, Word Processing Specialist
	William Ward, Copy Editor
	Ronald W. Wolf, Editorial Coordinator and Senior Copy Editor.

University of
California, San Diego,
Medical Center

Sharon Buxton, Word Processing Specialist

Tina Kim, Project Assistant

Jerry Vaughn, Programmer/Analyst

Introduction

In 1982, the National Cancer Institute began the Smoking and Tobacco Control Program (STCP). The STCP included a comprehensive research program for testing the efficacy of a variety of smoking intervention strategies. To date, nearly \$300 million has been allocated for this effort (Figure 1), making the STCP the largest program of its kind in the world.

Figure 1
National Cancer Institute funding for smoking and tobacco control research

(in \$000's)

1982	10,943
1983	9,476
1984	16,721
1985	21,131
1986	27,099
1987	37,288
1988	39,604
1989	40,151
1990	41,500
1991	46,900
Total 1982-1991	\$290,813

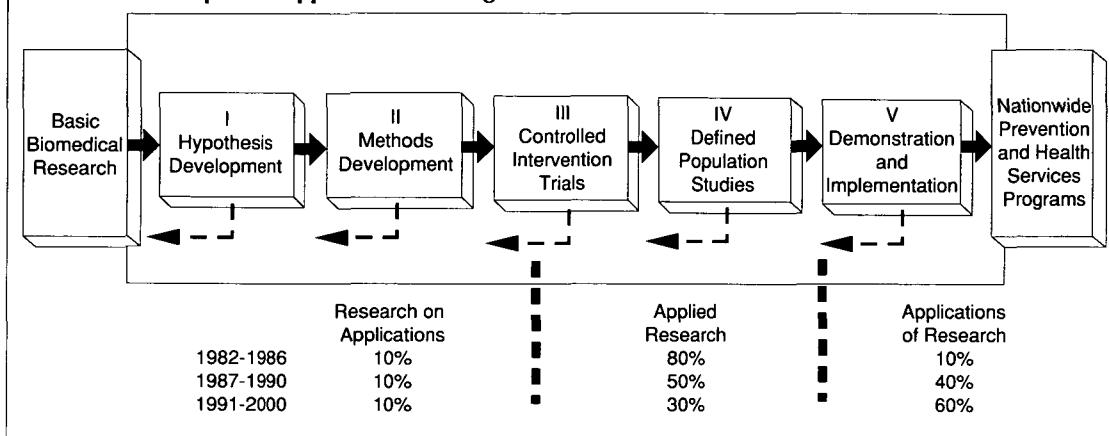
Source: National Cancer Institute

STCP TRIAL AREAS

The priorities for STCP intervention research grew from a systematic planning process for cancer prevention and control that had already been developed within the National Cancer Institute. This early strategy positioned the control of smoking as the cornerstone for NCI's effort to reduce cancer mortality by 50 percent by the end of the 1990's. The strategy's blueprint was a model that defined NCI priorities for cancer control (Figure 2).

Priorities for STCP intervention activities evolved from state-of-the-art reviews and consensus development incorporating contributions from hundreds of scientists and public health experts. The result was the two-pronged strategy now in use. The first part involves the study of intervention methods that are school-based programs, self-help techniques, physician-delivered and dentist-delivered interventions, mass media

Figure 2

Cancer control phases applied to smoking and tobacco control research

approaches, and community-based interventions. The second strategic arm targets specific populations that are (1) at greater risk for developing cancer and/or (2) amenable to prevention/cessation strategies. Included in the second strategy are youth, ethnic minority groups, women, smokeless tobacco users, and heavy smokers.

While nearly 100 separate intervention trials and studies now make up the NCI portfolio of smoking and tobacco use intervention research, 60 trials constitute the original core of the STCP program (Figure 3).

To aid in the national dissemination of STCP trial results, a series of monographs, of which this is the first, will be produced. This first monograph, *Strategies To Control Tobacco Use in the United States: A Blueprint for Public Health Action in the 1990's*, presents an overview of the components of an effective, comprehensive smoking control strategy. Future monographs will focus on individual trial areas or related topics.

SMOKING AND TOBACCO CONTROL MONOGRAPH

Smoking and Tobacco Control Monographs are but one means that NCI uses for informing both the public health and research communities of emerging results from the smoking intervention trials initiated in the mid-1980's. While monograph contents will be based primarily on information and findings from NCI-funded trials and studies, they also will address various issues of importance to the public health community in the effort to reduce smoking-related disease. One important area, which recently has begun to receive increased attention, is that of policies and their effect on practices related to smoking and tobacco use.

Figure 3
Smoking and tobacco control intervention trials

Goal: To develop and evaluate interventions to aid in either stopping or preventing tobacco use.

Number of Trials (1983-1987): 60

Intervention Areas	Number of Trials
School-Based Interventions	10
Self-Help Strategies	7
Physician/Dentist Interventions	6
Mass Media Interventions	5
Interventions in Black Populations	8
Interventions in Hispanic Populations	3
Interventions in Populations of Women	5
Control of Smokeless Tobacco Use	5
Heavy Smoker Interventions	11
Total	60

Purpose

In developing the concept for the Smoking and Tobacco Control Monographs, the Institute intended that the publications serve four major objectives:

1. Provide a cohesive and integrated description of individual smoking and tobacco issues, control strategies, and trial results to allow maximal utilization and dissemination of current and evolving knowledge and thereby influence the professional and layperson's understanding of these matters.
2. Significantly reduce the time between availability of information emanating from research projects and the publication and wide dissemination of this information.
3. Enhance the rapidity and efficiency with which NCI can utilize findings from research trials as a means of reducing cancer morbidity and mortality for those cancers most associated with tobacco use.
4. Provide a mechanism for codification and synthesis of information relevant to the use of those agencies, institutions, and individuals in the Nation that can affect the formulation of public policy related to smoking and tobacco use.

The rapidly growing understanding of what constitutes an effective strategy for controlling tobacco use has outstripped the ability of the peer-reviewed literature to disseminate this understanding to those responsible for implementing smoking

Monograph Development Process

Topic Selection And Outline

Scientific Content Development

control programs. The limited space available in peer-reviewed journals and the relatively long lag time from the initiation of a study to the publication of its results are barriers to the rapid dissemination of new information and approaches to tobacco control. In addition, the dispersion of information on a given smoking control approach across multiple journals and different years of publication makes it very time-consuming and complicated to assemble a comprehensive picture of what is known about that approach. The Smoking and Tobacco Control Monographs are intended to aid in overcoming these barriers to information dissemination.

The major strength of the peer-reviewed literature and of Government reports on smoking, such as the Surgeon General's reports on the health consequences of smoking, has been the extensive review provided by individuals knowledgeable and experienced in the topic under examination. In establishing the editorial system for the STCP monographs, NCI has decided to adopt a process that relies extensively on input from the large number of talented researchers and program personnel currently working to reduce the burden that tobacco places on our society. The following summarizes the process for compiling the Smoking and Tobacco Control Monographs.

The staff of the STCP, in consultation with its support contractor and outside experts, develops a short list of possible monograph topics or ideas for consideration, and from that list a single topic is selected. The selection is based on program need, availability of data (both within and outside the program), public health importance, and other factors. The monograph's senior scientific editor develops a detailed outline and transmits it to Institute staff along with a list of candidate authors for individual sections and chapters.

Individual authors are recruited to produce draft manuscripts. Because the monograph content is based primarily on NCI-supported intervention trials, the majority of authors are STCP principal investigators. An editorial team is assembled, consisting of the senior scientific editor and consulting editors with expertise in the area under development.

Depending on the complexity and length of the proposed material, authors are asked to produce an initial draft manuscript between 90 and 120 days after accepting their writing assignments. During this time, the authors are encouraged to discuss any problems of content, focus, or style with the monograph editorial team.

After the initial drafts are produced, a 1-day working meeting of all monograph participants (authors, editors, and STCP and contractor staff) is convened. During that meeting, each author is provided with specific comments and suggestions.

Approximately 60 days after the initial meeting, a second meeting of participants is convened, and final suggestions are provided. Within 30 to 45 days after the second meeting, a final version of each manuscript is delivered to the Institute. The individual manuscripts are then edited and consolidated into chapters by the Smoking and Tobacco Control Monograph editors.

Peer Review

All manuscripts are subjected to a two-tier peer review process. This process includes chapter reviews, whereby two or three experts in each subject area are asked to provide a critical review. Concurrent with the first review, a second peer review is conducted, involving senior scientists—individuals who have a long history of involvement in smoking control. These individuals are sent the entire monograph manuscript. Comments and criticisms from both groups are incorporated into the document by the scientific editorial team in collaboration with STCP staff.

The First Volume

This monograph was the work of dozens of individuals—STCP trial investigators, public health and smoking control experts, and scientists and experts from other disciplines.

The monograph is organized into six chapters:

Chapter 1—The Scientific Rationale for Comprehensive, Community-Based, Smoking Control Strategies

Chapter 2—Evolution of Smoking Control Strategies

Chapter 3—Smoking Prevalence and Lung Cancer Death Rates

Chapter 4—Approaches Directed to the Individual

Chapter 5—Approaches Directed to the Social Environment

Chapter 6—Interdependence and Synergy Among Smoking Control Activities.

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Chapter 1

The Scientific Rationale for Comprehensive, Community-Based, Smoking Control Strategies

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Chapter 1

The Scientific Rationale for Comprehensive, Community-Based, Smoking Control Strategies

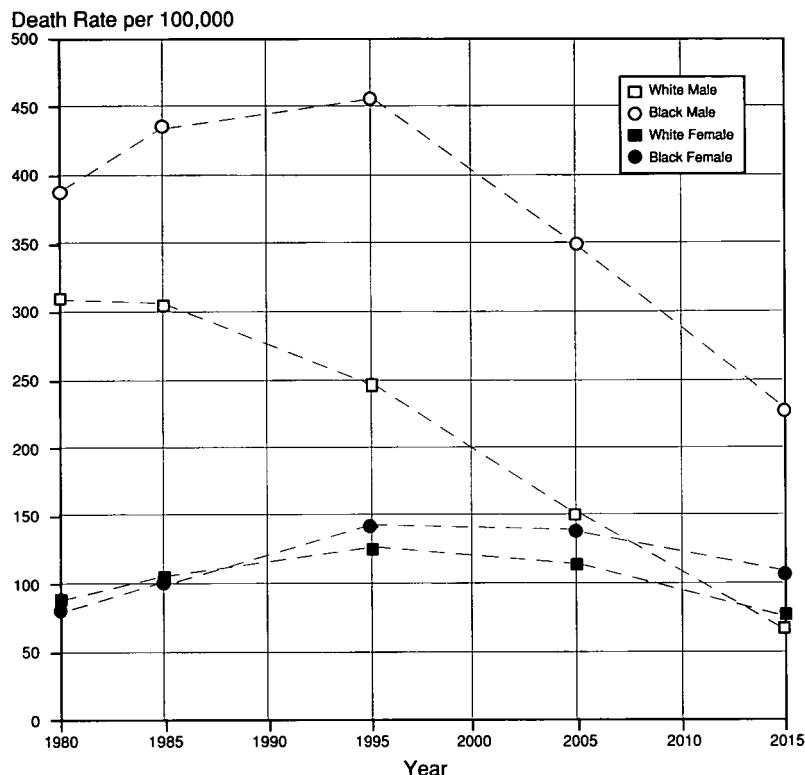
INTRODUCTION

The use of tobacco predates the discovery of the New World by Columbus, and tobacco was one of the major cash crops of the early American colonies (Robert, 1967). Efforts to control tobacco use have a history almost as long and colorful, including King James I's "Counterblaste to Tobacco" in 1604 (International Agency for Research on Cancer, 1986). However, in the last century the use of tobacco has become more widespread and more hazardous. The development of machines that could manufacture cigarettes in the late 1800's and safety matches at the turn of the century set the stage for mass marketing of cigarettes. This mass marketing of cigarettes in the United States resulted in a rapid rise in per capita cigarette consumption that began around 1910 and provided one of the first demonstrations that advertising could create demand for a product where no previous demand existed (Whelan, 1984).

Coincident with the increasing use of cigarettes was a change in the tobaccos used to manufacture U.S. cigarettes (International Agency for Research on Cancer, 1986). The smoke from those tobaccos was milder and easier to inhale and had a pH that prevented absorption of nicotine across the oral mucosa; users had to inhale the smoke into the lung to absorb substantial amounts of nicotine. The deep inhalation of tobacco smoke, with the subsequent deposition, retention, and absorption of the smoke's toxic and carcinogenic substances, dramatically changed the risks associated with tobacco use and resulted in the proliferation of lung cancer and other smoking-related diseases.

During the 1930's and 1940's, the rapidly rising rates of lung cancer in men led scientists to investigate possible causes of the epidemic, using the newly developed tools of case-control and cohort epidemiologic studies. By the mid-1950's, data from these studies allowed the scientific community to conclude that cigarette smoking clearly was hazardous to health (Study Group on Smoking and Health, 1957), and the public health community began its continuing effort to reduce the burden of tobacco-related disease by reducing smoking initiation and promoting smoking cessation.

Figure 1
Actual (1980) and projected (1985 to 2015) lung cancer death rates, ages 55 to 84*



*Forecast age standardized mortality rates using 1980 population.

The rapid rise in lung cancer death rates during this century can be closely linked to the rise in cigarette consumption by men and women of both black and white races. A model presented later in this volume (Chapter 3) predicts future lung cancer death rates based on the recent and projected future changes in smoking prevalence (see Figure 1). This model predicts that changes in smoking behavior that have already occurred will produce a decline in the lung cancer death rates for white males within the next decade, but the rates for women and for black males would not be expected to fall until after the year 2000. This prediction is based on a continuation of the current trends in smoking behavior. If the rate of smoking cessation can be increased, then an even more substantial fraction of the expected mortality from lung cancer can be averted. The comprehensive strategies for controlling tobacco use described in this volume offer the best hope of reversing and ultimately eliminating the epidemic of lung cancer that has characterized this century.

**BACKGROUND:
EFFORTS
TO CONTROL
TOBACCO USE**

This volume synthesizes what has been learned in the past 40 years of efforts to control tobacco use. As with most successful public health efforts, the current state of the art in control of tobacco use is built on a broad base of scientific investigation and includes the equally broad experience of successful and unsuccessful program activities that evolved in parallel with our scientific knowledge (Cullen, 1989).

Frequently, it is the operational experience with what works or does not work at the programmatic level that forms the core of interventions tested in controlled scientific investigations. It should come as no surprise, therefore, that current concepts of effective approaches to controlling tobacco use frequently outstrip both the tools needed to evaluate them and the data needed for definitive proof of their impact (US DHHS, 1990a). This volume presents our current best judgment of what constitutes an effective, comprehensive strategy to control tobacco use, and it draws extensively, and without apology, on the broad bodies of understanding developed by both controlled scientific investigation and the trial-and-error experience of interventions conducted in the community (Schwartz, 1987; US DHHS, 1990a).

The clear identification of cigarette smoking as a major health risk led to efforts to persuade current smokers to quit and to keep new smokers from beginning. Early approaches relied heavily on providing information about the risks of smoking (see Chapter 4). Although the impact of information campaigns was demonstrated by an increased awareness of smoking-related health risks and a decline in per capita consumption of cigarettes in the population at the time of the campaigns, it rapidly became apparent that information alone would not solve the problem. Knowledge of the health risks of smoking was transmitted to smokers and is probably a major motivational force in cessation attempts, but the vast majority of these cessation attempts failed, leaving most smokers wanting to quit but unable to do so.

In assessing the limited success of the educational campaigns against smoking, it is important to recognize that these campaigns were not presented in isolation (Schwartz, 1969). Rather, they were confronting the tobacco companies' much larger effort to promote smoking and to confuse the public about the risks of tobacco use (Whelan, 1984). In contrast to other health-based information campaigns, the effort to provide information on the risks of smoking was, and is, conducted against the backdrop of a multibillion-dollar advertising and promotional campaign that encourages cigarette smoking (Centers for Disease Control, 1990; Davis, 1987).

The tobacco industry responded to the initial burst of information on the risks of tobacco use with a combination of (1) a media effort designed to cast doubt on the level of scientific certainty about the risks and (2) a series of modifications to cigarettes (filters and lower tar content) designed to convince the public that the risk had been removed. It is not known how effective the antismoking public information campaign might have been if it had been delivered in the absence of the tobacco industry's much larger, competing campaign (Warner, 1977).

The recognition that information alone would not eliminate tobacco use shifted the focus of control strategies to the individual; programs were developed to help adults in their efforts to quit smoking and to prevent adolescents from beginning to smoke (see Chapter 4). The goal of these programs was to create psychological change within the individual that would enable successful change in smoking behavior and resistance to environmental stimuli that induce the start of smoking or a return to the practice after quitting. This focus on the individual presumed that the major determinants of smoking behavior are within the individual, a premise that turned out to be faulty, in part because many of the forces that promote smoking initiation and smoking cessation are sociological in nature rather than purely psychological. Also, the difficulty of attracting smokers and the limited resources for behavioral change that many smokers bring to such programs predict a very limited impact for individual-centered approaches relative to population-wide programs.

To broaden the appeal of individual-centered approaches, self-help programs and telephone hotlines to counsel smokers were developed (Glynn et al., 1990). These strategies did, indeed, attract a larger fraction of the smoking population, but their less intensive methods are also less effective at creating behavioral change by the smoker, leading to a lesser individual effect on a larger number of smokers.

Research on the determinants of smoking behavior and the observation that declines in cigarette consumption corresponded to changes in smokers' social and economic environment (Warner, 1977) led to a recognition that a focus on the larger social environment, rather than on the individual, could be an effective strategy for controlling tobacco use (see Chapter 5). Environmental changes that are believed to influence smoking initiation and smoking cessation include

- Increased tobacco costs;
- Antitobacco media campaigns;
- Declining social acceptability of smoking;
- Limitations on where smoking is allowed; and
- Restricted access for minors.

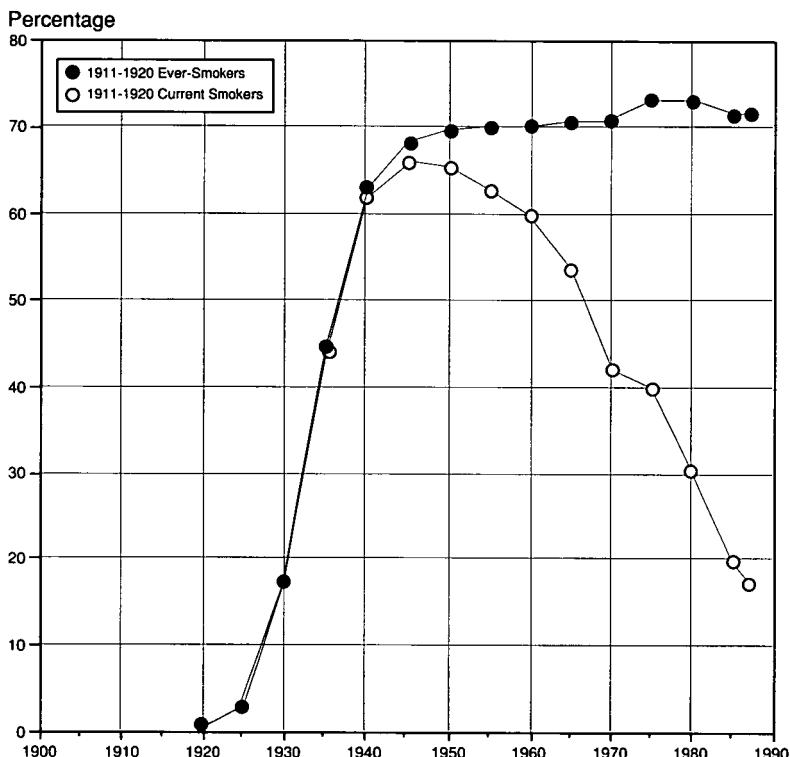
The impact of these changes is diffuse and, therefore, difficult to link to any change in the smoking behavior of an individual. However, the underlying premise of these social environment-centered efforts is that removal of environmental stimuli and reinforcements for smoking and the simultaneous creation of environmental disincentives for smoking markedly alter the personal psychological and sociological utility of smoking. This leads to higher rates of smoking cessation and lower rates of smoking initiation. If barriers to smoking are raised, the social reinforcement of smoking changed to social disapproval, and the smoker continually bombarded with messages to quit, then it is less likely that adolescents experimenting with cigarettes will continue on to dependence, more likely that smokers will attempt to quit, and, once they have quit, less likely that they will relapse.

As efforts to control tobacco use began to incorporate these social environmental approaches, it was realized that the two approaches, individual and environmental, were not competing strategies, but that they could be combined in a way that might synergistically increase their effect on smoking behavior (see Chapter 6). The combination of changing the environment to discourage smoking while simultaneously providing resources to increase smokers' ability to control their own behavior has the potential to effect substantial, sustained, population-wide change in smoking behavior (Pomrehn et al., 1990-91). These changes in the individual and in the social environment often occur incrementally and at a modest pace. Therefore, smoking behavioral changes may lag behind changes in policies or social norms. Changes in the social environment would be expected to have a modest initial impact that increases with time as the social changes percolate through the environment in which the smoker lives.

As the basis for current, comprehensive, community-based efforts to control tobacco use, this combined approach recognizes that individual and environmental inputs can be provided at multiple levels, through multiple channels, and over a relatively continuous time. Persistent and inescapable messages to quit are provided to the smoker concurrent with repeated offers of support and assistance in the quitting process (US DHHS, 1990a).

The description of control strategies presented in this volume recognizes that there is no single solution to the problem of tobacco use. Different programs have impact on different points in the process of initiation, maintenance, and cessation of smoking behavior. More than one program may simultaneously influence an individual to alter smoking behavior, and a single program may have different effects on

Figure 2
**Smoking prevalence among men born from 1911 to 1920
 (through 1987)**



individuals at different stages of smoking behavior. The recognition that smokers use the cigarette to interact and cope with their environment has led to current efforts to change both the smoker and the smoker's environment.

PATTERNS OF SMOKING BEHAVIOR

The prevalence of cigarette smoking is not uniformly distributed across the U.S. population. Cigarette smoking varies with age, gender, race, education, year of birth, and other factors (Pierce and Hatziandreu, 1989). These differences are important for assessing the disease risks associated with tobacco use, and knowledge of these patterns is essential to the development of strategies to control tobacco use.

The initiation of regular smoking is confined almost completely to those under the age of 25, and 90 percent of cigarette-smoking initiation is complete by age 21 among current cohorts (Pierce and Hatziandreu, 1989). Figure 2 shows the pattern of smoking initiation and cessation for men born in the years 1911 through 1920; initiation of smoking occurred only in early life, and the major change in smoking behavior after age 25 was cessation. This general pattern (smoking

initiation early in life and cessation later in life) appears among all subgroups of the population, but different subgroups have different rates and ages of initiation, achieve different rates of peak smoking prevalence, and have different rates of cessation (Harris, 1983). For instance, the rates of cessation are lower and prevalence of smoking is higher among individuals at lower socioeconomic levels and with lower levels of formal education (Pierce and Hatziandreu, 1989). In addition, differences in the pattern of smoking behavior between black Americans and white Americans (see Chapter 3) include a much smaller decline in the prevalence of smoking among blacks (Fiore et al., 1989).

Gender differences in patterns of smoking behavior are illustrated in Figures 3 and 4, which contrast the smoking behavior of men and women born during different decades of this century, from 1901 through 1970. The men born in the first few decades took up smoking early in the century and early in life and reached a very high peak prevalence of smoking. In contrast, the women born during the same periods began to take up smoking later in the century and consequently later in life, and they reached peak prevalence levels that were much lower than those of their male counterparts (Harris, 1983). The gender-related differences in smoking behavior among the cohorts born later in the century are far smaller, and the patterns of smoking behavior for men and women in the most recent birth cohort (1961 to 1970) are almost identical.

These differences in smoking behavior are important to the understanding of comprehensive strategies to control tobacco use because they explain the requirement for multiple channels and multiple interventions. Because of the diversity of smoking subgroups, no single approach should be expected to work for all smokers, and no single channel can be expected to reach all smokers.

The comprehensive strategies described in this volume are based on the premise that (1) specific programs to alter smoking behavior can be aimed at different points in the process of initiating, maintaining, and quitting smoking behavior and (2) a concerted effort to attack smoking behavior at each of these points will yield results far greater than those expected from the sum of the programs applied independently. Furthermore, there is an assumption that smokers must be reached within and by the structures where they live and work; therefore, a comprehensive strategy must include participation by a broad and representative selection of the groups and social structures that constitute the community in which the smoker lives (Thompson et al., 1990-91).

Figure 3
Changes in smoking prevalence among U.S. males born from 1901 to 1970 (through 1987)

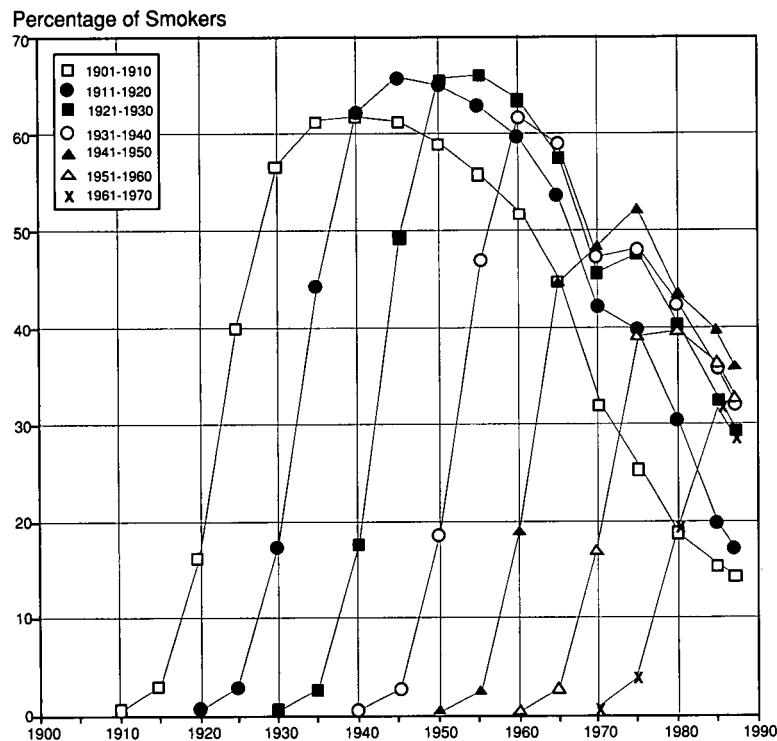
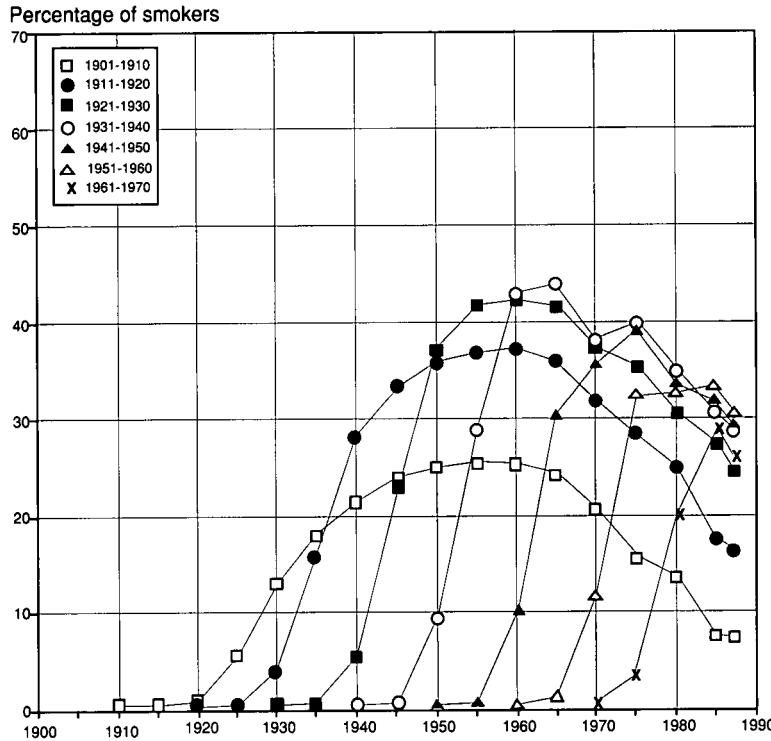
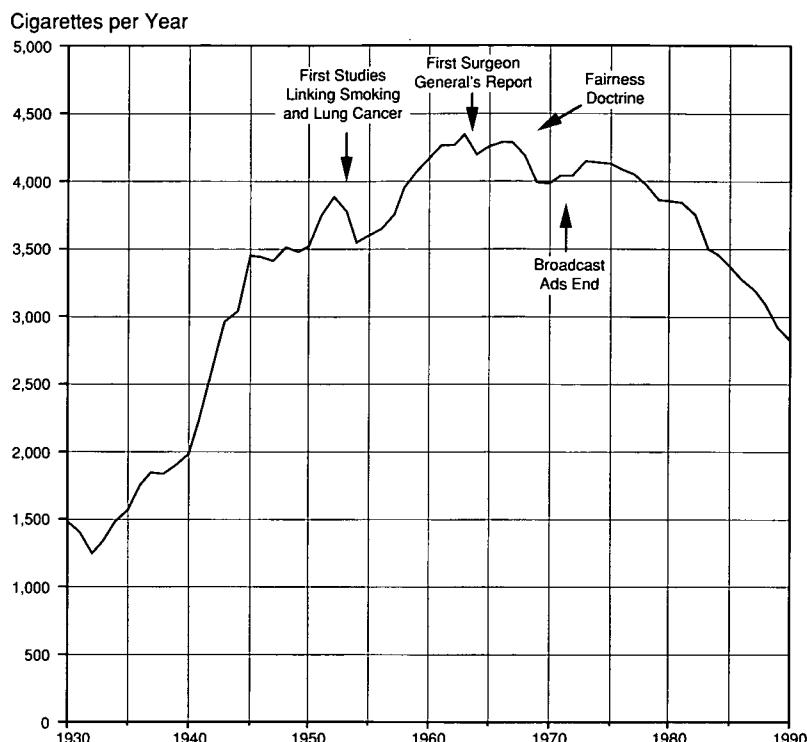


Figure 4
Changes in smoking prevalence among U.S. females born from 1901 to 1970 (through 1987)



**Figure 5
U.S. per capita cigarette consumption for adults, aged 18 and older (1930 to 1990)**



ROLE OF PUBLIC INFORMATION CAMPAIGNS

One of the earliest responses to the scientific data that established the risks of smoking was an information campaign to communicate the health risks of cigarette smoking with the expectation that relaying the risk information to the smoking public would lead to changes in smoking behavior. Clearly, these information campaigns have been successful in communicating risk information at the simplest level: In recent surveys, more than 80 percent of current smokers agreed that smoking is harmful and even that it is harming them as individuals (Pierce and Hatziandreu, 1989). Information campaigns have been less successful, though, at transmitting an understanding of the magnitude of the risks associated with smoking (Shopland et al., 1990).

The expected change in smoking behavior did occur, but it was far more limited than had been hoped (US DHHS, 1989), suggesting the individual smoker's difficulty with breaking his or her dependence on tobacco. Figure 5 shows the changes in cigarette consumption during this century and suggests the relation of such changes to media information campaigns. Per

capita consumption of cigarettes declined with each of these major informational events:

- A substantial downturn in consumption coincided with the lay media's presentation of scientific evidence establishing the risks of smoking in the mid-1950's.
- A smaller downturn occurred with the publication of the first Surgeon General's Report in 1964 (US DHEW, 1964) and the resultant media coverage.
- A major downturn in per capita cigarette consumption also occurred during the late 1960's; between 1967 and 1970, mandated antitobacco spots were shown on television to counter cigarette advertisements. When cigarette advertisements were banned from television in 1970, the bulk of the antitobacco advertising campaign also disappeared, and per capita cigarette consumption again increased.

Information alone is often dismissed as a means of influencing smoking behavior, but information about smoking-associated disease risks provides much of the motivational substrate for individual cessation efforts and is likely to trigger cessation attempts. It is clear, however, that these informational campaigns of themselves were unable to create and sustain cessation in the majority of smokers.

RESULTS OF EARLY TOBACCO CONTROL EFFORTS

The decline in smoking prevalence over time within a given birth cohort has led to the suggestion that aging is the dominant influence on smoking cessation. But the attribution of cessation to advancing age ignores the fact that activities to control tobacco use have increased over the last four decades, concurrent with the aging of the individuals that make up the birth cohorts. By examining the changes in smoking prevalence for the four oldest birth cohorts of males, one can see that the point where smoking prevalence begins to decline in each cohort is in the mid-1950's, which suggests that events in the social environment influenced all of the different cohorts simultaneously, regardless of age. The four earliest cohorts are cited because men born later would not have completed the initiation of smoking by the time of the 1950's campaigns.

Figures 6 and 7 present these data more clearly, showing the percentage of former smokers in each of these four earliest cohorts of black and white men, plotted by calendar year. The percentage of former smokers among white males in the earliest cohorts begins to rise in the 1950's. There appears to be an effect of age, with the oldest cohorts having the highest percentage of former smokers, but all of the cohorts show steep rises in the proportion of former smokers during the 1950's and 1960's, which suggests that the major effect is related to calendar year rather than to age.

Figure 6
Percentage of former smokers, black males born from 1901 to 1940 (through 1987)

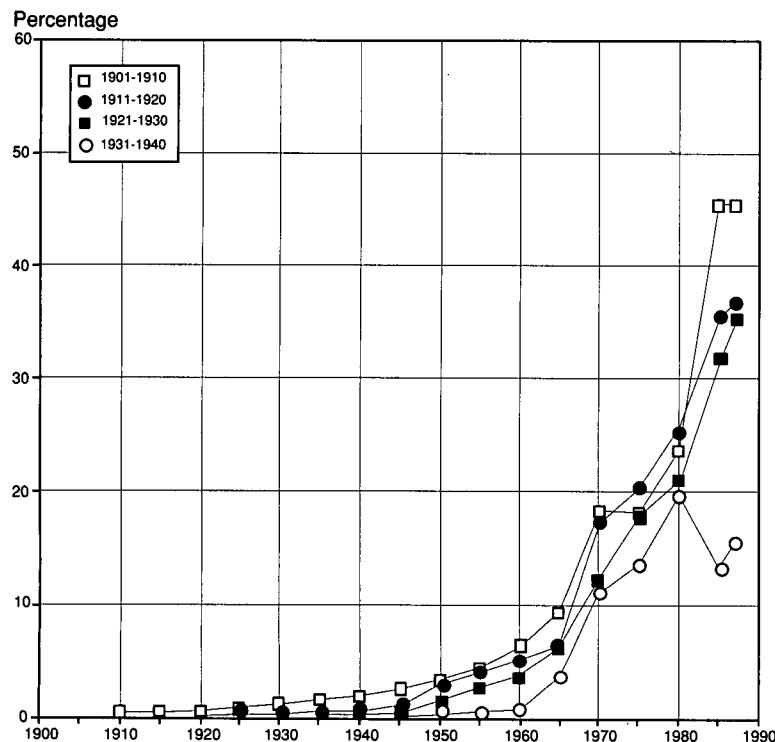
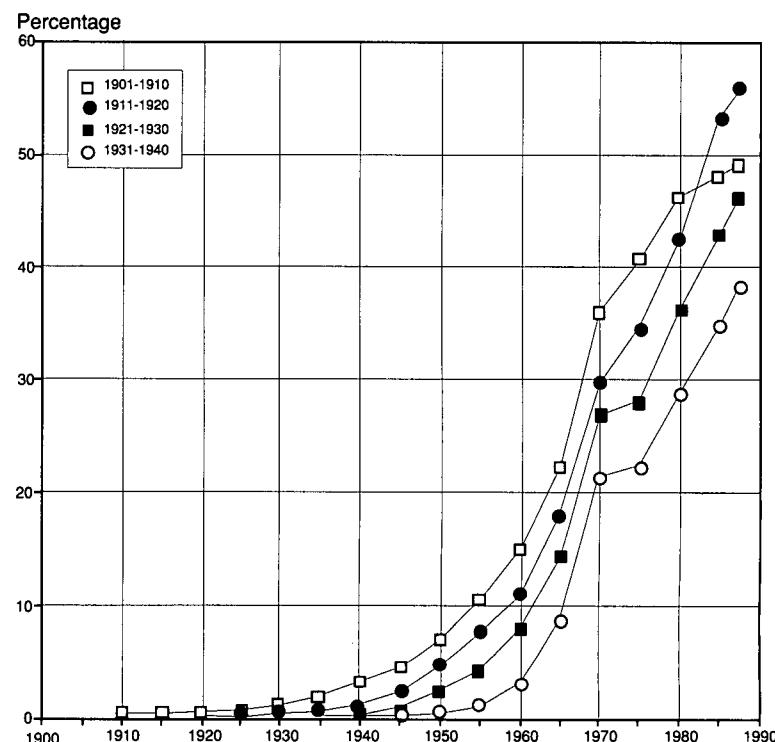


Figure 7
Percentage of former smokers, white males born from 1901 to 1940 (through 1987)



The change in the percentage of former smokers that occurs with calendar year is quite different for black males than for white males. Among the white males, a sharp upturn in the prevalence of former smokers begins in the 1950's and accelerates during the late 1960's. For black males, the prevalence of former smokers remains almost zero until the late 1960's. This difference between white and black males is even more evident when the fraction of smokers who have quit during each 5-year period (Figures 8 and 9) is plotted against the calendar year. Both black and white males show large changes in smoking prevalence during the period of counter-advertising on television (1967 to 1970), but only white males show a change in smoking behavior during the first wave of public information on the risks of tobacco use (in the mid-1950's), which relied much more heavily on print media.

The question of racial differences in source or timing of information transfer can be explored through comparison of the 5-year quit rates in the same birth cohorts of white women (Figure 10). The pattern in the white female cohorts is similar to that of black men rather than that of white men, with very little change in smoking behavior until 1965 to 1970. This suggests that the absence of an effect in black men corresponding to the early public information campaigns is not solely a racial phenomenon. The early studies of smoking-related disease risk were conducted largely with white males (US DHHS, 1982), so the absence of data on women and on black men may have prevented these groups from relating the risk information to themselves. On the other hand, the counter-advertising campaign of the late 1960's used messages and themes that addressed a range of issues in addition to health risks (Warner, 1977). This broader range of messages may have reached women and black males unaffected by the earlier health messages and may have been responsible for the greater level of smoking cessation in all racial and gender groups.

For all of the racial and gender groups, the rates of cessation plummeted when the antismoking spots were removed from television. This observation lends further support to the theory that the intensive media campaign against smoking had a profound effect on smoking behavior (US DHHS, 1989; Warner, 1977).

The provision of information to the smoker on the disease risks of smoking did not lead to successful cessation by the majority of smokers. The recognition that most smokers who wanted to quit were unable to do so on their own led to the development of programs that would produce change within smokers that would help them to break their addiction. The goals of these programs included providing smokers with the

Approaches to Influencing The Individual

Figure 8
Percentage of black male current smokers quitting over 5-year intervals

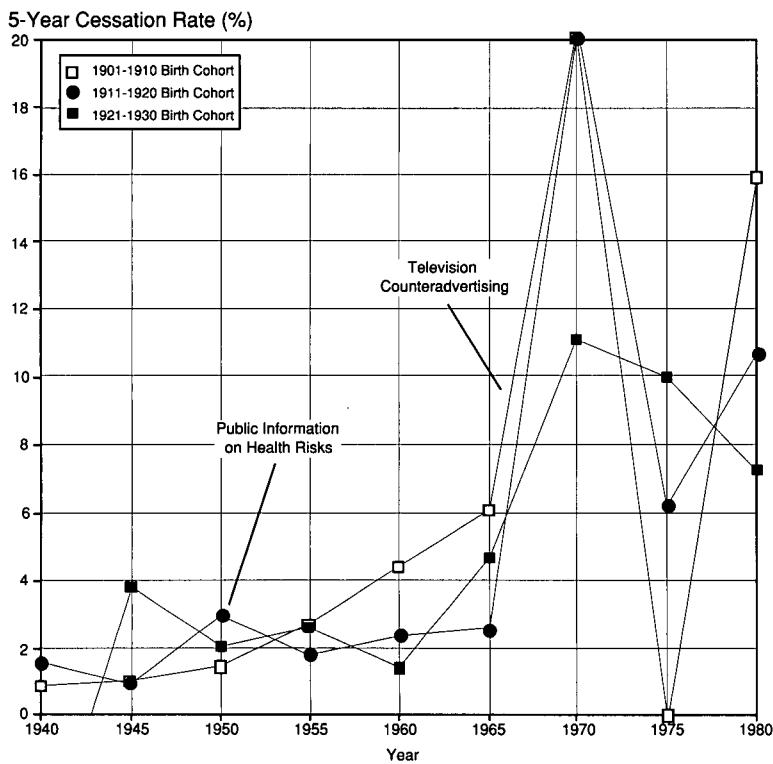


Figure 9
Percentage of white male current smokers quitting over 5-year intervals

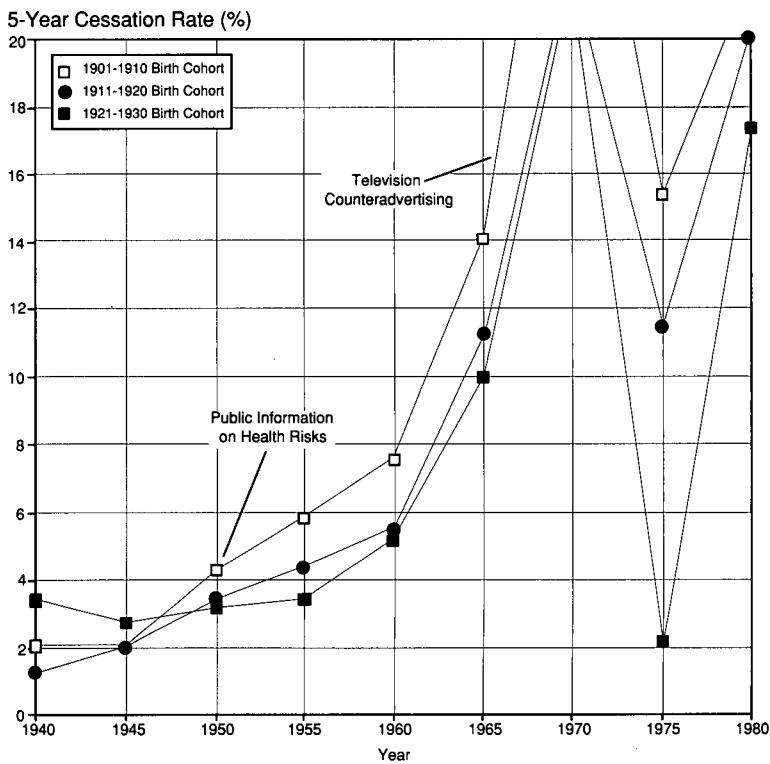
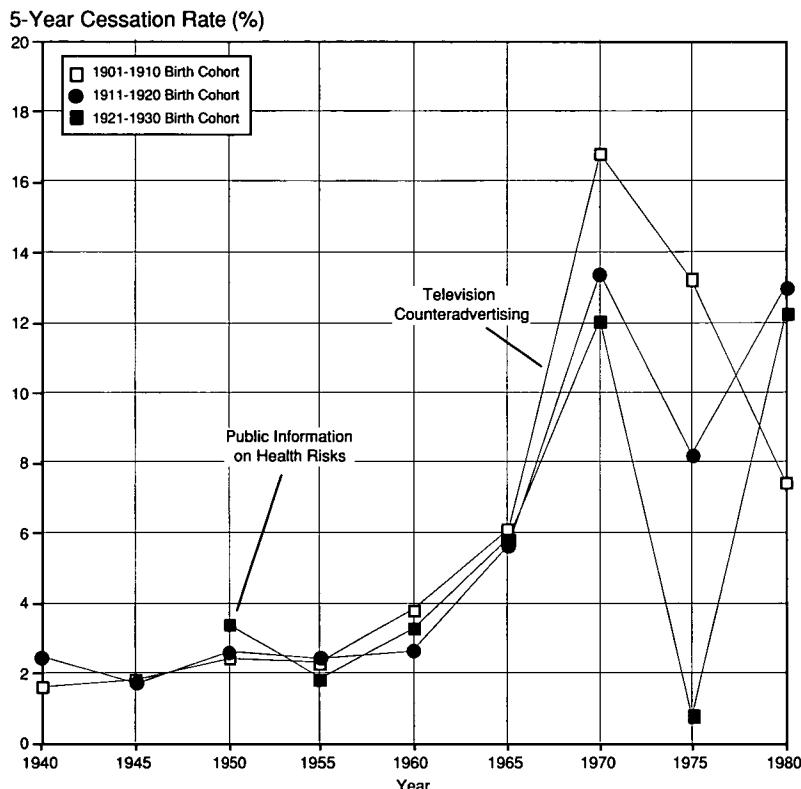


Figure 10
**Percentage of white female current smokers quitting over
 5-year intervals**



tools to change their behavior, changing the behavioral conditioning surrounding smoking, and altering the coping strategies used by smokers (see Chapter 4). However, the common link in all of these approaches was the attempt to alter the individual so that he or she could make the desired change in behavior in spite of environmental influences that promote smoking.

It was believed that the individual could be strengthened and retrained to eliminate dependence on cigarettes, and the multicomponent programs described in this volume have demonstrated that it is possible to produce long-term cessation in a large proportion of smokers willing to complete these programs. The major problem with clinic-based cessation programs has been the difficulty of convincing smokers to participate. An overwhelmingly large percentage of those who successfully quit smoking, and an even larger fraction of those who *attempt* to quit, do not use a clinic-based cessation program but try to quit on their own (Fiore et al., 1990; US DHHS, 1990b).

A companion problem has been program costs. One concept that emerges from evaluations of the various clinic programs presented in Chapter 2 is that the more intensive the program, the more likely it is to be successful. Programs with a greater number of sessions, professional rather than volunteer leaders, and more extensive followup and maintenance support show better results. As a result, the current state-of-the-art clinic-based cessation programs are expensive in time, energy, and dollars. The high costs for individuals, for insurance companies, and for health care providers are barriers to access.

It is unlikely, however, that cost alone is the major reason why clinic-based cessation programs get little use, since other, more expensive prevention efforts (such as diagnosis and management of essential hypertension) have enjoyed excellent results. It is more likely that the major limitation is the low demand for these programs by U.S. smokers. The long-term financial benefit for the individual and for society may outweigh the short-term cost, but those short-term costs, coupled with smokers' perceptions of little need for the programs, have markedly constrained the impact of clinic-based cessation programs on the prevalence of smoking.

Approaches to Influencing The Environment

The limited impact of clinic-based cessation programs, together with growing recognition of the importance of environmental factors in smoking behavior, led to the shift in tobacco control strategies described in Chapter 5. The association of shifts in global measures of U.S. tobacco use, such as per capita consumption, with changes in the environment, such as the shrinking social acceptability of smoking, has led to attempts to alter those environmental factors as a means of altering smoking behavior.

Raising the cost of cigarettes as a public health strategy has been accomplished through increased excise tax on tobacco, and the manufacturers have also substantially increased the cost of cigarettes (Grise, 1991). As described in Chapter 5, increases in the excise tax have generally resulted in a substantial and immediate fall in cigarette consumption, but the effect dissipates with time (Tobacco Institute, 1990). The experience in California, which raised its excise tax on tobacco by 25 cents on January 1, 1989, is presented in Figure 11, wherein California's per capita cigarette consumption is contrasted with that for the rest of the United States (California Department of Health Services, 1990). There was a rapid decline in per capita consumption coinciding with the California tax increase that was not present in the rest of the country. Analysis of those data suggests that there was a 5 percent decline in per capita cigarette consumption attributable to the increase in the tax (J. Elder, personal communication).

Figure 11
Impact of California state tax increase on per capita consumption of cigarettes, adults aged 18 and over

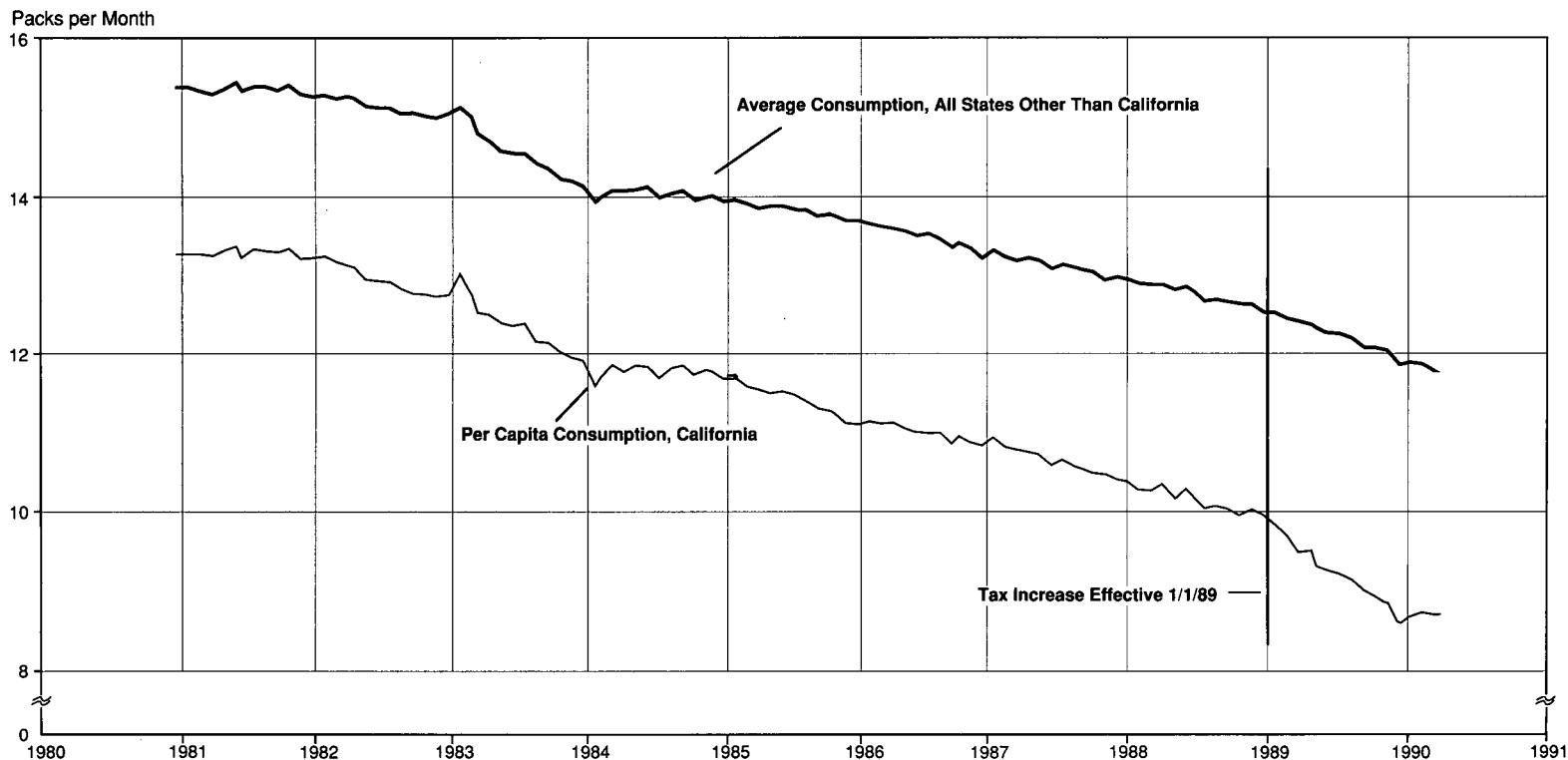
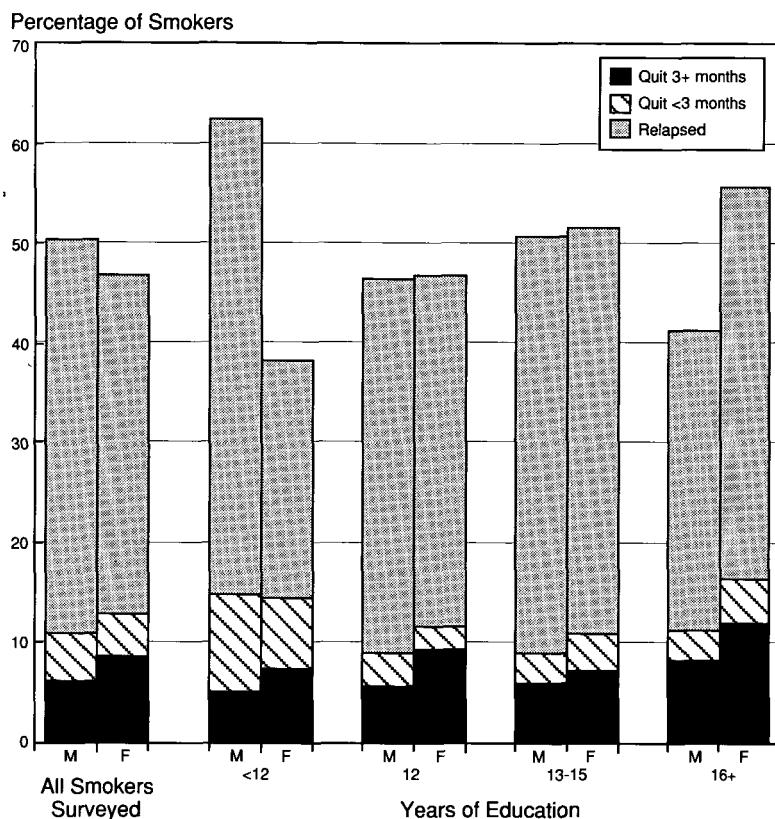


Figure 12
Smoking relapse rates, by gender and level of education
(California smokers, 1990)



One concern about using cost as a strategy to control tobacco use has been that the resulting decreases in tobacco consumption may be transitory; they may reflect large numbers of smokers trying to quit around the time of the tax increase, then relapsing, with no long-term change in the prevalence of smoking in the population. Evidence to support this concern is provided by a survey of California smokers conducted 18 months after the 1989 excise tax increase (California Department of Health Services, 1990). Figure 12 shows the status of all those who had been smoking 12 months prior to the survey. About one-half of those Californians who had been smoking 12 months prior to the survey made an attempt to quit, in contrast to approximately one-third of smokers in national surveys. However, the fraction of those who were smoking 12 months previously and who currently had been nonsmokers for 3 months or more is no larger in California than in the national surveys. This suggests that the tax may

have stimulated an increase in the number of cessation *attempts* but not increased the number of smokers *able to quit* successfully.

Because the majority of current smokers began smoking before the age when it is legal to buy cigarettes in most states, the access of minors to cigarettes is seen as an important precondition for the initiation of smoking behavior (US DHHS, 1989). The disparity between the consequences of cigarette use and the availability of cigarettes to minors through legitimate channels is greater than for any other dependence-producing substance in our society. More than 80 percent of children are able to purchase cigarettes over the counter, and minors essentially have no difficulty buying cigarettes from vending machines (see Chapter 4). The fact that this country's single largest cause of death and disability is sold to children through unattended vending machines has galvanized legislators in an increasing number of jurisdictions to restrict or ban the sale of cigarettes through vending machines (Tobacco-Free America, 1990), and it has promoted efforts to educate merchants and enforce the law prohibiting sales to minors (US DHHS, 1990c).

The social acceptability of cigarette smoking has been declining since at least the early 1970's (US DHHS, 1989). This decline is based on concerns about the disease risks of exposure to environmental tobacco smoke as well as irritation and annoyance produced by exposure to others' tobacco smoke. By early 1971, the probability that environmental tobacco smoke exposure could cause a substantial disease risk had been clearly announced by then U.S. Surgeon General, Jesse L. Steinfeld, M.D. (Steinfeld, 1972). The body of scientific data on this topic that developed subsequently and the national reviews of those data (US DHEW, 1972, 1975, and 1979; US DHHS 1982 and 1986; National Research Council, 1986; U.S. Environmental Protection Agency, in press) have led to increasing restrictions on where smoking is allowed (Pertschuk and Shopland, 1989). Regulations that established separate seating areas in airplanes and restaurants and banned smoking in public places put smokers on notice that their behavior annoyed a substantial number of nonsmokers, and the new rules empowered those nonsmokers to express that annoyance. The outcome was a slow but steady erosion of the rewards of smoking and a change in the smoker's self-image. A large part of the smoker's dependence on the cigarette is conditioned by the personal psychological and sociological utility of smoking. Removing this utility undercuts the foundation of tobacco addiction.

A more recent outgrowth of the increasing concern about the risks associated with exposure to environmental tobacco smoke has been absolute bans on smoking at worksites, on airlines, and in other locations (Shopland et al., 1990) (see

Chapter 5). These bans reinforce the social unacceptability of smoking by incorporating it into the norms for workplace behavior, and they keep the smoker from smoking on the job. Eliminating smoking at work may prevent young smokers from learning to use the cigarette to deal with workplace stress and may give older smokers experience in coping with life stresses without cigarettes, thereby improving their chances for success when they try to quit smoking. In addition, a smoker who has quit may be less likely to relapse in a work environment where smoking is not permitted.

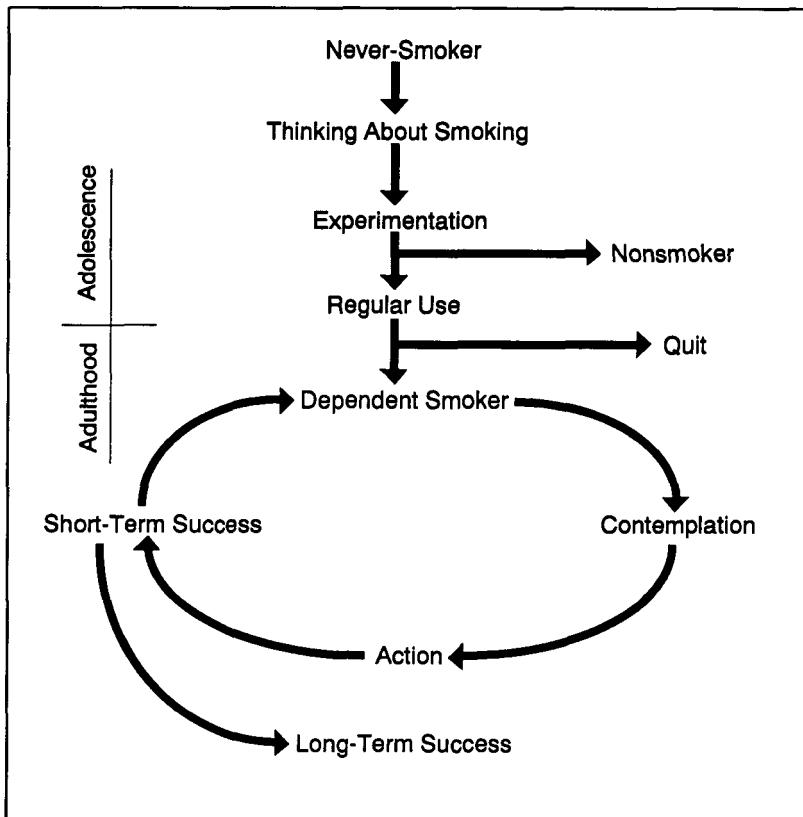
The specific relationship of advertising and promotion to smoking initiation and tobacco use is not clear, but it is clear that tobacco advertising presents images of smoking and smokers that are attractive to adolescents (Fischer et al., 1989). A concern is that the advertising images are most attractive to those adolescents with the least objective verification of their self-worth from their own social environment. This effect may explain the differences in smoking behavior between adolescents in school and adolescents who have dropped out (Pirie et al., 1988). The potential effect of advertising on the most vulnerable segments of society has led to efforts to restrict tobacco advertising and promotion at both national and local levels.

COMPREHENSIVE CONTROL STRATEGIES

As the focus of control strategies expanded beyond the individual to include the environmental factors described above, our understanding of smoking initiation and cessation also expanded. Researchers and health educators came to recognize that both smoking initiation and smoking cessation are dynamic, multistage processes, rather than linear, dichotomous events (Prochaska and DiClemente, 1986). It was also understood that smoking could be attacked at multiple stages in these processes and that different strategies could affect different stages with potentially synergistic outcomes. Programs that alter environmental influences, such as media campaigns, have proven much more effective when they are supported by resources to help individual smokers in their cessation efforts (see Chapter 5).

The current state of the art in controlling tobacco use combines multiple environmental changes with multiple programs directed to individuals in different stages of the initiation and cessation processes. It recognizes that no single approach is best for all smokers and that different smokers are most attracted to and most affected by different programs. Perhaps more importantly, it recognizes that no single channel reaches all smokers and that no single time is best for all smokers to make an attempt to quit. Comprehensive strategies are characterized by the delivery of persistent and inescapable messages to quit, or to not start, smoking, coupled with continuously available support for individual cessation efforts

Figure 13
Processes of smoking initiation and cessation

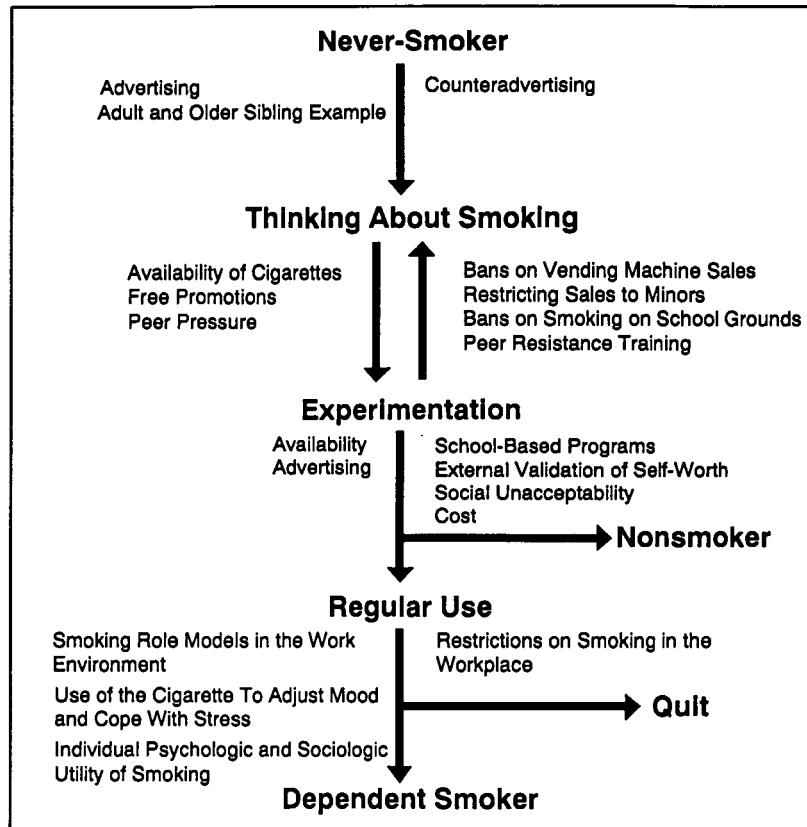


provided through multiple channels, and reinforced by environmental incentives for nonsmokers.

One formulation of the processes involved in cigarette initiation and cessation is presented in Figure 13. Exploration and initiation of regular cigarette use is largely confined to adolescents, with the transition from regular use to dependence during late adolescence and early adulthood. Experimentation with cigarettes and initial use is heavily influenced by issues that are active during adolescent development, whereas dependent use of cigarettes develops when smokers incorporate the personal psychological and sociological utility of smoking into the methods by which they function in and cope with the adult world. Many adolescents experiment with tobacco use but never become regular smokers, and some adolescent regular smokers stop before they become dependent on cigarette use.

The process of quitting smoking is often a cyclical one, with the smoker making many attempts to stop before finally

**Figure 14
Forces that influence adolescent progression into adult smoking**



gaining success. About one-third of current smokers attempt to quit each year, but 90 percent or more of those attempts fail (Pierce and Hatziandreu, 1989). Clearly, those who have unsuccessfully tried to quit need to be motivated to try again. A useful conceptualization of the cessation process is one in which smokers cycle through the stages of cessation, and each time smokers go through the cycle, a few more succeed in their efforts to quit. One goal of control strategies, then, is moving smokers from one stage of the cessation cycle to another, rather than using long-term cessation as the only goal and outcome measure of a program.

Affecting the Initiation Process

The development of tobacco dependence is not sudden, and the process of initiating tobacco use is a gradual one that probably begins early in adolescence or preadolescence. As outlined in Figure 14, the first step in the process is thinking about smoking cigarettes, and as children move into their teen years, a substantial fraction change from believing that they

will never use cigarettes to considering experimentation with smoking. The omnipresent images from tobacco advertising of the smoker as a confident, attractive, and secure individual (Tye, 1985), as well as examples of adult and older sibling smokers, are powerful inducements for children to perceive smoking as an entry into adulthood. Counteradvertising that creates a negative image of the smoker—for example, the smoker as inadequate and less mature—can be used in an effort to offset these influences.

The transition from thinking about smoking to having the first cigarette may not lead irreversibly to adult smoking, but clearly it is an important milestone in that passage. The widespread availability of cigarettes to teenagers and, particularly, the promotional distribution of free cigarettes, many of which are given to teens either directly or indirectly, clearly facilitate the teenager's experimentation with smoking. In contrast, programs that immunize teens through assertiveness training and modeling of refusal responses can be used to block this stage of initiation (Glynn, 1989).

The change from occasional experimentation with cigarettes to regular cigarette use is critical, because with regular use the adolescent develops a body of experience in which smoking is psychologically and sociologically useful. Clearly, the ability to purchase cigarettes easily, the social rewards, and peer acceptance of the teen's smoking behavior are critical to the development of regular use. However, the images created by tobacco advertising may also play an important role. The advertising images of the smoker as a confident, physically and sexually attractive, successful, and secure adult may resonate strongly in the adolescent who desperately wants to adopt and project those images. The ability to superimpose the advertising image on his or her own inadequate self-image makes the adolescent feel better, at least temporarily, and teenagers thus begin to develop a body of experience with the use of the cigarette to adjust their internal mood. Those adolescents without external validation of their self-worth have the greatest need to adjust their self-image and thus may be more likely to use cigarettes to do so.

School-based health education programs and programs that raise adolescents' self-esteem, as well as efforts to restrict advertising and promotional activities, are aimed at altering the transition to regular smoking (Glynn, 1989). Raising the cost of cigarettes, because adolescents have limited disposable income, and increasing the social unacceptability of smoking, even among teens, are further barriers to the transition.

Progressing from regular use to dependent use requires that the utility of tobacco use persist after the pervasive anxieties of

adolescence dissipate. For utility of the cigarette to continue, cigarette smoking has to be allowed in those situations when the smoker wants to use the cigarette. For smokers to learn to use cigarettes to handle stress at work, they must be allowed to smoke at the time when those stresses occur. If smoking is banned in the worksite, not only do smokers learn to not use the cigarette to cope with those stresses, but also they are obligated to develop alternative mechanisms to handle stress, and those mechanisms may be substituted for smoking in other settings as well.

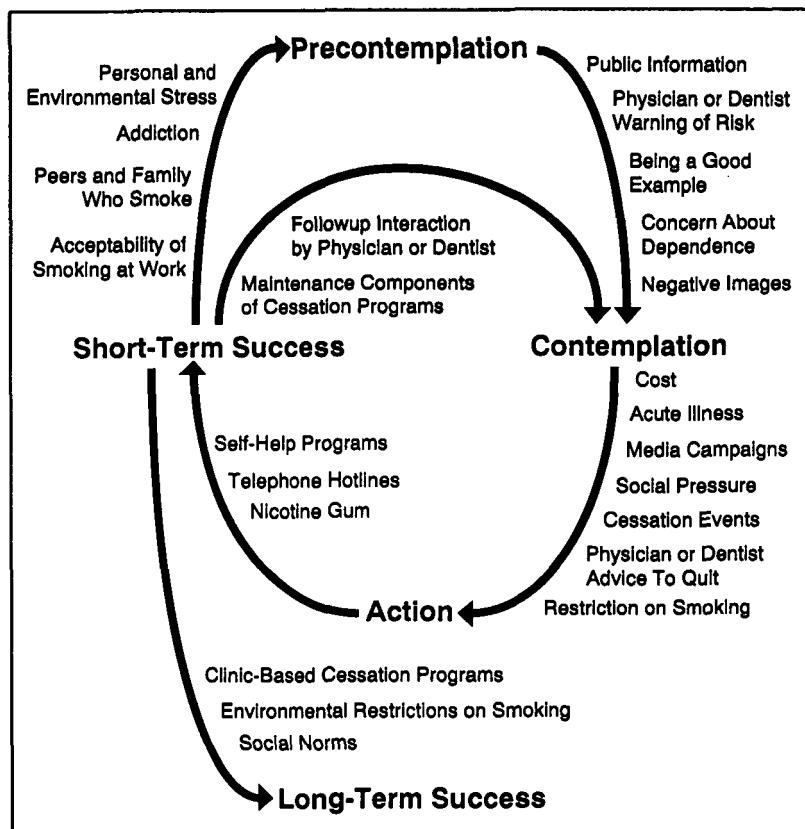
The socialization of an adolescent into the workforce may include powerful social reinforcement for smoking behavior, particularly in the military environment. Older role models and social norms that promote smoking can increase the utility of smoking for the young smoker and facilitate the transition to dependency. Conversely, the elimination of smoking from the worksite and the development of workplace norms that discourage smoking may weaken the dependence on tobacco and increase the development of other coping skills.

Affecting the Cessation Process

The majority of smokers want to quit, and this desire culminates in attempts to quit by approximately one-third of smokers each year (Pierce and Hatzisandreu, 1989). The cyclical pattern of not thinking about quitting (precontemplation), thinking about quitting (contemplation), and attempting to quit—with success or failure—generates a new set of nonsmokers each time a group of smokers passes through the cycle (Prochaska and DiClemente, 1986). One formulation of the process of cessation, and the points at which specific smoking control interventions can influence the stages of cessation, is presented in Figure 15. The diagram is a simplification of the effects of smoking control efforts, but it gives an overview of the possible interactions in a comprehensive control program.

Many environmental influences and programs for controlling tobacco use are intended to influence smokers at different points in this cycle. Public information campaigns that present the risks associated with smoking are intended to move smokers from the precontemplation to the contemplation stage, as is personalizing of the risk of smoking through physicians' warnings. However, there are other reasons why smokers think about quitting, including concerns about addiction to cigarettes and interest in being a good example. Recently the negative image of the smoker and the social unacceptability of smoking have also provided strong reasons why smokers think about quitting. Individual programs to control tobacco use can aim and have been aimed at altering the frequency and intensity with which these motivational issues are presented to the smoker.

Figure 15
Process of cessation



The move from thinking about quitting to making an attempt to quit is often triggered by a variety of environmental stimuli. The data from California presented above suggest that an increase in the cost of cigarettes can be a powerful trigger for cessation attempts.

A physician's or dentist's advice to quit smoking, particularly when it is related to an acute illness, also is a powerful trigger for cessation, with up to half of the patients who are advised to quit making a cessation effort (US DHHS, in press). Media campaigns, especially when coupled with cessation events such as the Great American Smokeout, also can trigger cessation attempts by large numbers of smokers (Gunby, 1984). Changes in workplace rules to restrict smoking on the job have been associated with attempts to quit by a substantial number of workers.

Triggering cessation efforts, whether or not they succeed, is an important strategy because each round of cessation activity results in a few more nonsmokers. The large proportion of smokers who attempt to quit each year is a testament to the success of those components of the control effort that are designed to move smokers from precontemplation to contemplation and from contemplation to action. The major gap in current control efforts is in converting cessation attempts into long-term successes.

Self-help programs, telephone hotlines, and nicotine gum are all useful enhancers of short-term success in smoking cessation, and clinic-based programs have a substantial benefit for long-term cessation for those who can be recruited to participate (Schwartz, 1987). However, the major barriers to long-term success remain difficult to alter and, with the exception of addiction, are largely in the smoker's environment. They include social norms and workplace rules that promote smoking and facilitate relapse, the continued smoking behavior of peers and family members, and unusual episodes of stress that lead the smoker to fall back on old coping strategies, including smoking. Long-term success remains the most elusive component of a comprehensive strategy to control tobacco use; however, the prospect of continued changes in social norms and tighter restrictions on where smokers can smoke offers hope that even this component may show improvement in the future.

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Evolution of Smoking Control Strategies

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Chapter 2

Evolution of Smoking Control Strategies

INTRODUCTION

Evidence linking cigarette smoking with cancer began to accumulate in the 1930's and rapidly increased in the late 1940's and early 1950's. Four retrospective studies of the smoking habits of lung cancer patients and controls were published in 1950 (Doll and Hill, Levin et al., Schrek et al., Wynder and Graham), and each noted a consistent, statistically significant association between smoking and cancer of the lung.

Between 1954 and 1958, Hammond and Horn reported the findings of their large-scale prospective study of 187,783 U.S. males that showed significantly higher overall death rates for smokers than for nonsmokers. In the same years, a prospective mortality study of 40,000 British physicians provided independent demonstration of the relationship between cigarette smoking and disease (Doll and Hill, 1954 and 1956). The strength and consistency of these results, combined with evidence from laboratory and autopsy studies, led a national scientific study group to conclude that there was a causal relationship between smoking and lung cancer (Study Group on Smoking and Health, 1957).

In the following sections, this chapter describes how strategies for reducing the prevalence of smoking in the United States have evolved from the simplest approaches to information dissemination, through clinics and self-help techniques, to contemporary, comprehensive approaches to smoking control—employing multiple strategies drawn from every relevant sector of our environment. The discussion is organized under topic headings, as follows:

- Information and Education Campaigns
- Cessation Program Strategies
- Prevention Strategies
- A Comprehensive Approach to Smoking Control
- Conclusions

INFORMATION AND EDUCATION CAMPAIGNS

In the early 1950's, a few popular publications transmitted the new scientific findings about smoking to the lay public. There were several reports in *Reader's Digest* (Lieb, 1953; Miller and Monahan, 1954; Norr, 1952; Riis, 1950) and in *Consumer Reports* (1953, 1954, and 1955) that informed the public of the health hazards of smoking. By the mid-1960's, information

and education campaigns—both private-sector and Government-funded—became more intensive.

Recognition of the health hazards of smoking led to organized efforts to inform smokers about the risks of tobacco use, with the expectation that large numbers of smokers would be convinced of the need to quit (Flay, 1987a). Media-based messages and educational campaigns were the earliest smoking control activities.

The 1964 Surgeon General's Report on Smoking and Health accelerated the Government and the voluntary health organizations' efforts to educate and inform the public about the hazards of smoking (US DHEW, 1964). The attention generated by the legislative requirement for an annual Surgeon General's Report, and the media coverage surrounding its release, became one of the primary ways that the Federal Government informed the public about the health consequences of tobacco use. Since 1966, the Government has required a health warning on all cigarette advertising and on every package of cigarettes sold in the United States.

The National Clearinghouse for Smoking and Health and national voluntary health organizations were also among the early sponsors of newspaper advertisements against smoking and of antismoking campaigns on television and radio. The American Cancer Society, the American Lung Association, and the American Heart Association used mass distributions of pamphlets, posters, and films to detail the risks of tobacco use. The voluntary health agencies also developed antismoking public service announcements.

Interagency councils on smoking and health and Federal, state, and local health departments participated in the anti-smoking campaign. Educational materials and programs were introduced in local communities, schools, hospitals, and businesses. Medical, dental, and public health groups joined in the campaign to curtail smoking. As a result of the educational campaigns precipitated by the accumulation of scientific evidence, temporary declines in total per capita consumption of cigarettes occurred during 1953 to 1954, 1964, and 1968 to 1970. These declines coincided with periods of increased publicity about the health hazards of cigarette smoking (US DHEW, 1979).

The statutory ban on broadcast cigarette advertisements virtually eliminated antismoking messages, as well, from prime viewing hours after 1971. Some studies (Schneider et al., 1981; Warner, 1977) attribute the subsequent increase in cigarette consumption in 1972 and 1973 to the discontinuation of the antismoking commercials.

The tobacco industry responded to these public information campaigns by denying that cigarette smoking caused disease, and industry spokespeople used the media to dispute the link between smoking and disease. In addition, they adopted a strategy that included attacking weaknesses in individual scientific studies—as a method of discrediting the large and growing body of information that was establishing the risks of smoking—and confusing smokers about the level of scientific certainty about the causal relationship and the importance of quitting.

At the same time, cigarette manufacturers were developing and marketing new filter cigarettes to ease (and take advantage of) smokers' growing health concerns. Filters were advertised as a technological improvement to remove the harmful elements of smoke (US DHHS, 1989). In 1952, when reports linking cigarettes to lung cancer first appeared, 1 percent of all cigarettes were filter-tipped (US DHHS, 1989). By 1954, the percentage of filtered cigarettes had increased to 9 percent. The filter-tip market share rose by at least 9 percentage points during each of the next 3 years, reaching 38 percent by 1957. By the time the 1964 Surgeon General's Report was published, the market share of filter cigarettes had reached 61 percent.

During the 1970's, the industry adopted a second marketing strategy in response to the increasing awareness and concerns of smokers. The advertising campaigns of this period encouraged smokers to switch to low-tar and low-nicotine cigarettes. Smokers' acceptance of low-tar and low-nicotine cigarettes accelerated rapidly.

At least 3 million people succeeded in quitting smoking in 1954 (Horn, 1978). In subsequent years, between 1 million and 3 million people gave up smoking each year (Horn, 1978); however, many more smokers tried to quit but did not succeed. Many smokers were dismayed to discover that long-term success was elusive.

Increasing awareness of the problems created by tobacco use, and the difficulties associated with achieving and maintaining cessation, led to the gradual adoption of more comprehensive and intensive approaches to the reduction of tobacco use.

Smoking cessation clinics were developed to address the difficulties smokers had in quitting on their own. Early clinics combined medication with educational lectures, pamphlets, and physician counseling over a 10-day course. During the 1960's, more than 100 smoking cessation programs were reported in the United States, Canada, 11 European countries,

CESSATION PROGRAM STRATEGIES

and Australia (Schwartz, 1969). During the 1970's, about 300 cessation methods were reported in the literature (Pechacek, 1979; Schwartz, 1977 and 1987).

A listing of cessation programs reported over the past four decades reveals a change in the emphasis of cessation methods (Schwartz, 1987). In the late 1950's, methods were primarily educational or medication-based (Schwartz, 1969). The leading programs in the 1960's and 1970's were 5-day plans, group discussion, and conditioning-based procedures such as rapid smoking and satiation (Schwartz and Rider, 1978). Other popular treatments in the 1970's were self-help in the form of "how-to-quit" manuals, books, filters, and over-the-counter drug products; group therapy; professional counseling; hypnosis; and cognitive-based, self-management approaches. The approaches that were emphasized in the 1980's (Schwartz, 1987) include self-help, multiple-component programs, hypnosis, acupuncture, physician advice and counseling, nicotine chewing gum, skills training and relapse prevention, and mass media and community programs.

Most of the early smoking cessation clinic approaches focused on changing smokers to enable them to alter their behavior and to resist environmental influences to smoke. The limited success of these early approaches, in terms of both smoker recruitment and long-term cessation, has led to a greater appreciation of the role of environmental influences on smoking behavior. A major emphasis of efforts to control tobacco use has been on altering the smoker's environment in ways that will promote cessation and facilitate long-term abstinence. Cessation clinic approaches are one component of the current comprehensive approach to smoking control, and they have incorporated awareness and manipulation of environmental factors in their program content.

Withdrawal Clinics

Following the lead of clinic programs in Europe, the National Interagency Council on Smoking and Health assisted local interagency councils in the development of smoking cessation activities. The National Council sponsored a series of workshops on smoking cessation and, with the American Cancer Society, initiated the First World Conference on Smoking and Health in 1967. The U.S. National Clearinghouse for Smoking and Health sponsored community antismoking campaigns in San Diego, California, and Syracuse, New York.

Local units of the cancer, lung, and heart associations also initiated clinic programs. The American Cancer Society developed a manual for withdrawal clinics based on a work conference attended by scientists who had experience with cessation methods. The Seventh-Day Adventist Church offered a highly

structured, intensive 5-day plan in many localities. Community health agencies, public health departments, hospitals, sanitariums, and group health plans also conducted cessation programs (Schwartz and Rider, 1978). The evolution of smoking cessation theories and programs through a variety of provider types is discussed below.

Health Voluntaries' Efforts

Clinic methods generally employed either an educational approach or a support-group format. The American Cancer Society "Helping Smokers Quit" clinics were an educational approach that was standardized throughout the United States via use of selected guides, printed materials, and trigger films presented by extensively trained volunteers (Schwartz and Rider, 1978). Groups met for eight 2-hour sessions, generally twice a week. Interaction of group members facilitated personal growth and helped to reinforce abstinence from smoking. The clinic had three phases: self-appraisal and insight development, practicing abstinence under controlled conditions, and maintaining abstinence. Volunteer clinic leaders were recruited from graduates who had quit smoking. American Cancer Society clinics spread to the organization's 58 divisions and 3,100 local units.

In the 1980's, the cancer society revised its clinic program. The revamped program, FreshStart, consists of four 1-hour, small-group sessions designed to help participants understand why people smoke, handle withdrawal symptoms, practice stress management, and assimilate tips to help them refrain from smoking.

Local units of the American Lung Association sponsored a variety of cessation clinics. The American Lung Association provided clinic guidelines to local units, but individual chapters designed their own programs. In the 1980's, the lung association produced excellent quitting and maintenance manuals that emphasized self-help. The lung association also developed a clinic program based on education and principles of behavior modification. The clinic used the *Freedom from Smoking* manuals in a seven-session format, a method that offered a systematic approach for reducing the stress of quitting. The American Lung Association initiated a national program to train staff members to run clinics, manage publicity, and recruit clinic leaders. The promotion's emphasis was to interest major corporations in sponsoring programs that used the self-help and clinic modes.

Many schools offered smoking prevention programs and cessation classes for high school students and adults; colleges and universities also provided quit courses (Schwartz and Rider, 1978). Hospitals, health departments, and physicians sponsored educational sessions for smoking cessation, generally

Five-Day Plan

consisting of lectures, films, literature, instructions on how to quit, diet information, and responses to questions. The *Smoker's Self-Testing Kit* (US DHEW, 1969) was used often, and each person was paired with a "buddy."

In 1960, the Seventh-Day Adventist Church launched the Five-Day Plan To Quit Smoking (McFarland et al., 1964), which consisted of five consecutive sessions of 90 to 120 minutes each. There were no followup sessions in the first several years of the program, but maintenance meetings were added later. Groups varied in size from 15 people to several hundred.

Usually, at the first session, a film showing surgery on a cancerous lung was presented. Immediate smoking cessation was prescribed, and participants were temporarily prohibited from drinking coffee, tea, cola, and alcohol. Physical fitness, exercise, balanced diets, increased fluid intake, warm baths, hot and cold showers, body rubs, deep breathing, and a "buddy system" were encouraged to offset the potential difficulties of withdrawal from nicotine. The physiological effects of smoking were discussed in these sessions, and lung specimens were displayed. Clergymen, psychologists, or physicians presented spiritual, mental, or medical lectures and conducted counseling.

The Five-Day Plan was copied widely, in modified form, by professionals and laypersons. The main aspects that other programs copied were the 5-day format and the buddy system.

Commercial Programs

Proprietary groups began offering cessation programs in the late 1960's (Schwartz and Rider, 1978; Schwartz, 1987). Smoke Watchers, formed in 1968, offered slow withdrawal and weekly goals. Smokers attended open group meetings, with new members joining and graduates and dropouts leaving the group.

SmokEnders, started in 1969, ran chapters directly and granted some franchises. SmokEnders did not build centers; instead, community facilities were used (e.g., churches, schools, and hotels). In terms of acceptance and marketing, SmokEnders has been the most successful commercial stop-smoking program. SmokEnders is a highly structured, systematic technique that emphasizes positive reinforcement and changing attitudes. The original format consisted of eight weekly meetings with a "cut-off day" after the fifth meeting (Schwartz, 1987). The last three meetings were intended as reinforcement, and all moderators were graduates of the program. The course was subsequently reduced to 6 weeks, with the quit day after the fourth session.

Schick Centers for the Control of Smoking started in 1971. The company operated all centers and invested in building

facilities and television promotion. When the public did not respond, Schick closed its Eastern U.S. units and concentrated in five states. The Schick method consists of 5 days of aversive conditioning (low-grade shocks and smoke satiation), followed by 6 weeks of predominately educational group meetings (Schwartz, 1987).

Two other national commercial organizations with similar programs were formed in the 1980's. SmokeLess and Smoke Stoppers license their treatment programs mainly to hospitals and businesses. These organizations conduct training and provide materials to licensees. The SmokeLess and Smoke Stoppers systems are educational, intensive, and highly structured. Attractive pamphlets guide the smoker through the program, with methods that include stress management, positive rewards and reinforcements, food management, and negative smoking practices. Four classes designed to enable smokers to quit are held the first week, followed by 2 or 3 weeks of maintenance sessions.

A review of the 1967 through 1977 telephone yellow pages from more than 200 U.S. cities revealed that commercial stop-smoking programs were available in most major cities and many smaller communities (Schwartz and Rider, 1978). A similar review of the 47 largest U.S. cities for the years 1984 and 1985 showed an increase in such listings from 112 to 385 (Schwartz, 1987). What was striking about the differences between these two periods was that commercial programs, which made up about one-half of the listings in the first survey, accounted for only one-fifth in the later survey. Hypnosis programs made up 17 percent of the listings in the earlier survey but almost one-third in the second survey. The proportion of physician and acupuncture listings also increased in the second survey.

Medication

Chemical agents have been offered as smoking deterrents since before 1900. Early deterrents consisted of herbs, spices, and mouthwashes that produced a disagreeable taste for the smoker (Schwartz, 1969). Other products aimed at diminishing the sensory drives or creating a dry mouth (US DHEW, 1964). In 1982, a Food and Drug Administration panel concluded that drug products such as chewing gum, mouth sprays, and tablets containing silver acetate were not effective as aids to smoking cessation (Food and Drug Administration, 1982).

A variety of drug types, including anticholinergics, sedatives, tranquilizers, sympathomimetics, and anticonvulsants, have been used to reduce the psychological and physiological symptoms of withdrawal. Prior to the introduction of nicotine chewing gum, Jarvik and Gritz (1977) reviewed the literature and concluded that drug therapy was not particularly useful in curing the smoking habit.

Nicotine Gum

Nicotine polacrilex (Nicorette) is a prescription drug in the form of chewing gum that contains 2 mg of nicotine bound by an ion exchange resin that allows for a slow release of nicotine when chewed. Patients are advised to use the gum for at least 3 months. However, some smokers need to use the gum for 6 months or more to alleviate their urge to smoke.

In 1984, Lakeside Pharmaceuticals, a division of Merrell Dow, undertook a massive promotional campaign after the Food and Drug Administration approved its nicotine gum. The result of this campaign was that nicotine polacrilex became one of the fastest selling prescriptions ever introduced. Sales were \$42 million in 1984 and grew to \$60 million in 1987 (US DHHS, 1989).

The availability of nicotine gum has encouraged physicians and dentists to advise their patients to quit smoking because now these providers have some assistance to offer the patient who wants to quit. There are indications, though, that most physicians do not provide proper instructions on the use of the gum. Schneider et al. (1984) and Sachs (1986) have cautioned that the patient must understand the limitations of the prescription and be instructed carefully on its use. Practitioners who have experience in the use of nicotine gum, and who provide instructions and additional advice and counseling, have achieved good results (Fagerstrom, 1982; Hall et al., 1987; Killen et al., 1984; US DHHS, 1988). In the absence of counseling or therapy, success rates are low (Schwartz, 1987; US DHHS, 1988).

Other Drug Treatments

More recent approaches to drug therapy include citric acid spray, nasal nicotine solution (Jarvis, 1986), nicotine vapor (Russell et al., 1987), nicotine-containing skin patches (Rose et al., 1985), and clonidine, a drug used to treat hypertension. Clonidine has been found to reduce the urge to smoke, and researchers have speculated that it may relieve nicotine withdrawal symptoms (Glassman et al., 1988). A clonidine transdermal patch is currently being tested as an aid to smoking cessation (US DHHS, 1989).

Mecamylamine has been suggested as an antagonist to block the nicotine-mediated reinforcing consequences of cigarette smoking (Henningfield et al., 1982; Pomerleau et al., 1987). Mecamylamine is not meant as a cessation aid; rather, it is used to maintain abstinence. In one clinical trial, however, heavy smokers were treated with mecamylamine and showed short-term positive cessation effects (Tennant et al., 1984).

Behavior Modification

Behavior modification entails two divergent approaches to behavior change. One approach uses punishment and the other uses positive reinforcement—including self-management

Aversive
Procedures

procedures. For a detailed overview of behavioral methods, the reader is referred to reviews by Best and Bloch (1979), Glasgow (1986), Hall and Hall (1985), Lando (1981), Lichtenstein and Brown (1983), Pechacek (1979), Pechacek and McAlister (1980), Schwartz (1969 and 1987), and Schwartz and Rider (1978).

Aversion therapy for smoking developed in the 1960's and included electric shock, desensitization training, breath-holding, overexposure to stale smoke, and covert sensitization. The use of electric shock as a punishing stimulus to eliminate smoking behavior has had limited success. The most promising techniques use some form of smoke aversion.

Satiation. Wilde (1964) attempted to induce a dislike for the taste of cigarettes by combining satiation with aversive, avoidance, and instrumental conditioning. This procedure showed only limited success. Subjects were required to increase the number of cigarettes they smoked and the rate at which they smoked. Early reports by Resnick (1968) claimed positive results for satiation, but other investigators were not able to replicate that success. Satiation has generally been combined with other procedures. Lando (1977) and Best et al. (1978) designed successful multicomponent programs that included satiation.

Rapid smoking. Lublin and Joslyn (1968) combined hot, smoky air with rapid smoking and reported fair results. Their study was criticized for invalid methodology, but it set off a series of experiments by Lichtenstein and his colleagues, which subsequently produced impressive results for rapid smoking. Their procedure required the subject to inhale from a cigarette once every 6 seconds for the duration of the cigarette or until nausea developed.

In the early trials, Lichtenstein's group used warm, smoky air along with rapid smoking but dropped the warm air when they found it did not contribute to effectiveness (Lichtenstein and Brown, 1983). There was some concern that rapid smoking created a risk to the cardiopulmonary system, but serious consequences have not been evident. Nevertheless, subjects should be screened and monitored closely during treatment. Rapid smoking has continued to be a popular treatment for smoking, and multiple-component treatments that include rapid smoking have shown good long-term success (Hall et al., 1984; Pechacek, 1979).

Covert sensitization. The objective of covert sensitization is to produce avoidance behavior through use of the subject's imagination. Both the behavior to be modified and the noxious stimulus are imagined. This procedure showed promise in early case studies, but controlled trials failed to replicate the early success (Pechacek, 1979; Schwartz, 1987).

Self-Management Techniques

Other smoke aversion procedures. Other smoke aversion methods include the use of smoky air, chain smoking, regular-paced aversive smoking, and smoke-holding. Regular-paced aversive smoking may be performed in a variety of ways. Generally, the procedure is done at home. Subjects smoke at their usual rate while focusing on the negative features of cigarettes, such as the irritation in the mouth and throat, coughing, and the accumulation of smoke. When regular-paced smoking is the only treatment, the procedure yields low success rates, but when it is used with a treatment program, the quit rates are much improved (Schwartz, 1987).

Smoke-holding consists of retaining the smoke in the mouth for 30 seconds or until feelings of discomfort reduce the desire to smoke. This appears to be a safe procedure, but there are not enough data for assessing its efficacy in smoking cessation.

Strategies for quitting smoking through self-management encompass a variety of techniques, some of which are employed with aversive methods. These techniques generally are initiated and directed by leaders or therapists. Predominant self-management methods are those based on concepts of self-monitoring, nicotine fading, stimulus control, contingency contracting, systematic desensitization, and restricted environmental stimulation therapy. Self-management techniques also have been employed in multiple-component programs, discussed below.

Self-monitoring. Program requirements for self-monitoring have differed greatly—from having the participants count the number of cigarettes smoked in just 1 day to having them keep elaborate records for 1 or more weeks, noting the time, place, activity, and mood when smoking each cigarette and somehow rating or ranking the perceived need for each. McFall (1970) demonstrated that, when people begin paying close attention to their smoking behavior, it is likely to change even though no change may be intended or desired. Glasgow (1986) commented that self-monitoring can be useful, provided that monitoring assignments are not overly complex, are varied, and are not continuously required throughout a lengthy program.

Nicotine fading. Slowly reducing nicotine intake by changing to brands with lower nicotine content (brand fading) or cutting down the number of cigarettes smoked (tapering) are ways of gradually withdrawing from nicotine. Smoke Watchers, the first national commercial program, based its method on gradual withdrawal and weekly goals assigned by the group leader (Schwartz and Rider, 1978). Although Smoke Watchers had some success with tapering, the evidence for gradual

reduction in numbers is not very positive. As the number of cigarettes is reduced, each remaining cigarette can become more reinforcing. However, with nicotine fading, individuals can continue to smoke the same number of cigarettes while reducing their nicotine intake. Some investigators have shown good results with brand fading. Several commercial filters are marketed with the aim of progressively reducing the tar and nicotine content of a cigarette as a way of helping smokers to break the habit.

Nicotine fading by changing brands was introduced by Foxx and Brown (1979), who advocated nicotine content reductions of 30, 60, and 90 percent over a 3-week period. Some investigators use a different schedule, and most include other procedures in the treatment. The many trials conducted in the 1980's attest to the level of interest in nicotine fading. Brown and Lichtenstein (1980) combined nicotine fading with relapse training, whereas Lando and McGovern (1985) used it with smoke-holding.

Stimulus control. In the mid-1960's a number of behavioral investigators used stimulus control techniques as a treatment for smoking (Schwartz, 1969). Stimulus control is intended to eliminate undesirable behaviors by altering the situations in which the maladaptive response occurs. Either the situation can be altered or the individual's response to the situation can be altered. Generally, smoking is associated with a variety of specific environments and internal events, and these associations trigger the smoking response.

One strategy seeks to increase the stimulus interval through use of a cueing device (e.g., pocket timer or signal device). Once the new smoking cue is well established, it is gradually faded out via increased time intervals.

Another type of stimulus control is hierarchical reduction. Subjects are asked to monitor their smoking activity carefully and identify situations in which they are more likely or less likely to be smoking. The subject then eliminates smoking in a cumulative and progressive fashion, from the easiest situation to the hardest. Limiting the circumstances in which smoking is allowed is another strategy. The procedure permits smoking only in a deprived setting, one devoid of all possible distractions and accompanying reinforcers.

The reported studies do not provide evidence to support stimulus control as an effective cessation procedure (Schwartz, 1987). Keeping a detailed account of the subject's feelings and activities related to smoking provides insight to the habit, which can assist the smoker in quitting as long as the treatment also includes other features, such as counseling, maintenance, and relapse prevention.

Contingency contracting. The purpose of contingency contracting is to enhance the smoker's motivation through commitment. Two forms of these contracts are monetary deposits and social contracts with peers. Early studies (Elliott and Tighe, 1968; Winett, 1973) demonstrated that refunding portions of deposits to subjects for continued abstinence influenced long-term cessation.

Signing formal contracts with subjects is one program aspect that achieved good success rates (Lando, 1977). Subjects pledged to forfeit money for every cigarette smoked and agreed to undergo an aversive booster treatment after any smoking. Stitzer and Bigelow (1982) offered contingency payments to subjects who reduced their smoking and thereby reduced their carbon monoxide levels by 50 percent. Including contingency contracting as one aspect of a multicomponent program may contribute to success, but it has limited application as a primary treatment.

Systematic desensitization and relaxation. Desensitization was intended to strengthen responses that are incompatible with smoking. It was hypothesized that smoking behavior is frequently cued by anxiety, and if the prior and proximal stimuli leading to smoking were desensitized, then smoking would diminish. Other investigators suggested that subjects could be conditioned to relax as an alternative to smoking. Still others believed that reducing the stress generated by quitting would help to create positive results.

Many investigators have incorporated desensitization and relaxation training into their programs. However, controlled studies do not support desensitization as a treatment for smoking. Although relaxation seems to make sense as a helpful procedure, nicotine has primarily stimulating effects, and the smoker seeking stimulation may not find a satisfactory replacement in relaxation.

Restricted environmental stimulation therapy. The form of therapy known as restricted environmental stimulation derives its rationale from evidence that a period of sensory deprivation increases persuadability and responsiveness to external cues (Suedfeld and Best, 1977; Suedfeld, 1984). Although several investigators have demonstrated success with this method, the need to keep a subject in a soundproof chamber and provide a monitor has discouraged use of this procedure.

The large number of smokers who attempt to quit each year, coupled with the reluctance of smokers to participate in cessation clinic promotions, has led to the production of a variety of aids to assist smokers in their self-directed efforts to quit smoking (Schwartz and Rider, 1978; Schwartz, 1987). The earliest materials were stop-smoking books, quit kits, and

filters; later, audiotapes, correspondence courses, and smokeless cigarettes were marketed. Videocassettes and computer programs have become available more recently (Schwartz, 1987).

The *Smoker's Self-Testing Kit* was used by several million smokers (Horn, 1972; US DHEW, 1969). It helped smokers gain insight about their habit by providing an understanding of how one feels about cigarettes, how one uses them, and the factors that inhibit or enhance the effort to quit.

Several dozen quit-smoking books and guides have been produced (Schwartz, 1987). In 1977, the American Cancer Society developed the *I Quit Kit*, which consisted of portions of the *Smoker's Self-Testing Kit*, instructions for quitting, and tips on how to stay away from smoking. The Federal Office on Smoking and Health provided smoking cessation pamphlets, and NCI designed the *Helping Smokers Quit Kit*, which contained materials for the smoker and the physician.

The American Lung Association produced two manuals for people who aim to quit on their own: *Freedom From Smoking in 20 Days*, a 64-page cessation guide, and *A Lifetime of Freedom From Smoking*, a 28-page maintenance booklet. The cessation guide includes part of the *Smoker's Self-Testing Kit*, identifies smoking triggers, and offers information about controlling weight, handling smoking situations, and performing deep breathing and relaxation exercises. The maintenance booklet supports ex-smokers after they quit. These are well-designed manuals that have proven to be very popular (Lando et al., 1990).

"How-to-quit-smoking" books have been written primarily by ex-smokers and psychologists. Glasgow et al. (1981) compared the cancer society's *I Quit Kit* to two behavioral self-help books, one by Pomerleau and Pomerleau (1977) and the other by Danaher and Lichtenstein (1978). Under self-help conditions, the American Cancer Society manual was rated best. Glasgow (1986) postulated that subjects using relatively complex self-administered behavioral programs would have great difficulty in following them. When a therapist led the treatment using the same materials, the behavioral books came out better than the cancer society's manual.

An early aid to quitting, still marketed today, is a filter that reduces the nicotine level in cigarette smoke and permits the smoker to be weaned from the chemical addiction (Schwartz, 1987). The device, marketed by Teledyne Water Pik, consists of four reusable filters that reduce the nicotine content of inhaled smoke progressively. The smoker is supposed to use each filter for 2 weeks. As with any cessation method that does not attack the psychological addiction to smoking, evaluations of filter use have shown little long-term success.

Multiple- Component Programs

A new filter system is currently being marketed by Vipont Pharmaceuticals; it consists of three nicotine-fading filters to be used over 21 days. To address psychological addiction, the system includes a deck of cards to help in overcoming dependence and provide coping tips to be used after quitting.

Other self-help cessation aids include quitting by mail, taped telephone messages, cigarette holders and dispensers, videotapes, and several types of computer-based methods.

Many clinic approaches combine several procedures in their methods. Almost all multiple treatments include self-control procedures (e.g., nicotine fading, abstinence training, relaxation, or stimulus control). Many multicomponent programs include smoke aversion as a way of breaking the habit and self-control to maintain nonsmoking (Best et al., 1978; Lando, 1977). Some of the very best results have been achieved with multiple-component programs (Hall, 1980; Killen, 1984; Lando, 1977).

Lando (1977) has used satiation, contractual management, and group support for his multicomponent program; and Pomerleau et al. (1978) provided a multicomponent treatment consisting of stimulus control, covert conditioning, contingency management, relaxation, and use of pocket timers.

Multicomponent programs have achieved the highest quit rates at 1-year followups (Schwartz, 1987). For example, Lando (1977) reported 76 percent success at 6 months after combining satiation, contractual management, and group support; and Hall et al. (1984) achieved a 52 percent quit rate at 1 year by using rapid smoking and relapse prevention. On the other hand, Beaver et al. (1981) scored only 6 percent success at 6 months with the combination of nicotine fading and anxiety management training, which suggests that not all multicomponent programs are highly successful.

Lichtenstein and Brown (1983) and Glasgow (1986) have cautioned that more is not always better. Too many procedures may confuse subjects and make it difficult to provide an integrated treatment. Multicomponent treatments remain attractive because they deal with the multiple factors involved in smoking, as well as the considerable differences among smokers (Lichtenstein and Brown, 1983).

Once smokers have quit, there are myriad environmental, social, and psychological forces that act to influence them to return to smoking (Schwartz and Rider, 1978). During the first 4 months after treatment, many successful quitters become recidivists, and during the next 8 months, other ex-smokers return to smoking. Some people return to smoking after a year or more of abstinence (Schwartz, 1987). During the 1980's,

investigators studying relapse identified high-risk situations. Multicomponent programs included training in cognitive behavioral skills to help quitters develop strategies for identifying and coping with high-risk situations.

Relapse Situations

Marlatt and Gordon (1980) found that the majority of relapse situations involved social pressure to smoke. They indicated that causes for relapse fell into three categories: social pressures, coping with negative emotional states, and coping with interpersonal conflict. They concluded that effective maintenance requires that the smoker be taught coping responses to relapse stimuli.

Shiffman (1984) interviewed people who called a relapse counseling hotline and found that most of their relapse crises were associated with negative feelings (e.g., anxiety, anger, depression). One-third of the crises however, were linked to positive emotional states and frequently involved other smokers. Ex-smokers who used coping responses more often were able to refrain from smoking.

Maintenance Strategies

Lichtenstein (1979) identified three maintenance strategies: social support, coping skills, and cognitive restructuring. Social support is based on the theory that a group of close companions can provide support or influence to help the ex-smoker sustain the motivation to continue abstaining. Coping skills are required to help the new nonsmoker deal with withdrawal symptoms, develop substitute responses that will replace smoking, and learn to recognize and modify cues to smoke (Lichtenstein, 1979). Cognitive restructuring involves changing attitudes and self-perceptions related to smoking.

Support may come also from a support group or from the teaming of two or more clients as "buddies" to telephone each other and provide mutual support. Another support tactic is continued contact between the program and the client via telephone, letters, and personal meetings. Other support techniques include contingency contracting, bonuses, self-rewards, and positive feedback.

Effective treatment procedures include cognitive recognition and behavioral training in coping with abstinence violation (defined as a slip by a quitter that leads to backsliding) and self-efficacy factors (Marlatt and Gordon, 1980). Investigators caution that effective maintenance calls for minimizing the impact of slips as a way of coping with abstinence violation.

Skills Training

Coping strategies can be used both to prevent high-risk situations and to respond to them (US DHHS, 1988). Both knowledge and performance of relapse prevention skills are needed to maintain change. Lichtenstein and Brown (1983) cite a number of studies that yielded favorable results from use of coping skills or self-management training.

Schwartz (1987) found differences between some programs that offered self-management procedures and those that offered coping skills, relapse management training, or abstinence training. For example, Hall et al. (1984) combined rapid smoking with a relapse prevention program that included both behavioral and cognitive components. The coping skills addressed withdrawal symptoms and situational factors related to relapse (skills training for high-risk situations). This program attempted to individualize techniques. Relaxation was presented as a means of coping with the anger and anxiety that often precipitate a relapse. Four relapse prevention sessions were devoted to skills training, and subjects role-played alternate responses to high-risk situations.

Another example is the relapse prevention program devised by Brown and Lichtenstein (1980), which was based on strategies suggested by Marlatt and Gordon (1980). It consisted of five components: identification of high-risk situations, coping rehearsal, avoidance of the abstinence violation effect, lifestyle balance, and self-rewards.

Killen et al. (1984) studied the effects of skills training and nicotine gum, as separate methods and combined, in promoting abstinence after smoking cessation. Therapists demonstrated how strategies for selected target situations might be implemented. Participants then rehearsed coping responses specific to personal high-risk situations in front of the group. Therapists and group members provided corrective feedback after each rehearsal. Positive results were obtained in both skills training treatments.

Fortmann et al. (1988) studied self-directed relapse prevention in combination with nicotine polacrilex. Sixteen modules were written to provide self-instruction on avoidance of smoking in specific high-risk situations. All subjects perceived efficacy in coping with different high-risk situations. The study demonstrated that relapse prevention could be self-directed.

Efforts To Prevent Initiation

The recognition of the disease risks associated with tobacco use led to efforts to educate nonsmokers and to prevent adolescents and women from initiating tobacco use. These efforts evolved from preexisting campaigns to prevent women and children from smoking, programs that were based on concerns about the effects of smoking on morals and behavior (Troyer and Markle, 1983).

During the 1950's and 1960's, the major efforts directed at preventing initiation focused on adolescents. Unfortunately, little effort was directed at countering the advertising and promotional campaigns of the cigarette manufacturers that were directed to women, blacks, and Hispanics. The cigarette manufacturers' targeting may be largely responsible for the

current higher prevalence of cigarette smoking among young women than among young men, and the higher prevalence of smoking among black males than among white males (see Chapter 3).

The efforts directed at preventing adolescent initiation fell into two categories: school-based smoking prevention education and restrictions on the availability of cigarettes to adolescents. However, the perception that either or both of these approaches could eliminate use of tobacco by adolescents has led to disappointment and to recognition of these efforts as important components of a comprehensive smoking control strategy that requires the support and activity of other channels to be maximally effective.

We now have several comprehensive and effective curricula that deal with tobacco use (see Chapter 5); however, these curricula are not being used in the majority of U.S. school districts. Most states have mandates requiring that health education be taught in schools, but the task of implementing these mandates has often proven difficult or impossible. School health educators have come to realize that community perception of the importance of smoking as a problem, financing the costs of curricula and teacher training, and involvement of parents and the community in implementation of the curriculum are as important as the curriculum content for the success of these programs.

Similarly, the efforts to restrict adolescents' access to tobacco have been largely unsuccessful. Although 44 states have laws restricting the sale of cigarettes to adolescents, young people report little difficulty in obtaining cigarettes from stores and vending machines. Passage of legislation to limit tobacco sales to adolescents is ineffective in the absence of community support and enforcement.

COMPREHENSIVE APPROACH TO SMOKING CONTROL

The recognition that most adult smokers first become regular smokers as adolescents led to an early and continuing concern about the role of mass media, particularly through their advertising, in promoting tobacco use by adolescents. Some gains were made initially, most notably the effort to reduce the positive images of smoking in motion pictures, the ban of advertising on radio and television, and the elimination of sports personalities from cigarette ads. However, these early efforts did not prevent the continued targeting of adolescents, minorities, and women in the advertising and promotional efforts of the tobacco industry.

Perhaps the most visible failure to prevent use of tobacco by adolescents came in the late 1970's, with the reintroduction of smokeless tobacco products. These products were advertised on television with endorsement by sports personalities, and

adolescents were induced to use them through give-away programs. All of this activity occurred at a time when the scientific evidence establishing the carcinogenicity of these products had already been published. Once again, the failure in the effort to prevent initiation occurred secondary to the absence of a societal consensus and concern rather than an absence of knowledge or effective programs.

The recognition that efforts directed at educating the individual smoker and treating the individual to change smoking behavior had limited impact has led to an appreciation of the role of environmental influences in changing smoking behavior. Examples of more environment-related strategies that are believed to have had substantial impact on tobacco use include the nonsmokers' rights movement, which is changing the image of the smoker and restricting the number of locations where smoking is permitted, and the increase in taxes on cigarettes, which is creating a financial disincentive to smoke. These approaches reflect a growing understanding of environmental influences on the smoker, but even more important, they acknowledge the necessity of approaching the control of tobacco use through multiple channels and multiple programs. We now recognize that changes in the community's perception of smoking risks influence the adoption of school curricula and their effectiveness. By bringing all of the elements of society to bear on the problem, we hope to reduce initiation of smoking, provide persistent and inescapable messages to the smoker to quit, and create an environment where the smoker who is trying to quit has a better chance of success.

Six major subsystems, or sectors, are important in a comprehensive approach to smoking control: (1) the political sector, in which laws and policies are made; (2) the economic sector, which includes general taxation, workplace, business, and insurance policies concerning smoking control; (3) the educational sector, in which youth are educated about tobacco use; (4) the communication sector, through which information is disseminated to the general public; (5) the health care sector, in which health professionals play a crucial role in smoking control; and (6) the health voluntary sector, which provides many of the resources and coordination efforts directed to control of tobacco use.

Any system contains a number of established structures that can be mobilized to address smoking control; however, each structure must be examined for what the subsystem itself can do, for the opportunities it provides for multiple activities related to smoking control, and for opportunities for synergism with other sectors. In the following sections, the six subsystems named above are reviewed in this light.

The Political Sector

The political sector is viewed as the major authority in determining what behavior is considered normative and what is deviant. This sector is especially important in defining ambiguous norms, because it is often the final arbiter in the interpretation of societal norms. In addition, societal norms are frequently codified into laws and/or policies; the political sector provides the mechanisms for such codification.

The political sector has already contributed enormously to tobacco restrictions. At the Federal level, tobacco use restrictions have been placed on transportation and in Federal Government workplaces (US DHHS, 1989). Through a number of initiatives, more than 40 states and the District of Columbia now have laws restricting smoking in at least one public place (US DHHS, 1989). Some states have comprehensive restrictions, and there is a trend toward increasing restrictiveness in such legislation. Local jurisdictions are rapidly taking the lead in tobacco use restrictions; close to 400 cities and counties have enacted smoking control ordinances (Pertschuk and Shopland, 1989).

Diverse groups that have some interest in smoking control have banded together, an increasingly common tactic, to present a united front to legislatures. Recruiting support from their various constituencies, such coalitions have been influential in convincing state legislators to increase cigarette taxes (Pertschuk and Shopland, 1989), provide smoke-free schools (Minnesota Department of Health, 1984; New Mexico Health and Environment Department, 1988; Pennsylvania Department of Health, 1986), and restrict sales of tobacco products to minors (Minnesota Department of Health, 1984; Pennsylvania Department of Health, 1986).

Enacting legislation at the local rather than the state level has been hailed as a method for controlling tobacco use while minimizing the influence of the tobacco lobby. This method has resulted in a number of local initiatives that range from control of minors' access to tobacco to mandated nonsmoking restaurant seating (Pertschuk and Shopland, 1989).

Interventions within the political sector are appealing for many reasons. First, smoking control activities may be implemented at multiple levels—by Federal, state, and local governments. Second, the political sector is the most likely sector to reach all members of the smoking population. Third, there is a high potential for synergy between the political sector and other subsystems within our society; legislative actions may be accompanied by economic resources for tobacco control activities, media attention, or cessation opportunities. A good example of how synergy can occur is found in the response of Iowans to a smoking ban on commercial airlines: A local group

produced "quitters' survival kits," distributed them to smokers at the municipal airport on the effective date of the ban, and garnered a great deal of local publicity in the process.

The Economic Sector

Taxation

In terms of the relative influence and importance of smoking control activities, there are three major aspects of the economic sector to review: taxation of individuals, workplace policies on smoking, and practices in other economic institutions (e.g., businesses).

The taxation of tobacco products has a predictable effect on tobacco use (Harris, 1982; Lewit and Coate, 1982). Studies have examined the decrease in smoking prevalence that accompanies a tax increase on tobacco products (Harris, 1982; Lewit and Coate, 1982; Warner, 1986); this type of decrease was particularly pronounced among adolescent and young smokers (Warner, 1986). In addition to a Federal cigarette tax, all states now have their own cigarette taxes (US DHHS, 1989), and some municipalities and counties have added taxes on tobacco products as well (Pertschuk and Shopland, 1989; US DHHS, 1989).

A few state governments have allocated a portion of the tobacco taxes to general health-promotion activities, and a few have dedicated some portion of the taxes to antitobacco activities (US DHHS, 1989). Early in 1989, California imposed a large additional tax on cigarettes (25 cents per pack), with a portion of the funds going to antitobacco research and activities (US DHHS, 1989). This strategy has a direct economic effect on smoking behavior and provides the resources to support a comprehensive, long-term intervention designed to alter tobacco use. Municipal and county government units could also examine taxation as a method of increasing resources for smoking control.

Taxation is an especially appealing form of smoking control intervention, because only tobacco users bear the costs. When accompanied by prevention activities in other channels, taxation appears to be especially effective in preventing young people from beginning to smoke. Its synergistic potential is enormous, because taxation can help fund smoking control activities in multiple intervention channels.

Workplaces

Working adults spend nearly one-half of their waking hours on the job. They are strongly affected by the norms of the environment in which they work, and managers of workplaces are rapidly adopting policies to restrict tobacco use (Bureau of National Affairs, 1986; US DHHS, 1987).

Although restrictive policies are a key factor of worksite involvement in smoking control, there are other smoking cessation opportunities in the work setting as well. Worksites

have engaged in internal and external competitions, as well as incentive programs, to encourage employees to stop smoking (Cummings et al., 1988; Klesges et al., 1986; Rosen and Lichtenstein, 1977). The basic philosophy behind such an approach is that the workplace can provide a supportive environment for smoking cessation; furthermore, incentives for smokers to achieve and maintain cessation can add to the environmental support and lead even more smokers to try quitting.

Employers have collaborated with other groups to offer smoking cessation programs at the worksite, both on and off company time (Klesges et al., 1987; Omenn et al., 1988; Schilling et al., 1985). Synergy is assumed to occur when a program is offered in a setting where coworkers are also attempting cessation and providing support for fellow quitters. Results of such programs are generally comparable with those of clinic-based programs, but costs are considerably lower. Some employers have institutionalized regular smoking cessation programs at the worksite, in which employees are free to enroll at their own convenience. Other programs go even further and encourage the smoker's spouse and/or significant others to participate.

Typically, the American Cancer Society's annual Great American Smokeout has a segment designed for workplaces, and employers can use that opportunity to encourage smokers to quit for a day by organizing smoking cessation activities for the day. Similarly, the American Lung Association sponsors an annual Non-Dependence Day and produces many materials and suggestions for worksite participation in nonsmoking activities. The American Heart Association promotes a Sweet-Heart Day in February, with smoking cessation opportunities, advice, and materials incorporated in the day's activities.

Workplaces afford multiple opportunities to promote smoking cessation, and a restrictive smoking policy can establish not smoking as the appropriate behavior in a particular workplace. Smokers may be encouraged to attempt cessation as regular smoking control events are incorporated into the work environment. Incentives and competitions can increase smokers' motivation to try cessation. Activities that build on national or local events can reinforce the messages that a non-smoking environment is desirable and that the employer supports such an environment. As a group, these smoking control activities in the workplace can have a powerful influence on smokers.

Restaurants. A number of states have laws that require restaurants to offer nonsmoking sections (Hanauer et al., 1986; US DHHS, 1986). Public opinion surveys support the value of such restrictions. In one poll, 85 to 91 percent of restaurant-goers

expressed a desire for restrictions on smoking in restaurants (Gallup, 1983); in another, 39 percent of people surveyed said they would not return to a restaurant that did not offer a no-smoking section (Gallup, 1985).

Insurance. The insurance sector offers an economic incentive for smoking cessation and prevention that cuts across both employment and other business sites. Reductions in insurance premiums for nonsmokers and smoke-free workplaces offer individuals and organizations an added stimulus for smoking control activities. Although insurance premium reductions are not as influential as other sectors might be, they can add to the economic benefits that accrue from avoidance of tobacco use.

The insurance industry has reacted to the demonstration of the disease risks associated with smoking by discounting life insurance premiums for nonsmokers who purchased their own policies (Cowell, 1985). The vast majority of states now allow differential pricing of life insurance premiums according to smoking status (National Association of Insurance Commissioners, 1987a). Movement in other forms of insurance incentives has been slower. Health insurance providers have had difficulties in offering reduced premiums for nonsmokers because (1) the vast majority of health insurance policies are written for groups where smoking prevalence is difficult to determine; (2) actuarial data that support reduced health insurance premiums for nonsmokers are scarce; and (3) Federal regulations make it difficult for some health insurance plans (e.g., health maintenance organizations) to set premiums based on smoking status (US DHHS, 1989). Property and casualty insurance has fared somewhat better—homeowner policies are routinely offered at reduced premiums to nonsmokers. A few companies also provide nonsmoker discounts for automobile policies (National Association of Insurance Commissioners, 1987b).

To the extent that premium differentials by smoking status become institutionalized within society, and depending on the amount that insurance carriers reimburse for cessation treatment, a number of synergistic effects may result: (1) worksites and businesses could offer encouragement for nonsmoking; (2) worksites and businesses could make smoking cessation assistance available; and (3) the political sector could place economic sanctions on smokers.

The Education Sector

The education sector can have an influence on children and their possible initiation of tobacco use. In the educational setting, there are opportunities to expose children to anti-tobacco information and provide them with nonsmoking role models. Educational interventions have focused on incorporation of tobacco information in school curricula; however,

when such programs are provided without a companion community intervention, their effects appear to be small. Current research is examining ways to increase the influence of the educational programs by linking them with community and parent-related activities.

Educators can have an influence on children in ways other than the formal school curriculum. Educational facilities that are smoke-free for employees as well as for children can provide good models for nonsmoking environments. Students may participate in antitobacco activities through the schools; for example, many schools collaborate with advocacy groups to sponsor poster contests for children, sports activities with antitobacco sponsors, and other antismoking activities in the community.

Curricula that incorporate annual segments on tobacco use, a smoke-free environment, and annual smoking control activities in the community could be instrumental in developing the norm of not using tobacco. Activities in the educational sector can be synergistic with other sectors; for example, students may be enlisted to participate in a supervised "sting," where minors' success rates at purchasing tobacco products are documented, which can raise community awareness about the accessibility of tobacco products to minors, thereby melding the political and educational sectors.

The Communication Sector

The media play a pivotal role in smoking control activities. Mass media provide information to the public on facts and issues related to smoking, and they also influence public perceptions of appropriate behavior by portraying certain people either engaging in or abstaining from a particular behavior. The media have presented images and taken direct action against smoking. Media information dissemination has been designed to stimulate help-seeking behavior by smokers (Danaher et al., 1984; McGuire, 1984). Public service announcements have been used to encourage people to call a hotline for information (Cummings et al., 1986) and to recruit smokers into treatment programs (Jason et al., 1988; Mogielnicki et al., 1986).

Electronic media campaigns designed to assist people in achieving smoking cessation have been somewhat successful (Flay, 1987b). The American Lung Association "Freedom From Smoking in 20 Days" program has been used in many mass media markets, and the results appear quite favorable (Flay, 1987b). Print programs for smoking cessation have been successful as well (Cummings et al., 1987).

There is little doubt that the media can keep tobacco news and messages in the public eye; however, there is evidence that the media are somewhat constrained by the influence of the

tobacco companies. Media that carry tobacco advertisements give differential attention to tobacco issues compared with those that do not carry such advertisements (Warner, 1985; Whelan et al., 1981). In spite of these constraints, the media can be used for creative smoking control activities.

The communication sector is the conduit by which other sectors may publicize and disseminate their smoking control information and activities. The communication sector can be synergistic with all other sectors in four ways: (1) It can reinforce norms that promote smoking control by presenting positive images with respect to nonsmoking behavior and refusing to portray smoking as glamorous or desirable; (2) it can raise the public's awareness of smoking as an important issue; (3) it can provide direct information to the public about tobacco use; and (4) it can provide direct services in recruiting people into smoking cessation activities.

The Health Professional Sector

As a group, health professionals are an extremely influential force for reaching smokers. The vast majority of smokers see a physician each year (Ockene, 1987), providing an excellent opportunity for physicians to advise and counsel smokers to abandon their habit. Health professionals also can have an influential role in national policymaking and in promoting societal norms related to healthy living.

Increasingly, health professional associations are adopting an assertive stance with respect to controlling tobacco use. The American Medical Association has recognized smoking as a "serious health problem" since 1964 (Lundberg, 1985) and has advocated education about smoking since 1969 (Rosenberg, 1983). As early as 1964, the American Dental Association urged its members to educate patients about tobacco use, and it recently hosted its first national dental symposium on smoking cessation (McCann, 1989). The American Pharmaceutical Association has recommended that pharmacies not sell tobacco products (Smith and Fincham, 1989). Other health care provider groups, including nurses, have not taken official antismoking stands but are beginning to address the issue. Counseling against tobacco use is an appropriate topic for physicians' and dentists' continuing education, and many medical and dental schools are now incorporating such training into their disease prevention curricula.

Health professionals' advice about ceasing tobacco use is accompanied by inherent opportunities for expanding the effect of a single message about cessation. An office system that identifies smokers will help ensure that smoking patients receive repeated messages about smoking cessation and assistance with quitting. Smoke-free health care environments will support that goal by providing positive sanctions for a norm that health professionals are advancing.

In addition to multiple opportunities for intervention, health professionals' activities can lead to synergy with other intervention channels. For example, physicians have participated in the cancer society's Great American Smokeout by organizing activities, staffing information booths, and prescribing nicotine replacement therapy for their smoking patients. Some physician groups, such as Doctors Ought to Care, have participated in many visible antitobacco events. There is an increasing awareness of the importance of joint activities with other health professional groups in smoking control activities.

Just as physician input can be synergistic with other channels of smoking control activity, other sectors can be synergistic with physician efforts. The development of standards for physician management of smoking patients in the outpatient care setting and the implementation of these standards through the quality assurance auditing process are examples of how governmental and regulatory agencies can influence physician motivation and behavior. Physicians have an important role in establishing societal norms, particularly with respect to health issues, but societal norms and expectations are also important determinants of physician behavior. For example, the majority—about two-thirds—of prescriptions for nicotine gum as a smoking cessation aid are written at the patient's request rather than on the physician's initiative (US DHHS, 1989).

The Health Voluntaries' Sector

Three national voluntary groups, the American Cancer Society, the American Heart Association, and the American Lung Association, have a rich history of smoking control efforts. In addition to these three groups, a number of other voluntaries, such as Americans for Nonsmokers' Rights and Fresh Air for Nonsmokers, emphasize smoking control activities in their mandates. These organizations are influential in that their staffs and volunteers form networks that extend to almost all geographic sections of the United States.

The cancer society, heart association, and lung association have a variety of events and activities that support tobacco control. Each of the groups has a major annual event that emphasizes nonsmoking. The American Cancer Society sponsors the Great American Smokeout in November; the American Heart Association promotes SweetHeart Day in February; and the American Lung Association coordinates activities around Non-Dependence Day in July. The voluntaries have also produced various smoking cessation materials and free or low-cost programs for smokers who are trying to quit. Special programs have been developed for some targeted populations, such as low-income pregnant women—the cancer society's "Special Delivery" and lung association's "Freedom from Smoking for You and Your Baby." The voluntary groups also offer self-help programs.

The strength of the health voluntaries lies in their networks of volunteers throughout the country, and antitobacco activities that build on that strength are likely to be successful. Door-to-door fundraising campaigns also serve as public education opportunities. Collaboration with other sectors, such as smoking cessation media campaigns, may be successful (Flay, 1987b). Multiple opportunities for smokers to attempt cessation are available, because the voluntaries provide ongoing cessation services and resources. Public information campaigns detailing the available resources will help ensure that smokers are aware of the assistance that is available in any geographic location.

In terms of synergism, voluntaries may be considered the resource centers of diverse cessation activities and events in the community. To the extent that information on smoking control activities, on smoking cessation opportunities and materials, and on special communitywide events is widely available and publicized, this sector helps to coordinate all sectors of the community in promoting smoking control efforts.

CONCLUSIONS

- Smoking control strategies have evolved and expanded during the last 40 years as our understanding of smoking behavior and its risks has developed.
- Attempts to educate smokers and treat them individually have given way to more comprehensive efforts to treat both the individual smoker and the environment within which smoking takes place.
- Multiple channels and approaches to all sectors of the social environment characterize the state of the art in comprehensive control of tobacco use. This approach is used because different channels may reach different groups of smokers and because the synergism of multiple inputs to the smoker may create an effect greater than the sum of the effects of the individual channels.

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Chapter 3

Smoking Prevalence and Lung Cancer Death Rates

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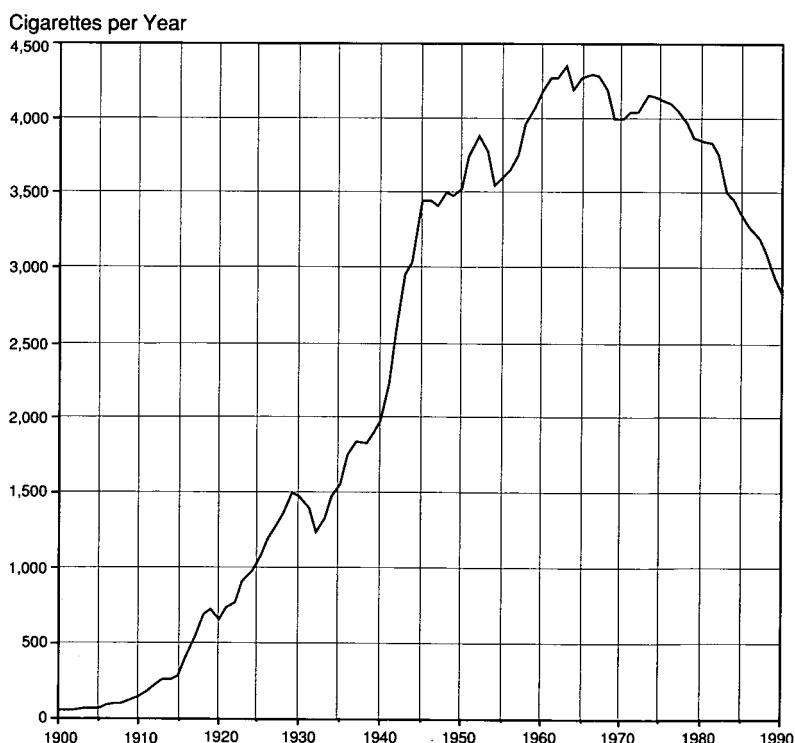
Chapter 3

Smoking Prevalence and Lung Cancer Death Rates

INTRODUCTION

The use of cigarettes, in contrast to other tobacco products, is a behavior that has developed relatively recently. Widespread use of cigarettes has been predominantly a 20th century phenomenon, with per capita consumption of cigarettes rising from 54 in 1900 to a peak of 4,345 in 1963 and then declining (Shopland et al., 1990) (see Figure 1). [Note: The data points used for plotting all figures in this chapter are listed in Appendix A.]

**Figure 1
U.S. per capita cigarette consumption for adults, aged 18 and older (1900 to 1990)**



Other chapters of this monograph address the social and environmental influences that have produced these changes in per capita consumption over time. This chapter describes the changes in smoking prevalence that occurred during this

century and links them to observed changes in lung cancer death rates. A model for predicting future lung cancer death rates is presented also.

The prevalence of cigarette smoking is not spread uniformly across the U.S. population. There are marked differences in smoking prevalence across gender, racial, educational, and age groupings in the current population, and these differences have varied markedly across the first nine decades of this century. The risk of developing lung cancer is defined predominantly by past smoking exposure rather than by current smoking status. For these reasons, the data presented in this chapter are arranged by 10-year birth cohort. (A birth cohort is a group of individuals born during a specific span of calendar years.)

By following the changes in smoking behavior and lung cancer occurrence in a cohort as it ages, one is able to construct an accurate picture of the cumulative smoking history of the cohort and compare it with the resultant lung cancer occurrence in the same cohort. The more traditional approach, presenting data from multiple cross-sectional surveys done in different calendar years by the age of the individual surveyed at the time of the survey, leads to a biased impression of the changes in smoking prevalence that occur with age and an underestimation of the past smoking behavior of the older segments of the current population. When age-specific rates from multiple cross-sectional studies are compared to one another, the implicit assumption is that attained age (rather than calendar year of birth) is the dominant determinant of the rate being measured. For smoking behavior, however, calendar year of birth has a major influence on the possibility that an individual will become a cigarette smoker and on the duration of that smoking behavior. The individuals who constitute a given age group in cross-sectional samples drawn many years apart will belong to different birth cohorts. To compare the cross-sectional smoking prevalences at a given age without considering the peak prevalences of the birth cohorts that they represent distorts the true relationship between smoking behavior and age.

The excess death rates in cigarette smokers compared to nonsmokers lead to a diminishing fraction of ever-smokers being measured in a birth cohort as the population ages. Current measures of current and former smokers in older age groups will then underestimate the true prevalence of smoking of the same birth cohort several decades earlier. Since past rather than current smoking behavior causes lung cancer, and since the bulk of the U.S. lung cancer deaths occur among those same older segments of the current population, an accurate description of their smoking behavior is essential to

ANALYSIS OF SMOKING BEHAVIOR

the development of a model that relates smoking behavior to lung cancer death rates.

This section characterizes smoking behavior in the United States between 1901 and 1987. Smoking prevalence is examined over time, by 10-year birth cohort, gender, and race. This information was produced from analyses of the National Health Interview Surveys (NHIS) conducted in 1970, 1978, 1979, 1980, and 1987. Because of its large sample size and high response rate (typically greater than 95 percent), the NHIS was used for estimates of smoking prevalence in the United States. The NHIS data sets used here are the only NHIS data sets available for computer analysis that include information regarding age of initiation and cessation of smoking—the two variables necessary to this analysis for constructing the past smoking behavior of a birth cohort from recent cross-sectional data.

Similar analyses have been reported previously in the Surgeon General's Reports (US DHHS, 1980 and 1985). The 1980 report included an analysis of the 1978 NHIS, with prevalence estimates through 1978. The 1985 report included analysis of the 1978, 1979, and 1980 NHIS combined, and also reported prevalence through 1978. The current analyses update the previous analyses by providing estimates through 1987 (an additional 9 years) and make use of the earlier 1970 data, which are likely to provide more accurate estimates of smoking behavior prior to 1970. This greater accuracy may be most applicable to earlier birth cohorts (e.g., people born from 1901 to 1910), which experienced significant mortality prior to 1978 (see discussion below). In addition, of all the NHIS samples, the 1970 NHIS is the largest, with 116,466 cases overall, including smoking data for 76,675 of these cases. The total number of cases for the other surveys used for this analysis were as follows: 1978, 12,111; 1979, 26,271; 1980, 11,333; and 1987, 22,043.

The analyses reported here rely mainly on responses to three questions: "How old were you when you first started smoking cigarettes fairly regularly?", "Do you smoke cigarettes now?", and "About how long has it been since you smoked cigarettes regularly?" The wording of these questions remained essentially identical across all surveys; however, the order of the questions and coding of responses may have resulted in slight differences in the categorization of smokers as *regular* versus *occasional* smokers. *Occasional* smokers typically are defined as those who *volunteer* that they never smoked cigarettes regularly, and thus they do not consistently report an age of onset and/or age of quitting. Because of the inconsistency of reporting, these respondents, when identifiable, were treated as *never-smokers* in these analyses.

Another difference among the five NHIS data sets used here is the source of responses—that is, self or respondent proxy. Of those responding to the smoking questions, the proxy response rates among those over age 17 in the surveys are: 1970, 39.0 percent; 1978 to 1980, 0.5 percent; and 1987, 22.2 percent. Proxy respondents typically are thought to report smoking status accurately but to underreport the number of cigarettes smoked per day and to be less knowledgeable about the age of onset and cessation of smoking (US DHHS, 1990).

Diagnostic analyses regarding the effects of using both proxy reports and self-reports in the 1970 NHIS demonstrate that estimates of age of initiation and age of cessation, by cohort and by cohort and gender, generally differ by less than 1 percentage point when based on proxy versus self-reports. In most cases, proxy reports result in slightly higher ages of initiation and cessation. This suggests that proxy reporting does not substantially affect cohort trends in smoking over time as reported here. Use of only self-reports for estimates of smoking prevalence results in smoking rates for females that are generally less than 2 percentage points higher than those reported here for all respondents (self and proxy). Among males, for whom the proportion of proxy reports is considerably higher, the use of only self-reports results in smoking prevalences between 0 and 6.2 percentage points higher, depending on the cohort. While part of the discrepancy is likely attributable to underreporting of smoking behavior by proxy respondents, those who respond by proxy have been noted to be generally younger, employed, and never married or married (as distinguished from divorced, separated, or widowed), and to have higher incomes and fewer health problems (Crane and Marcus, 1986). These characteristics suggest that those responding by proxy may indeed have lower smoking rates; thus, part of the difference between self-reports and all reports may reflect real differences in smoking status.

Because this analysis estimates smoking prevalence beginning in 1905, it relies on recall of smoking behavior many years before the surveys. In general, the data used are those collected closest to the year for which smoking prevalence is being estimated. Two assumptions guided this decision: First, recall of previous smoking behavior is likely to be better when the survey is conducted closer in time rather than further from the year being estimated; second, each cohort experiences mortality as time passes, with the earlier cohorts experiencing greater mortality. Using earlier data to estimate smoking behavior assures that more members of each cohort are available to provide a more accurate picture of the cohort's smoking behavior in years past. Since both current and former smokers

have higher age-specific mortality rates than nonsmokers overall, a birth cohort has a progressively lower percentage of smokers and former smokers and a higher percentage of never-smokers as the individuals in the cohort grow older. Therefore, measurements of smoking behavior made earlier in time for the oldest cohorts provide a more accurate picture of their smoking behaviors during the middle part of the century than do current measurements.

In keeping with this, 1970 NHIS data were used for estimates of smoking prevalence for time points up to and including 1970; the 1978, 1979, and 1980 NHIS data were combined for estimates of smoking prevalence in 1975; the 1979 and 1980 NHIS data were combined for estimates of smoking prevalence in 1980 (with the assumption of no changes in smoking status in 1980 for those who responded in 1979); and the 1987 NHIS data were used for estimates of smoking prevalence in 1985 and 1987. There were two exceptions to this scheme. Because the 1951 to 1960 birth cohort includes members who were only 10 years of age in 1970 (and thus did not respond to the smoking questions), 1978 through 1980 data were used for estimates of smoking for this cohort prior to and including 1970. Similarly, the 1987 data were used to provide estimates of smoking for *all* time points for the 1961 to 1970 birth cohort.

In the 1980 Surgeon General's Report on smoking (US DHHS, 1980), there is an attempt to quantify the potential underestimation of smoking prevalence for earlier cohorts attributable to the differential mortality between smokers and nonsmokers. Applying the author's line of reasoning to this case, the group for which the mortality bias would have the most effect is the 1901 to 1910 cohort, which was aged 60 to 69 when surveyed in 1970. According to insurance life tables reported by Cowell and Hirst (1979), a male cigarette smoker at age 32 has an 80 percent chance of surviving to age 60, while a nonsmoker has a 93 percent chance. Data from the 1970 NHIS indicate that this cohort reached its peak smoking prevalence of 62 percent in 1940. Given the estimated mortality differences between smokers and nonsmokers, the actual smoking rate may have been as high as 66 percent. Thus, the estimated underreporting for this cohort is about 4 percentage points. The underestimate would be less for younger cohorts. The estimated survival rates to age 60 for female smokers and nonsmokers are 91 percent and 93 percent, respectively (Hammond, 1966), which would result in a negligible underestimation (less than 1 percentage point). These adjustments to the prevalence estimates assume that smokers remain continuous smokers and derive no survival advantage from cessation, which provides a worst-case estimate of bias.

As noted previously, the sample sizes of the data sets used for these analyses varied, so the confidence intervals for estimates vary. For most groups and time points reported, 95 percent confidence intervals are less than ± 2 percentage points (assuming a simple random sample; i.e., not taking into account the complex sampling strategy of the NHIS). However, estimates for the years 1985 and 1987 used the 1987 NHIS and are based on considerably fewer respondents than other estimates. Confidence intervals for estimates in 1985 and 1987 are in the range of ± 2 to 4 percentage points for most groups. These generalizations hold for smoking estimates for all males, all females, white males, and white females. Sample sizes for blacks of both sexes are considerably smaller, and confidence intervals for estimates are consequently much larger, in the range of ± 4 to 7 percentage points for time points prior to 1985, and in the range of ± 5 to 9 percentage points for estimates of smoking in 1985 and 1987. Sample sizes for the three major data sets—by cohort, gender, and race—are presented in Table 1.

SMOKING PREVALENCE

Figures 2 through 7 show changes in prevalence of cigarette smoking over time among successive birth cohorts for all males, all females, white males, black males, white females, and black females in the United States. As shown in Figure 2, among males, the 1911 to 1920 and 1921 to 1930 birth cohorts achieved the highest peak prevalences, at 65.9 percent and 66.1 percent, respectively. According to these data, the 1901 to 1910 cohort reached a peak smoking rate of 61.8 percent, which should be adjusted upward somewhat because of the differential mortality likely to have occurred between smokers and nonsmokers prior to the survey in 1970. The overall exposure to cigarettes appears to be different for these three cohorts, however, because of differences in the rates of cessation. For example, when the 1901 to 1910 cohort was aged 55 to 64 in 1965, its smoking rate was 45.0 percent. The comparable rate for the 1911 to 1920 cohort in 1975 was 39.8 percent, while for the 1921 to 1930 cohort, the rate in 1985 was 32.5 percent. Thus, although the three cohorts achieved similar peak rates, cessation was progressively greater for the later cohorts, resulting in fewer total years of exposure to cigarettes for the later cohorts at any given age. Birth cohorts after the 1931 to 1940 cohort experienced successively lower peak prevalence (52.3 percent, 39.6 percent, and 32.4 percent, respectively).

Figure 3 presents the smoking prevalence for successive birth cohorts of U.S. women and clearly demonstrates that women began to smoke in substantial numbers much later in the century than did men. The earliest birth cohort of men (1901 to 1910) showed marked initiation of smoking during adolescence (around 1915 to 1920) and had a high peak prevalence. In contrast, the same birth cohort of women took up smoking much more slowly (around 1925 to 1930) and had a

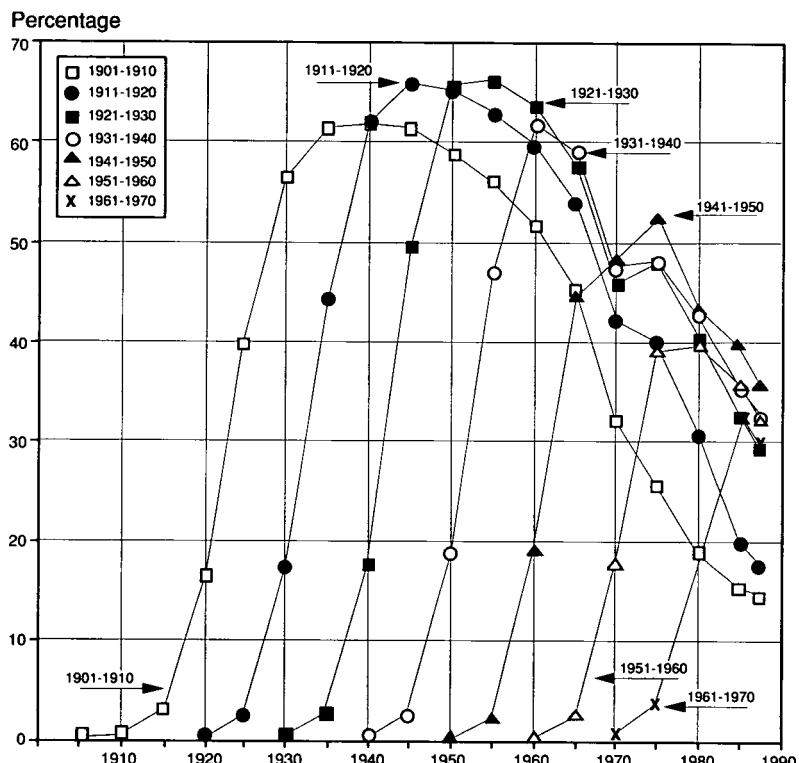
Table 1
**Sample sizes for three major NHIS data sets, by birth cohort,
 gender, and race**

	Male			Female		
	All	White	Black	All	White	Black
Birth Cohorts, 1970 NHIS						
1901-1910	3,363	3,065	256	4,677	4,215	440
1911-1920	4,715	4,331	334	5,934	5,350	525
1921-1930	5,484	4,991	419	6,884	6,129	696
1931-1940	5,188	4,663	438	6,532	5,662	762
1941-1950	6,690	6,008	586	8,409	7,332	941
Birth Cohorts, 1978-80 NHIS						
1901-1910	1,511	1,388	107	2,031	1,839	178
1911-1920	2,520	2,290	200	3,261	2,947	282
1921-1930	3,194	2,922	231	3,768	3,388	335
1931-1940	3,048	2,734	265	3,739	3,260	412
1941-1950	4,185	3,765	342	4,866	4,249	512
1951-1960	5,172	4,572	509	6,137	5,284	747
Birth Cohorts, 1987 NHIS						
1901-1910	331	289	37	831	754	74
1911-1920	833	731	96	1,412	1,240	159
1921-1930	1,084	937	135	1,583	1,345	220
1931-1940	1,125	957	134	1,399	1,145	221
1941-1950	1,757	1,501	205	2,198	1,821	324
1951-1960	2,144	1,839	242	2,936	2,318	528
1961-1970	1,548	1,305	187	2,033	1,581	376

Source: National Health Interview Survey (NHIS) 1970, 1978, 1979, 1980, 1987 Public Use Data tapes, National Center for Health Statistics.

very low peak prevalence. Clearly the increase in per capita consumption of cigarettes during the first part of the century was confined largely to males, while the rapid increase in per capita consumption that occurred just prior to and during World War II involved both men and women. The highest peak prevalence among women occurred for the 1931 to 1940 cohort, with a rate of 43.9 percent in 1965. The peak for the 1921 to 1930 cohort was only slightly lower (42.5 percent in 1960). Thus, the highest peak prevalence for women occurred about 10 years behind the peak prevalence for men. Notable among females is the considerably lower prevalence of smoking

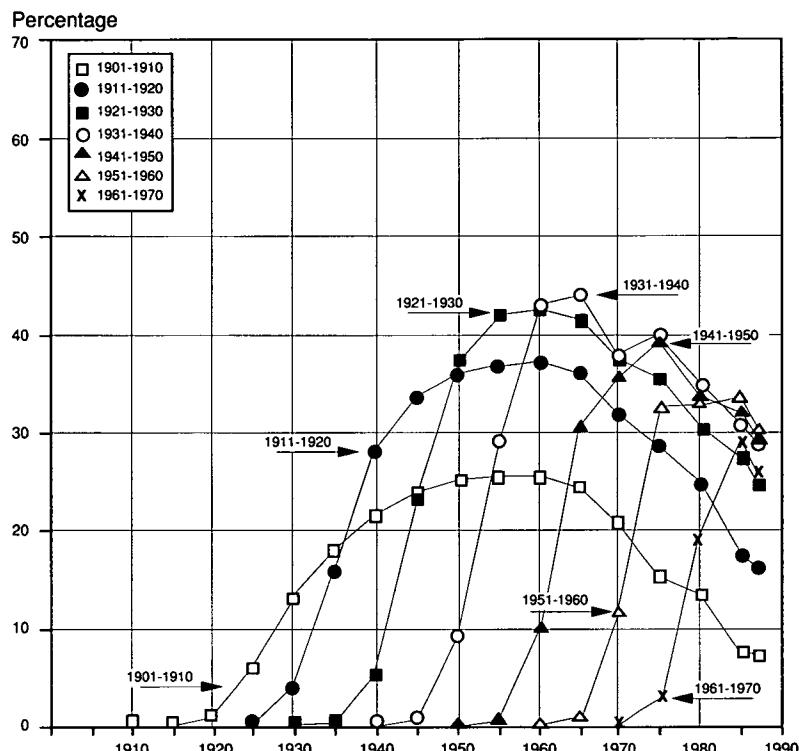
Figure 2
Changes in prevalence of cigarette smoking among successive birth cohorts of U.S. males, 1900 to 1987



in the 1901 to 1910 cohort than in all other cohorts (with a peak of only 25.4 percent in 1955). While the peak prevalence declined considerably for males among those cohorts after 1931 to 1940, the decline has been more modest for females (the peak was 39.3 percent for the 1941 to 1950 cohort, 33.6 percent for the 1951 to 1960 cohort, and 29.2 percent for the 1961 to 1970 cohort).

One impact of this difference in the smoking behavior of the same birth cohorts of men and women is a difference in the current and future lung cancer death rates. Lung cancer occurrence is roughly proportional to the cumulative smoking experience of a cohort (the area under the prevalence curve for the cohort), but lung cancer occurs predominantly in the older age groups of the population. Therefore, overall lung cancer death rates for the U.S. population reflect largely deaths among individuals from ages 50 to 80. The men who are in this age group currently include those cohorts that have the highest peak prevalence of smoking and the greatest cumulative exposure to smoking. The cohorts now entering the 50 to 80 age range, when most lung cancers occur, have a lower peak

Figure 3
Changes in prevalence of cigarette smoking among successive birth cohorts of U.S. females, 1900 to 1987



and cumulative smoking exposure than the cohorts they are replacing. This should result in a decline in the number of lung cancers caused by smoking, and the timing of the projected decline is discussed later in this chapter.

The picture for women is substantially different. Peak and cumulative smoking exposures are substantially lower for those birth cohorts that are currently in the 50 to 80 age range, and so are lung cancer death rates. However, the women who are entering this age range (those cohorts born after 1930) have substantially greater peak and cumulative smoking exposure than those women whom they are replacing (the cohorts born from 1901 to 1930), and overall lung cancer death rates for women are continuing to increase steeply and will not begin to decline until much later than those for men.

Figures 4 and 5 present smoking data for the same cohorts of white and black males. There are several important differences between the smoking patterns for white males and black males that are evident from a comparison of these figures. First, the adoption of cigarette smoking in the early part of this century was somewhat slower among black males than among

Figure 4
Changes in prevalence of cigarette smoking among successive birth cohorts of white U.S. males, 1900 to 1987

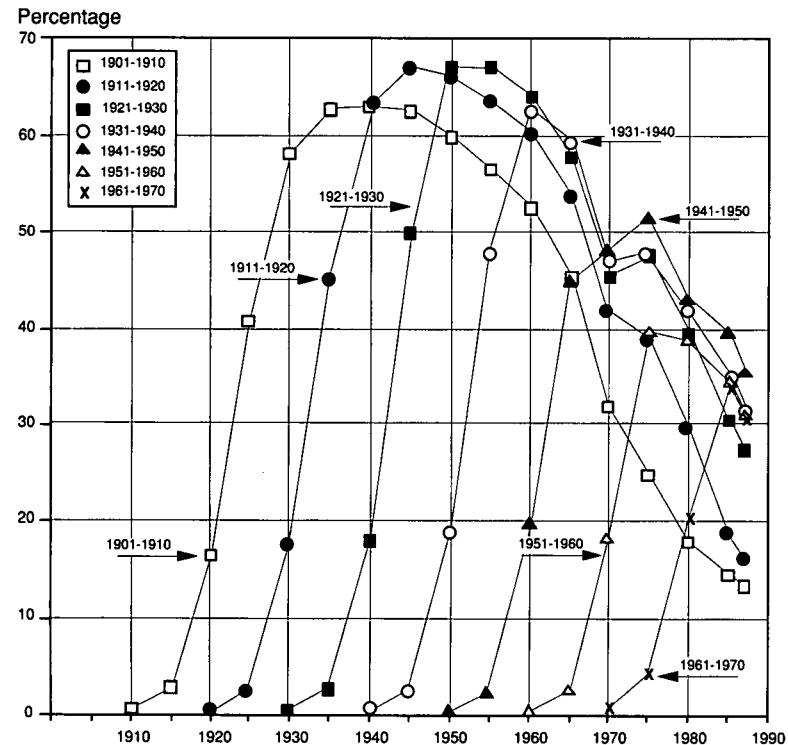
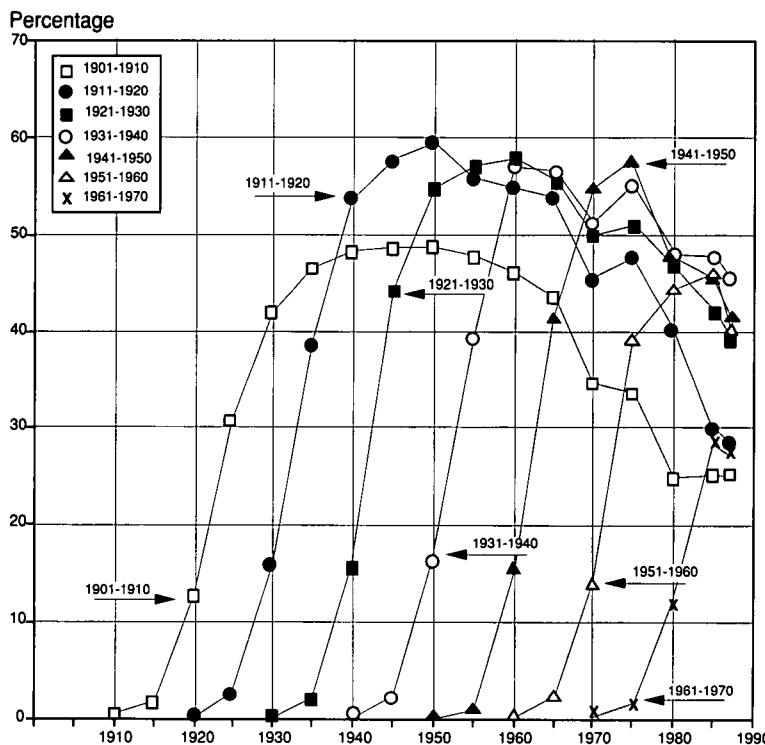


Figure 5
Changes in prevalence of cigarette smoking among successive birth cohorts of black U.S. males, 1900 to 1987



white males. The peak prevalence of smoking for the oldest cohort of black males is dramatically lower than that for the same cohort of white males, and the peak prevalence for each of the next two birth cohorts is also lower for black males. The peak prevalences for the 1931 to 1940 cohorts are similar and the peak prevalences for the cohorts born after 1940 are higher for black males than for white males. It is not until the 1951 to 1960 birth cohort that there is any evidence of a decline in peak prevalence. This suggests that the influences that drive the initiation of smoking occurred somewhat later in this century among the black male population; but among more contemporary cohorts, they have exerted a stronger influence on the black male population than on the white male population.

A second major difference between these two patterns is the width of the prevalence peaks. The number of years that a birth cohort spends at or close to its peak before beginning to decline is much greater for black males than for white males, resulting in the black male cohorts' having a greater cumulative smoking exposure than would be estimated from an examination of their peak prevalence alone. There appears to have been very little smoking cessation among black males until they reached a substantially greater age than their white birth-cohort peers. These two differences in the prevalence patterns are consistent with the lag in black male lung cancer death rates, compared to white male lung cancer death rates, that was observed early in this century, which has now reversed to produce current lung cancer death rates for black males that are substantially above those for white males.

A third difference relates somewhat to the longer duration of peak prevalence for black males. White males in all of the older birth cohorts began to quit in significant numbers in the mid-1950's, but cessation did not become evident among black male cohorts until the middle to late 1960's. A steep decline is evident in each of the three oldest white male cohorts (those that had already reached their peak) by the mid-1950's, and the onset of the steep part of the decline seems to be more closely related to the calendar year than to age. This timing coincides with the drop in per capita tobacco consumption that occurred during the mid-1950's and which has been attributed by Warner (1981) and others to the widespread publicity on smoking-related disease risks that occurred after publication of the first major prospective mortality studies on smoking risks. The same three cohorts of black males do not show a similar decline in prevalence until the 1970 data point, where all three cohorts show a steep decline from 1965. This time point also coincides with a drop in per capita cigarette consumption that occurred from 1967 to 1970 and which has been attributed to

the antismoking advertisements that were on television at that time to counter cigarette commercials. This difference in the timing of the decline in prevalence between white and black males suggests that the knowledge of the disease risks associated with smoking may not have effectively penetrated into the black community until much later than it reached the white community.

Figure 6 shows smoking prevalence for white female cohorts and closely resembles Figure 3 (all females). Figure 7 (black females) shows some general similarities to the pattern for white females.

LUNG CANCER MORTALITY

From 1950 to the present, the age-adjusted cancer mortality rate for all sites combined has been increasing. However, when these rates are calculated for "all other cancers" (excluding lung cancer) the overall cancer death rate has been constant or declining, as shown in Figures 8 through 13. This decline is evident for the total male and female populations (Figures 8 and 11), and it is evident for the subgroups of white males, white females, and nonwhite females (Figures 9, 12, and 13); however, the death rates for "all other cancers" among nonwhite males are still increasing slightly. [Note: For all analyses in this chapter, the designations "black" and "nonwhite" may be considered interchangeable, as black men and women constitute about 90 percent of the nonwhite population studied.]

This section of Chapter 3 examines trends in mortality from primary cancers of the lung between 1950 and 1985. Its purpose is to review the changes in lung cancer death rates as a reflection of the changes in smoking prevalence described above.

Methodology

Data from the National Death Tapes, supplied by the National Center for Health Statistics, were used to calculate mortality rates. These rates were age-adjusted according to the direct method (Lilienfeld, 1967), with the 5-year age distribution of the total 1970 U.S. population as the standard. Except where noted, rates are presented as cases per 100,000 population. The analysis is based on the same birth cohorts as those used in the previous section on smoking prevalence.

Mortality Rates for Lung Cancer

Lung cancer mortality rates, by 10-year birth cohort, gender, and race, are presented in Tables 2 through 7. Lung cancer mortality becomes measurable when a cohort reaches a minimum age of 35, and it rises sharply as age increases. One can compare age-specific lung cancer death rates for different birth cohorts by using these tables and matching the death rate for one birth cohort with the death rate recorded 10 years earlier for the preceding birth cohort. Each birth cohort is 10 years younger than the preceding one, so the rates for the

Figure 6
Changes in prevalence of cigarette smoking among successive birth cohorts of white U.S. females, 1900 to 1987

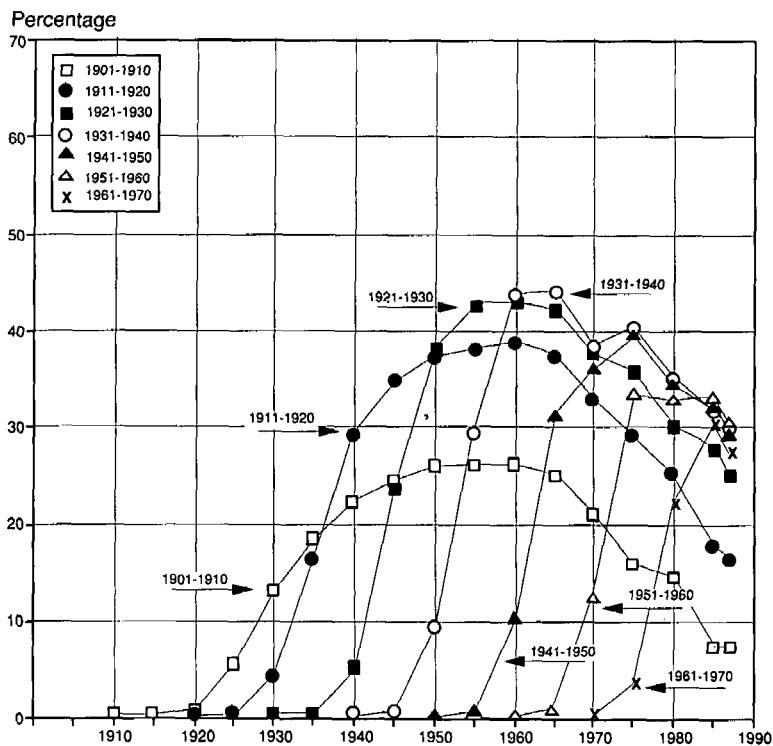


Figure 7
Changes in prevalence of cigarette smoking among successive birth cohorts of black U.S. females, 1900 to 1987

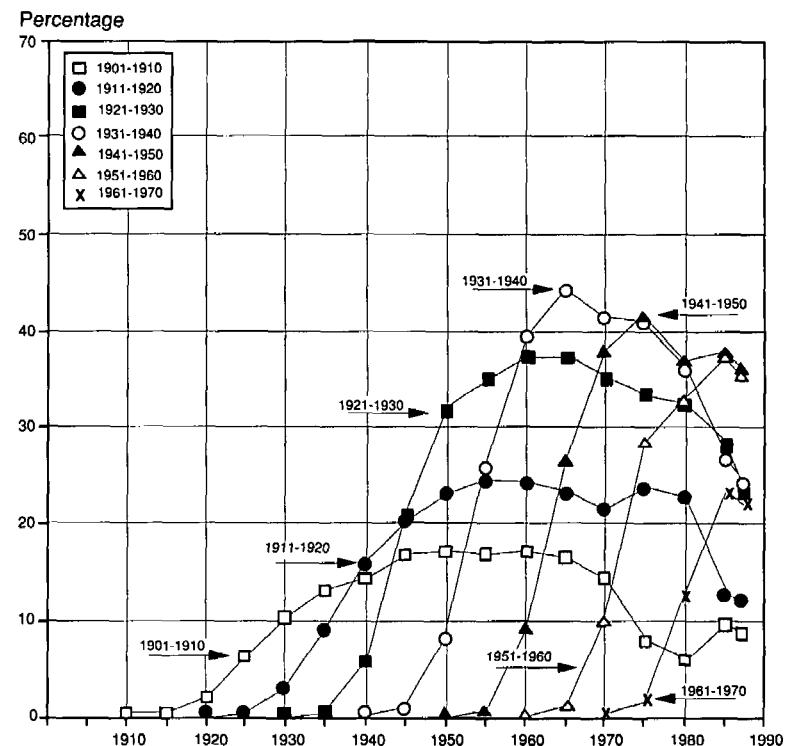
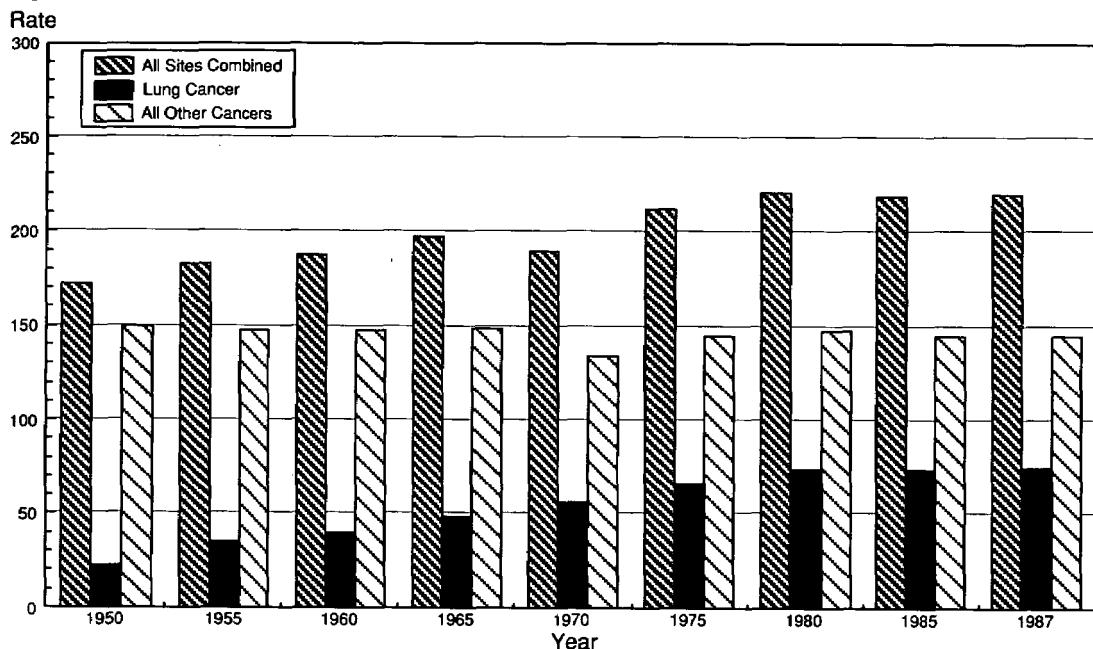


Figure 8
Age-adjusted cancer mortality rates,* all males



* Deaths per 100,000.

preceding cohort at a given age will have occurred 10 years earlier. The age-specific death rates are presented by birth cohort in Tables 8 through 13. Successive cohorts of males experienced higher age-specific mortality rates through the 1921 to 1930 cohort. However, beginning with the 1931 to 1940 cohort, the age-specific rates have been declining. This is a reflection of the downward trend in cigarette smoking that began with the 1931 to 1940 cohort of males in the United States.

Table 4 shows the mortality rates for lung cancer among nonwhite males. The rates for nonwhite males born during the period from 1901 through 1910 are somewhat lower than those for all U.S. males and for white males. However, for each subsequent cohort, the nonwhite male death rates from lung cancer are considerably higher than those for all males. The higher rates among nonwhites may be explained in part by the longer maintenance of the smoking habit and higher rates of smoking during the critical older ages.

The lung cancer death rates for women, first measurable at age 35, are considerably lower than those for males and rise more slowly with age in the older birth cohorts (Table 5). While the rates for males began to decline with the 1931 to 1940 cohort, the rates continued to rise among women for successive cohorts through 1931 to 1940.

Figure 9
Age-adjusted cancer mortality rates,* white males

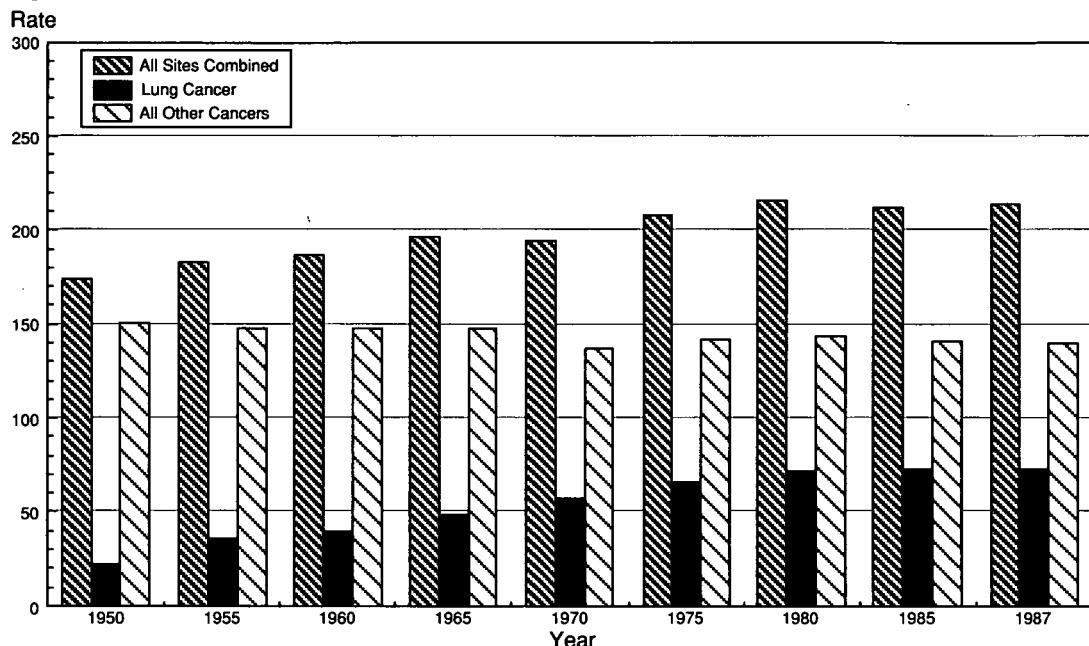


Figure 10
Age-adjusted cancer mortality rates,* nonwhite males

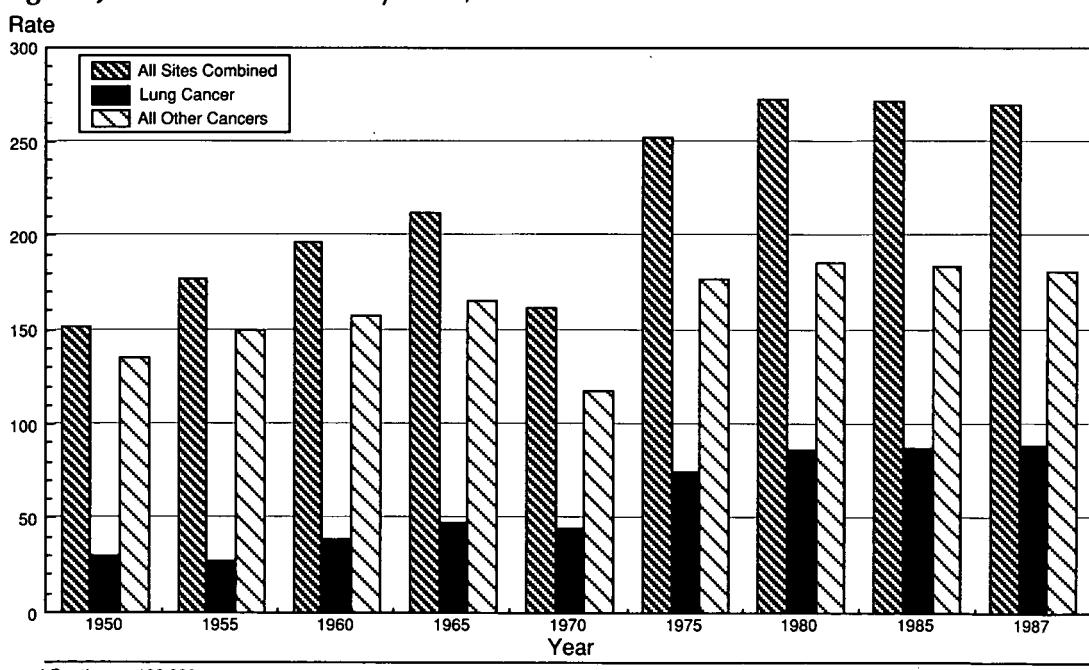
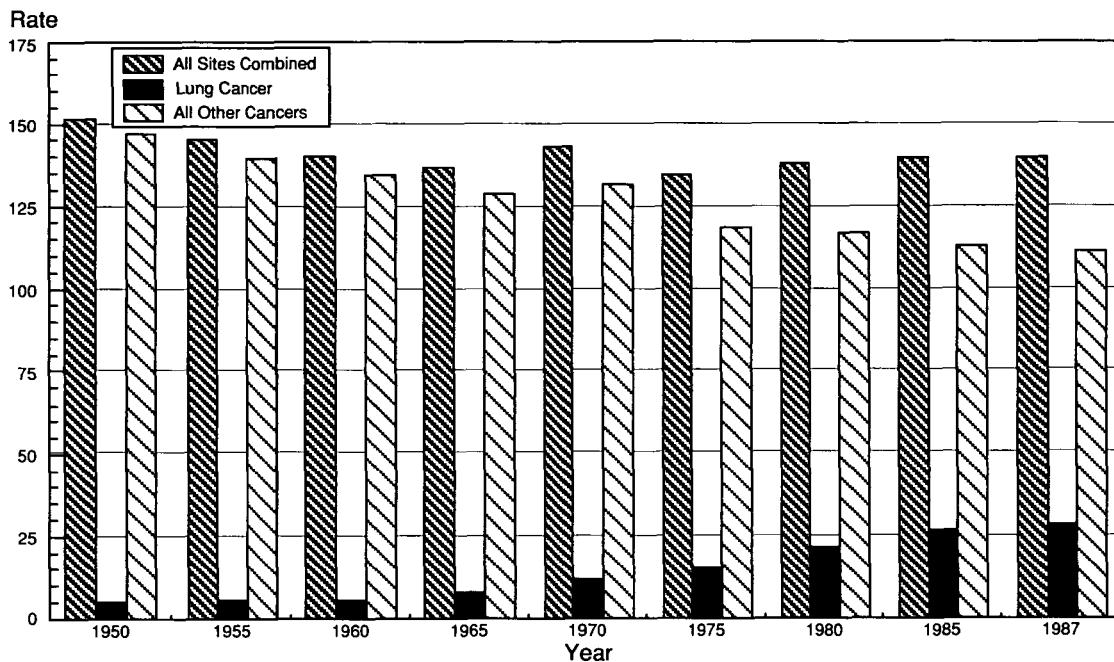


Figure 11
Age-adjusted cancer mortality rates,* all females



* Deaths per 100,000.

The U.S. white female lung cancer mortality rates (Table 6) are very close to those for all females (Table 5). The lung cancer mortality rates among the nonwhite female cohorts before 1921 to 1930 (Table 7) were generally, though not consistently, lower than among the whites; however, at that point they seem to catch up and then slightly surpass the white females. Smoking prevalence data suggest that lung cancer mortality would be lower for nonwhites than for whites in the earliest two cohorts.

Tables 8 through 13 provide a retabulation of data from Tables 2 through 7, as age-specific rates with percentage of change between cohorts. This allows a ready comparison of the lung cancer experience of the different cohorts at the same ages. For example, when males in the 1911 to 1920 cohort were aged 40 to 49, their lung cancer mortality rate was higher than that of the 1901 to 1910 cohort at the same age. The rates continued to rise as the 1921 to 1930 cohort reached age 40 to 49; however, the rates declined slightly for the 1931 to 1940 cohort. This pattern is seen for all males, regardless of race. At ages 50 to 59, the rates rose considerably less between the 1911 to 1920 and 1921 to 1930 cohorts than they did between the 1901 to 1910 and 1911 to 1920 cohorts (for all males, 13 percent compared with 32 percent), suggesting a leveling off of lung cancer mortality among this age group.

Figure 12
Age-adjusted cancer mortality rates,* white females

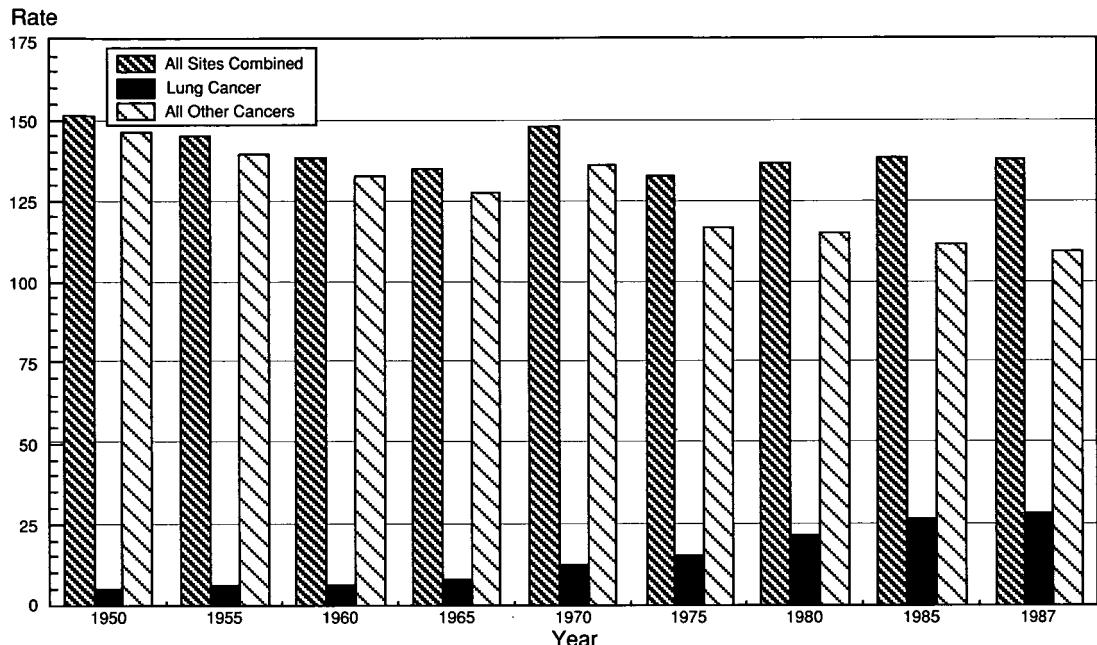


Figure 13
Age-adjusted cancer mortality rates,* nonwhite females

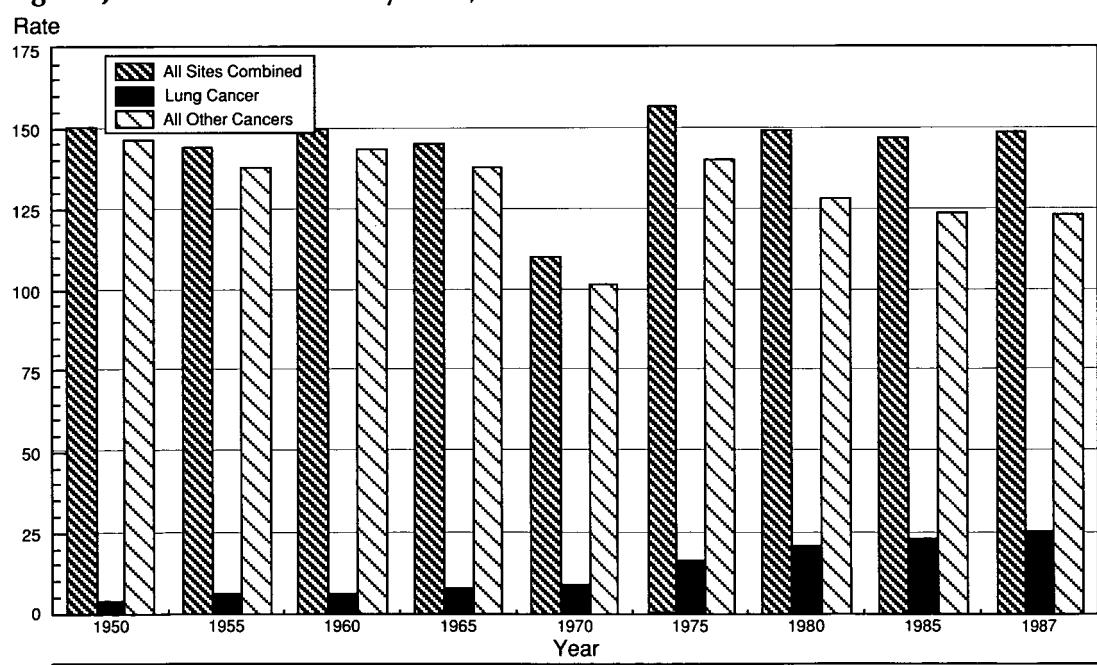


Table 2

Lung cancer mortality rates, 1950 to 1985, for all males born 1901 through 1950, by birth cohort

Year	Lung Cancer Mortality,* by Birth Cohort				
	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950
1950	17.0				
1955	47.6				
1960	91.1	24.0			
1965	159.3	58.7	13.2		
1970	259.7	120.1	35.4		
1975	363.4	200.5	74.3	14.0	
1980	470.7	308.2	135.3	33.9	
1985	543.0	415.9	220.3	67.0	9.9

* Deaths per 100,000.

Table 3

Lung cancer mortality rates, 1950 to 1985, for white males born 1901 through 1950, by birth cohort

Year	Lung Cancer Mortality,* by Birth Cohort				
	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950
1950	17.1				
1955	46.9				
1960	90.2	22.6			
1965	159.4	56.8	12.2		
1970	259.9	115.2	32.7		
1975	365.2	193.9	69.3	12.6	
1980	473.5	301.1	128.4	30.9	
1985	546.4	409.5	211.9	62.2	9.0

* Deaths per 100,000.

Smoking Prevalence And Lung Cancer Mortality

Figures 14 through 33 offer a closer look at the effect of smoking and at trends in lung cancer mortality, by birth cohort. For each gender and race group by birth cohort, the figures show changes over time in the percentage of those currently smoking, percentage of those who have ever smoked, and rates of lung cancer mortality, expressed as number of deaths per 10,000 population.

Table 4
Lung cancer mortality rates, 1950 to 1985, for nonwhite males
born 1901 through 1950, by birth cohort

Year	Lung Cancer Mortality,* by Birth Cohort				
	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950
1950	16.1				
1955	54.1				
1960	99.8	36.7			
1965	158.7	77.0	22.3		
1970	257.8	166.2	59.0		
1975	347.6	262.2	117.1	24.1	
1980	445.1	374.5	194.7	54.8	
1985	511.6	475.3	288.7	99.4	16.5

* Deaths per 100,000.

Table 5
Lung cancer mortality rates, 1950 to 1985, for all females born
1901 through 1950, by birth cohort

Year	Lung Cancer Mortality,* by Birth Cohort				
	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950
1950	3.5				
1955	7.2				
1960	12.0	6.1			
1965	21.9	13.9	4.4		
1970	40.0	30.1	12.1		
1975	65.8	54.4	26.6	7.0	
1980	101.6	91.5	52.1	16.9	
1985	133.3	141.8	91.2	34.8	5.6

* Deaths per 100,000.

Small sample sizes create some difficulty in interpreting findings in smoking behavior among the black male cohorts (Figures 15, 17, 19, 21, and 23). For example, estimates for the 1901 to 1910 cohort in 1985 and 1987 are based on only 37 respondents. This results in a 95 percent confidence interval of approximately ± 14 percentage points (assuming a random sample). Regardless, the following trends appear: For the four oldest cohorts (1901 to 1940), there is an apparent rise

Table 6
Lung cancer mortality rates, 1950 to 1985, for white females born 1901 through 1950, by birth cohort

Year	Lung Cancer Mortality,* by Birth Cohort				
	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950
1950	3.5				
1955	6.8				
1960	11.8	6.0			
1965	21.7	13.8	4.2		
1970	40.5	30.1	11.7		
1975	64.7	55.4	26.5	6.8	
1980	103.4	92.8	51.6	16.5	
1985	136.4	145.6	91.7	35.1	5.5

* Deaths per 100,000.

Table 7
Lung cancer mortality rates, 1950 to 1985, for nonwhite females born 1901 through 1950, by birth cohort

Year	Lung Cancer Mortality,* by Birth Cohort				
	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950
1950	3.6				
1955	10.5				
1960	13.1	7.2			
1965	23.8	14.5	5.9		
1970	35.0	29.7	14.9		
1975	79.3	45.8	28.1	8.0	
1980	83.8	79.6	55.8	19.5	
1985	101.2	108.7	87.7	33.0	6.2

* Deaths per 100,000.

between 1970 and 1985 in the number who have ever smoked. In addition to the small sample size, slight changes in survey methodology over the different years of administration (as described previously) could cause these results. Still, these increases deserve further exploration.

Also of note are the rates of lung cancer relative to white males. Although the prevalence of current smokers and ever-smokers is lower among black males through the 1931 to 1940

Table 8
Age-specific lung cancer death rates,* 1950 to 1980, for all males born 1901 through 1940, by birth cohort

	1901- 1910 Cohort	1911- 1920 Cohort	Percent Change	1921- 1930 Cohort	Percent Change	1931- 1940 Cohort	Percent Change
Age							
40-49	17.0	24.0	(41.2)	35.4	(47.5)	33.9	(-4.2)
50-59	91.0	120.1	(31.8)	135.3	(12.7)		
60-69	259.7	308.2	(18.7)				
70-79	470.7						

*Per 100,000 population.

Table 9
Age-specific lung cancer death rates,* 1950 to 1980, for white males born 1901 through 1940, by birth cohort

	1901- 1910 Cohort	1911- 1920 Cohort	Percent Change	1921- 1930 Cohort	Percent Change	1931- 1940 Cohort	Percent Change
Age							
40-49	17.1	22.6	(32.2)	32.7	(44.6)	30.9	(-5.5)
50-59	90.2	115.2	(27.7)	128.4	(11.5)		
60-69	259.9	301.1	(15.8)				
70-79	473.5						

*Per 100,000 population.

cohort, lung cancer death rates are similar between the races for the 1901 to 1910 cohort, and they are noticeably higher for black males in each successive cohort. For example, for the 1921 to 1930 cohort (Figure 19) in 1985, the lung cancer death rate for black males was more than 36 percent higher than for white males, even though the peak prevalence of smoking among black males in that cohort never achieved that of white males, and the ever-smokers rate matched that of whites only since 1970 (see Figure 18). The reason for this disparity in lung cancer death rates is not clear. Differences in smoking behavior other than prevalence may play a role, such as the type of cigarette smoked and the amount of each cigarette smoked. However, consumption in terms of the number of cigarettes smoked is considerably *lower* among blacks (US DHHS, 1988).

Table 10
Age-specific lung cancer death rates,* 1950 to 1980, for nonwhite males born 1901 through 1940, by birth cohort

	1901- 1910 Cohort	1911- 1920 Cohort	Percent Change	1921- 1930 Cohort	Percent Change	1931- 1940 Cohort	Percent Change
Age							
40-49	16.1	36.7	(128.0)	59.0	(60.8)	54.8	(-7.1)
50-59	99.8	166.2	(66.5)	194.7	(17.1)		
60-69	257.8	374.5	(45.3)				
70-79	445.1						

*Per 100,000 population.

Table 11
Age-specific lung cancer death rates,* 1950 to 1980, for all females born 1901 through 1940, by birth cohort

	1901- 1910 Cohort	1911- 1920 Cohort	Percent Change	1921- 1930 Cohort	Percent Change	1931- 1940 Cohort	Percent Change
Age							
40-49	3.5	6.1	(74.3)	12.1	(98.4)	16.9	(39.7)
50-59	12.0	30.1	(150.8)	52.1	(73.1)		
60-69	40.0	91.5	(128.8)				
70-79	101.6						

*Per 100,000 population.

Also to be considered is the shorter life expectancy of black males compared with white males—approximately 8 to 10 years for males born between 1920 and 1950 (Hoffman, 1987). The mortality rate for black males in that age group may result in considerable underestimation of past smoking behavior of the earlier cohorts, more so than for white males, because estimates are based on the behavior of survivors only. Thus, it is possible that there were higher rates of smoking than those reported for those cohorts, resulting in the observed lung cancer mortality rates.

White females (Figures 24, 26, 28, 30, and 32) are similar to white males in that, in later cohorts, there is considerably more initiation of smoking after the peak prevalence than for earlier cohorts, as indicated by differences between the current smoker and ever-smoker curves. For white females, as with

Table 12

Age-specific lung cancer death rates,* 1950 to 1980, for white females born 1901 through 1940, by birth cohort

	1901- 1910 Cohort	1911- 1920 Cohort	Percent Change	1921- 1930 Cohort	Percent Change	1931- 1940 Cohort	Percent Change
Age							
40-49	3.5	6.0	(71.4)	11.7	(95.0)	16.5	(41.0)
50-59	11.8	30.1	(155.1)	51.6	(71.4)		
60-69	40.5	92.8	(129.1)				
70-79	103.4						

*Per 100,000 population.

Table 13

Age-specific lung cancer death rates,* 1950 to 1980, for nonwhite females born 1901 through 1940, by birth cohort

	1901- 1910 Cohort	1911- 1920 Cohort	Percent Change	1921- 1930 Cohort	Percent Change	1931- 1940 Cohort	Percent Change
Age							
40-49	3.6	7.2	(100.0)	14.9	(106.9)	19.5	(30.9)
50-59	13.1	29.7	(126.7)	55.8	(87.9)		
60-69	35.0	79.6	(127.4)				
70-79	83.8						

*Per 100,000 population.

white males, this becomes apparent for the 1941 to 1950 cohort (Figure 32). The lower overall smoking rates for white females compared with white males for all cohorts shown are borne out in considerably lower lung cancer death rates for women. It can be expected, however, that as later cohorts (e.g., 1951 to 1960) enter the ages at which lung cancer death rates increase rapidly, the lung cancer death rate differential between males and females will begin to disappear because of the narrowing gap in smoking behavior.

Starting with the 1931 to 1940 cohort (Figure 31), the pattern of both current smokers and ever-smokers for black women is similar to that for white women. Prior to 1931 (Figures 25, 27, and 29), black women had lower rates of current smokers and ever-smokers than did white women, with one exception. In the 1921 to 1930 cohort (Figures 28 and 29),

Figure 14
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1901 to 1910

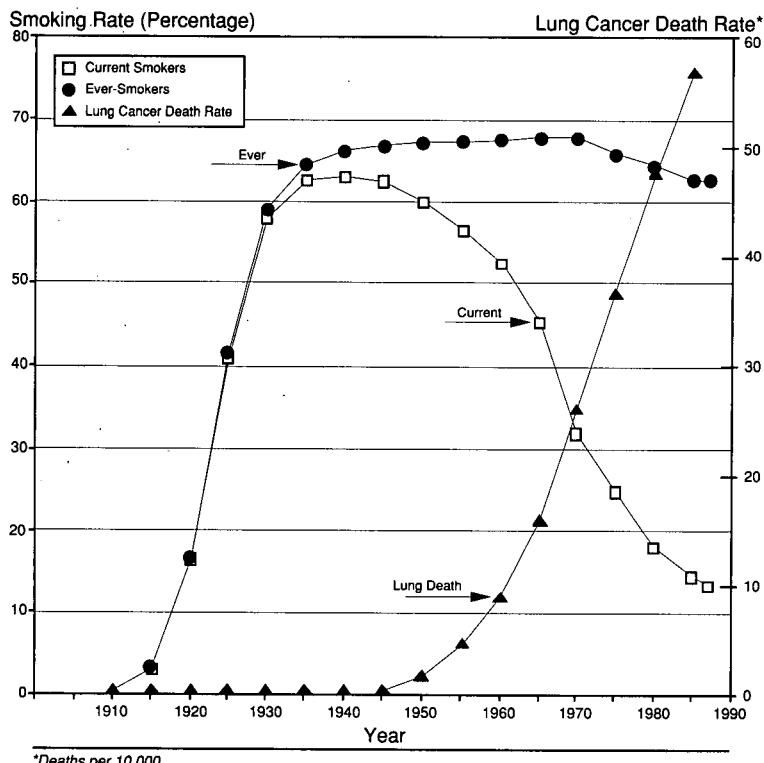


Figure 15
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1901 to 1910

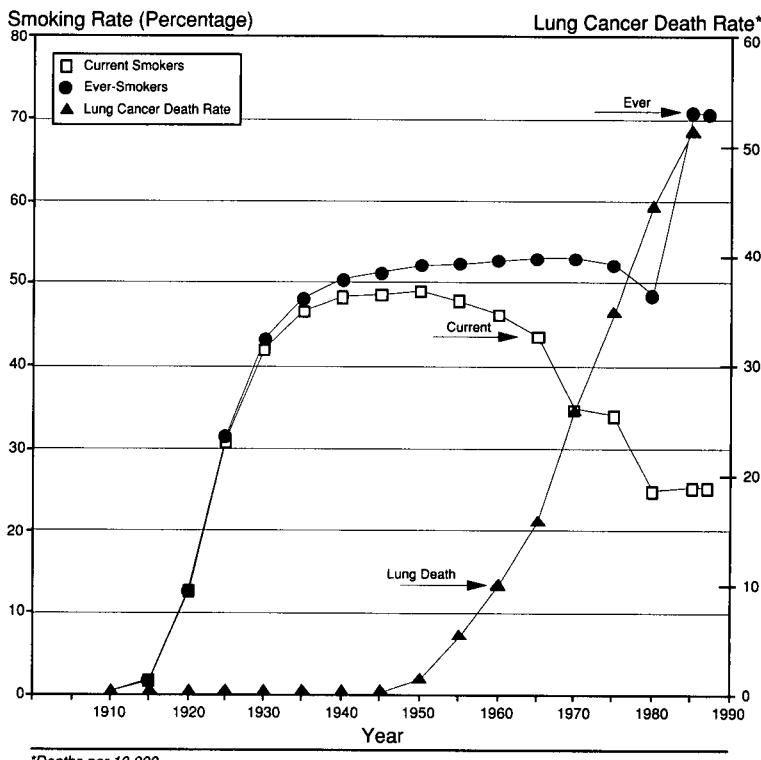


Figure 16
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1911 to 1920

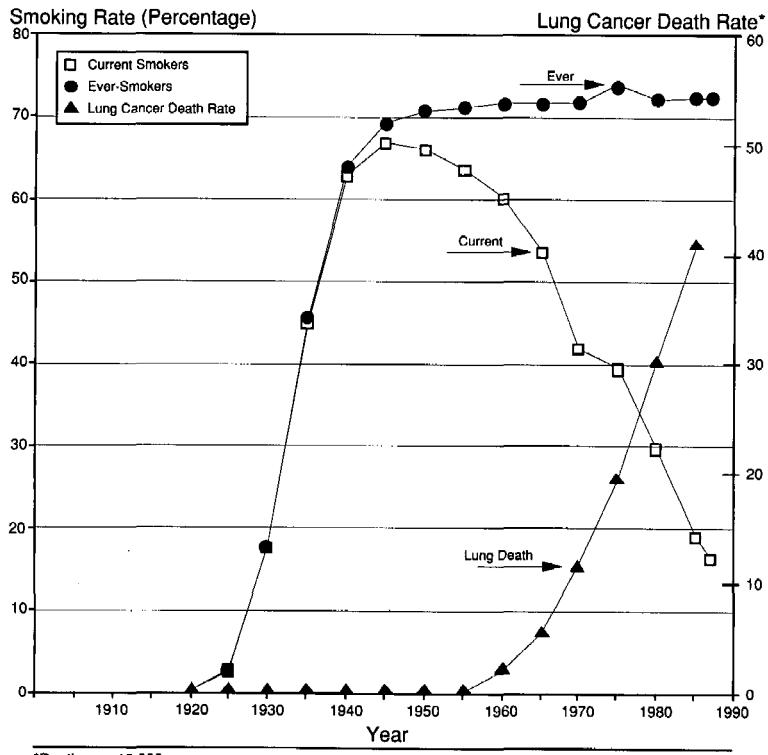


Figure 17
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1911 to 1920

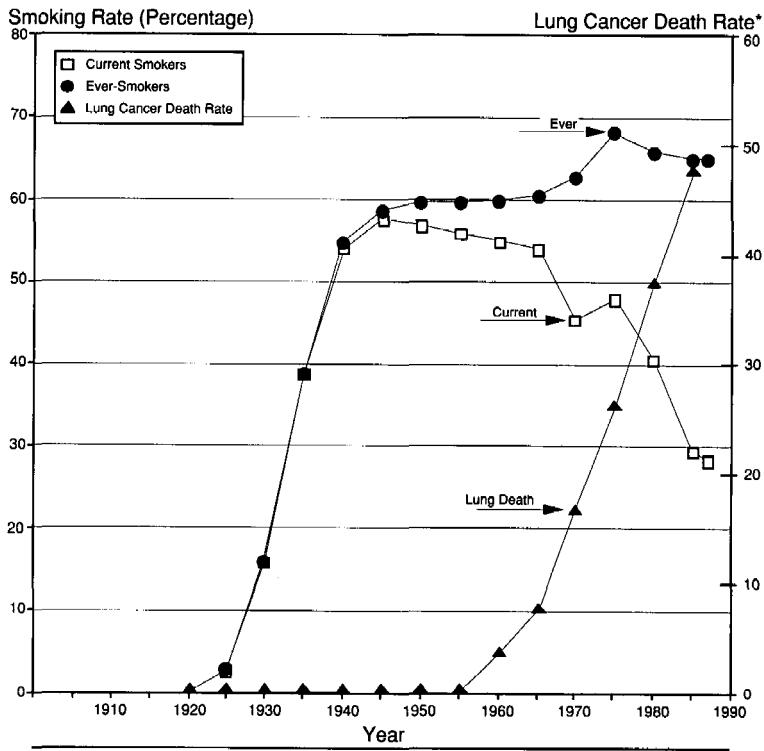


Figure 18
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1921 to 1930

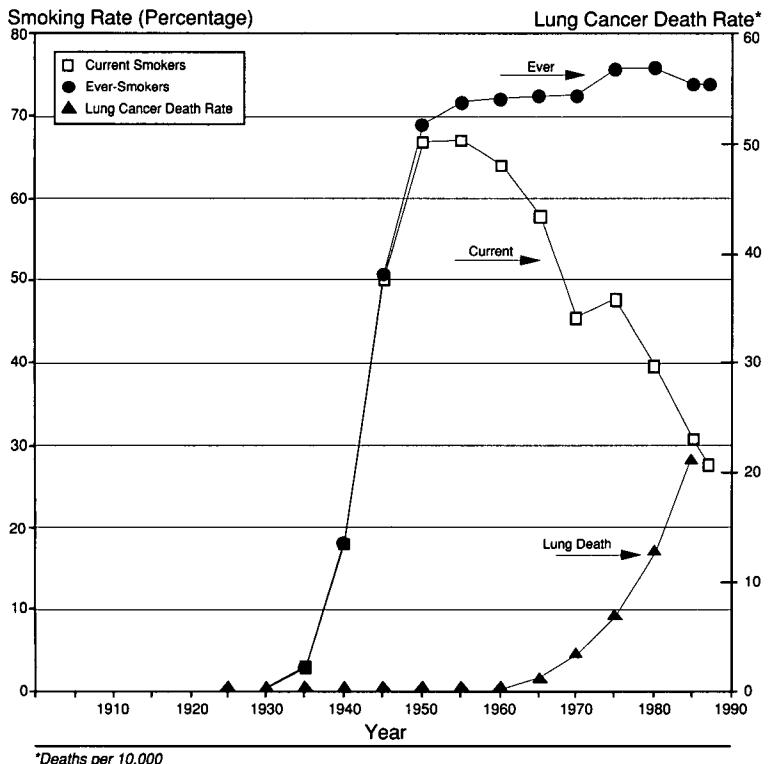


Figure 19
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1921 to 1930

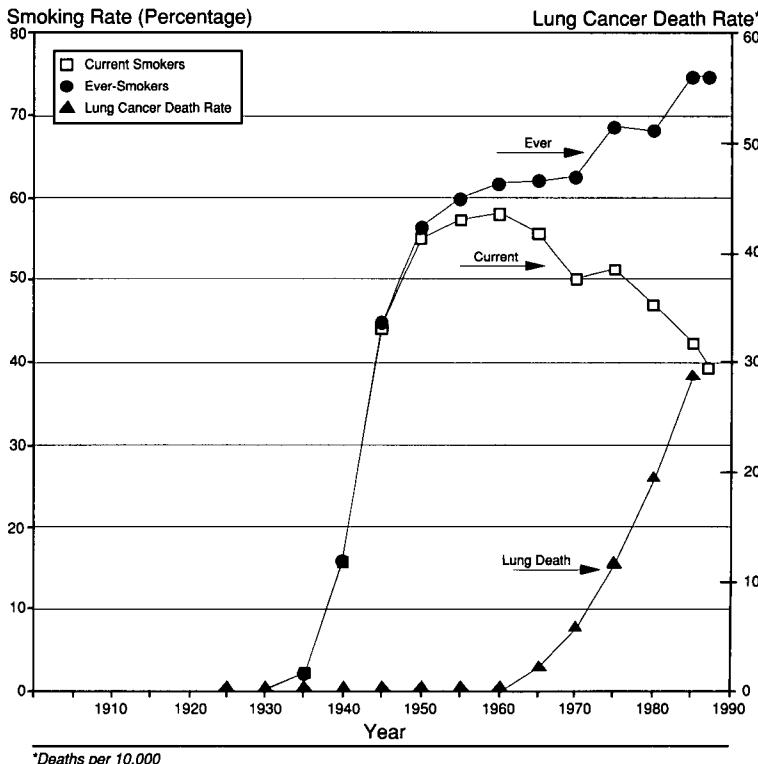


Figure 20
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1931 to 1940

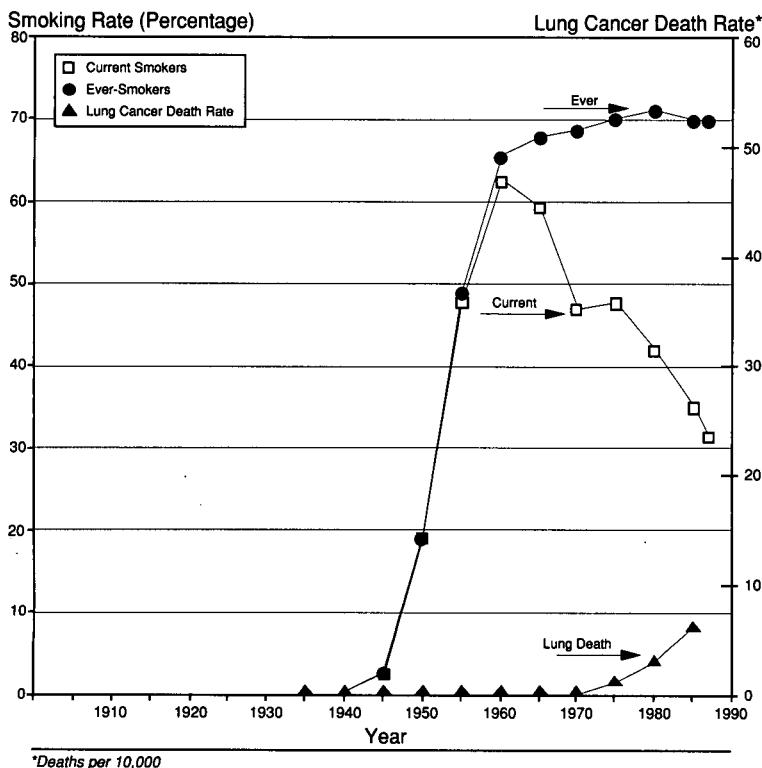


Figure 21
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1931 to 1940

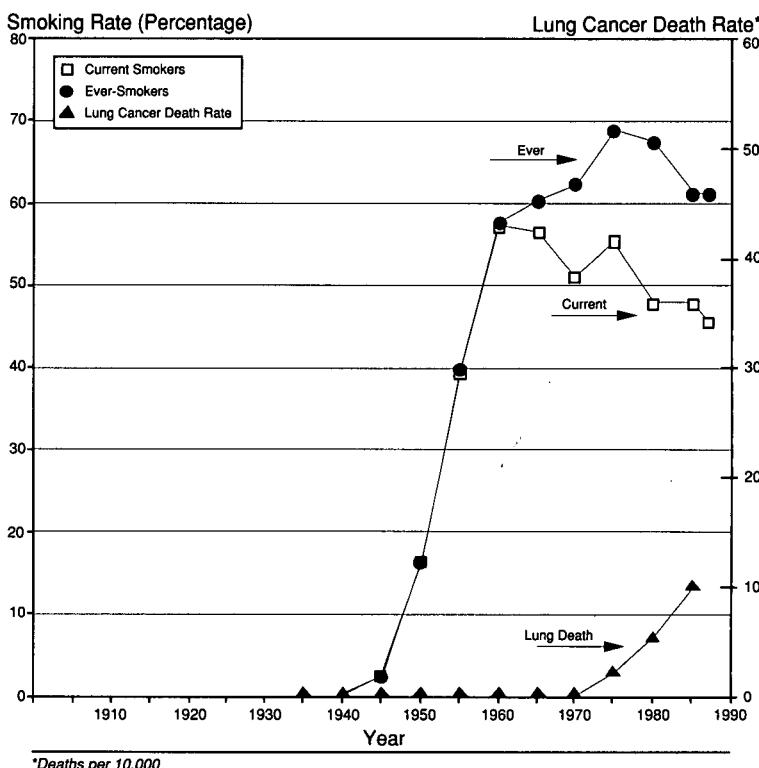


Figure 22
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1941 to 1950

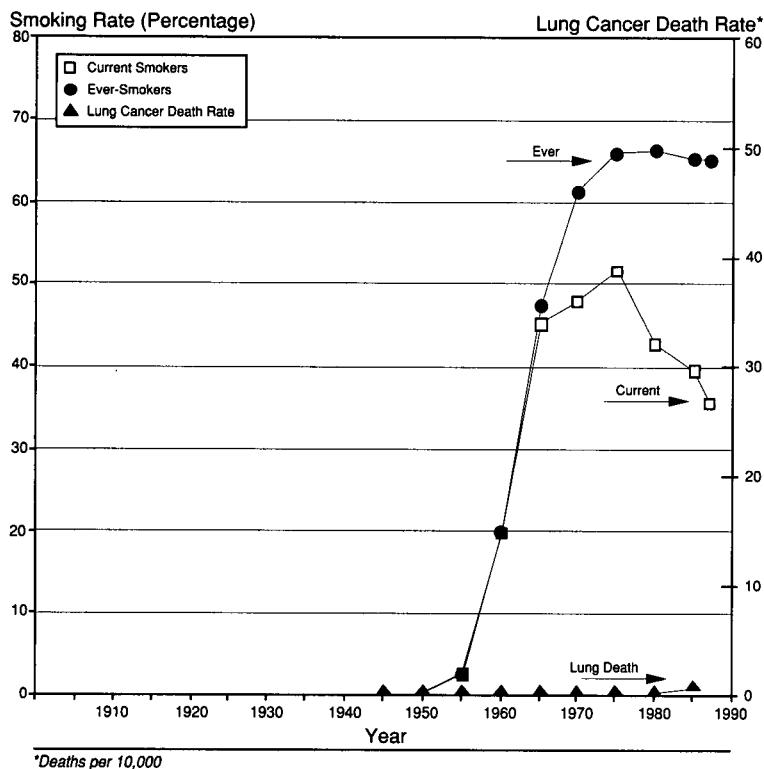


Figure 23
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1941 to 1950

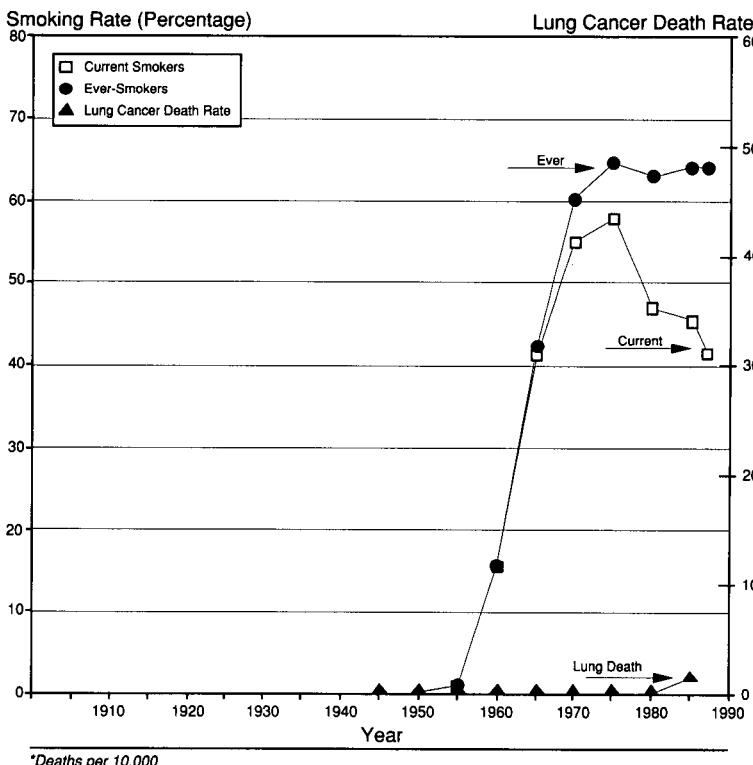
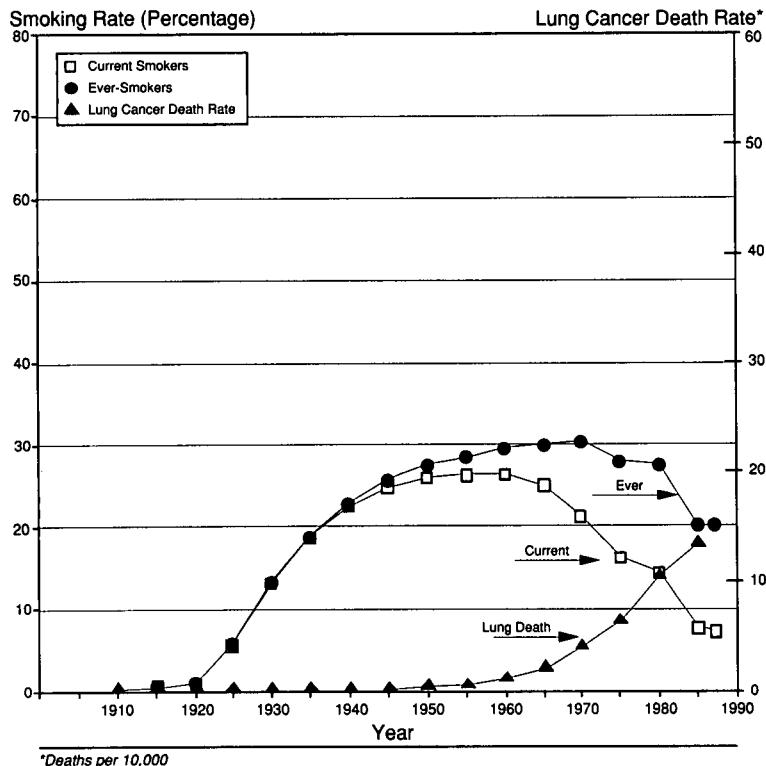


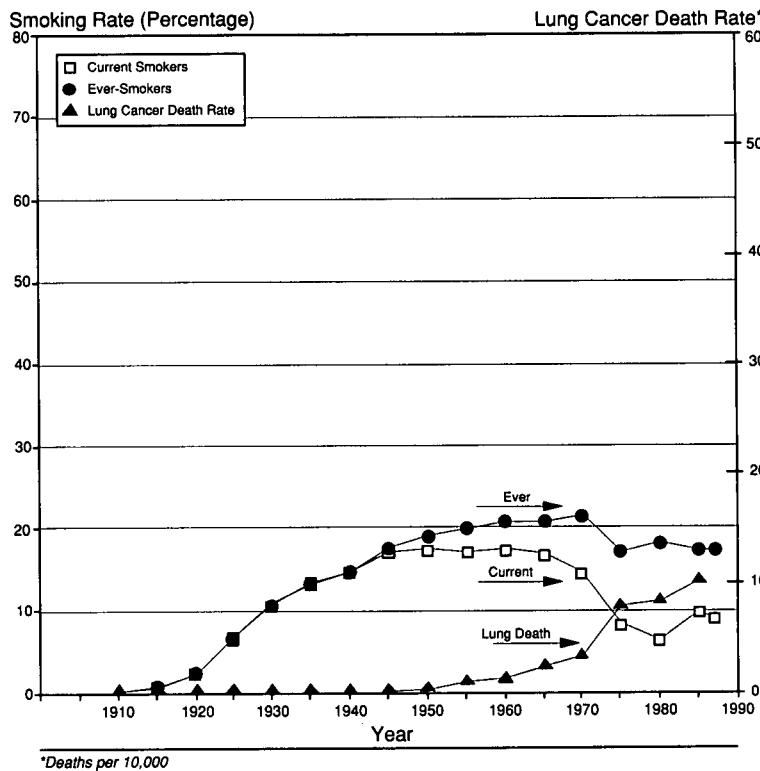
Figure 24
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1901 to 1910



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*Deaths per 10,000

Figure 25
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1901 to 1910



*Deaths per 10,000

Figure 26
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1911 to 1920

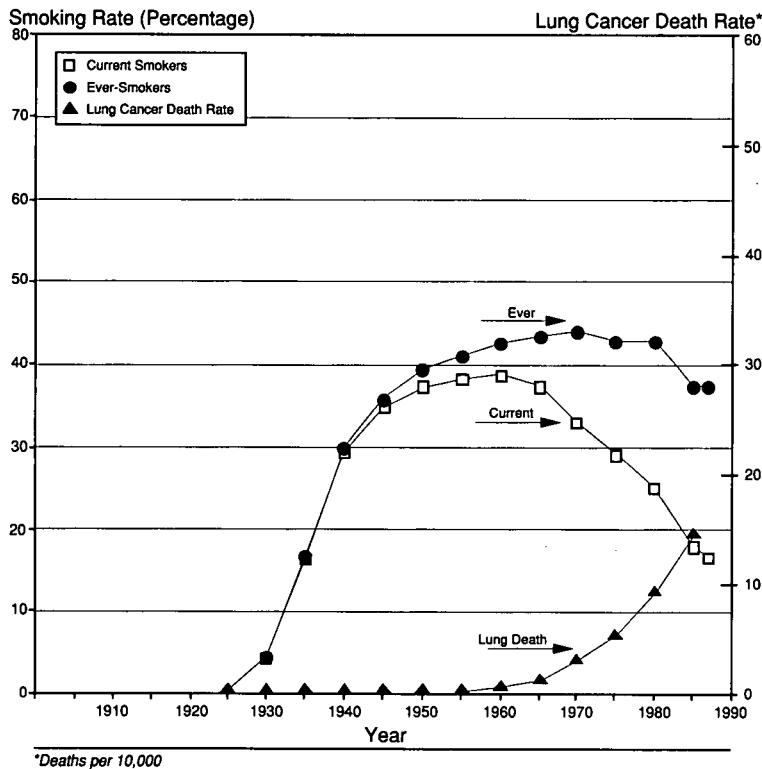


Figure 27
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1911 to 1920

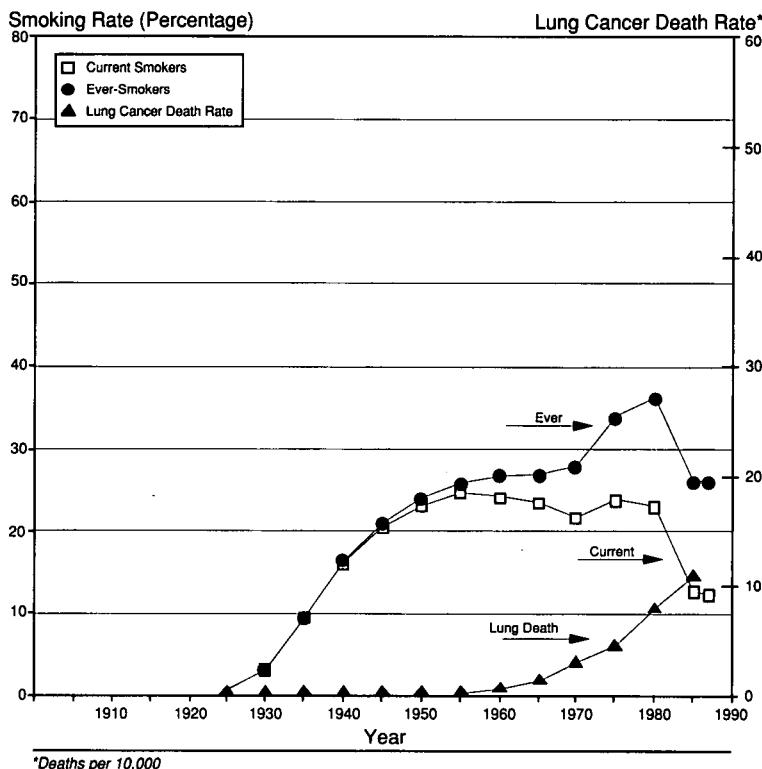


Figure 28
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1921 to 1930

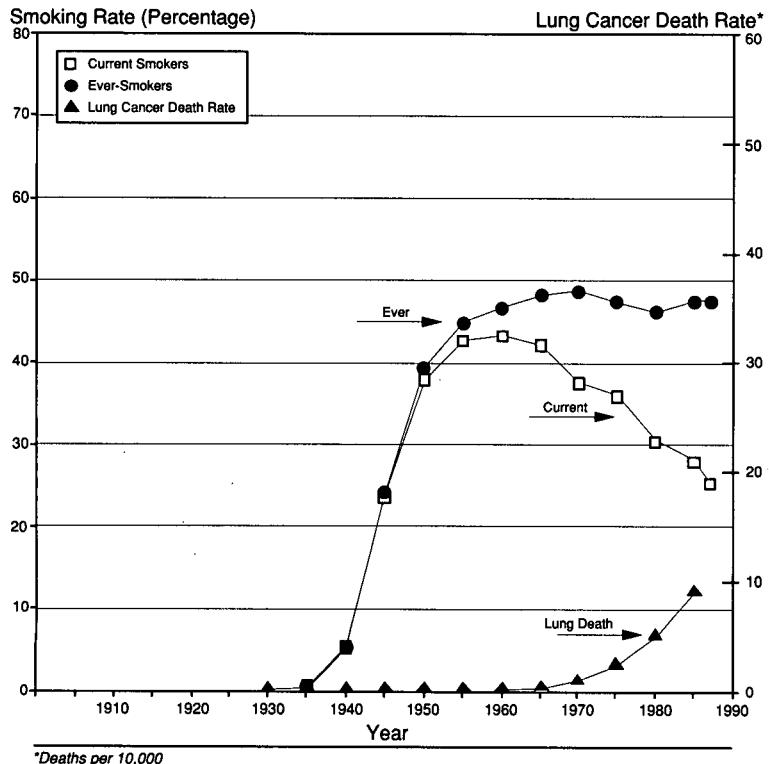


Figure 29
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1921 to 1930

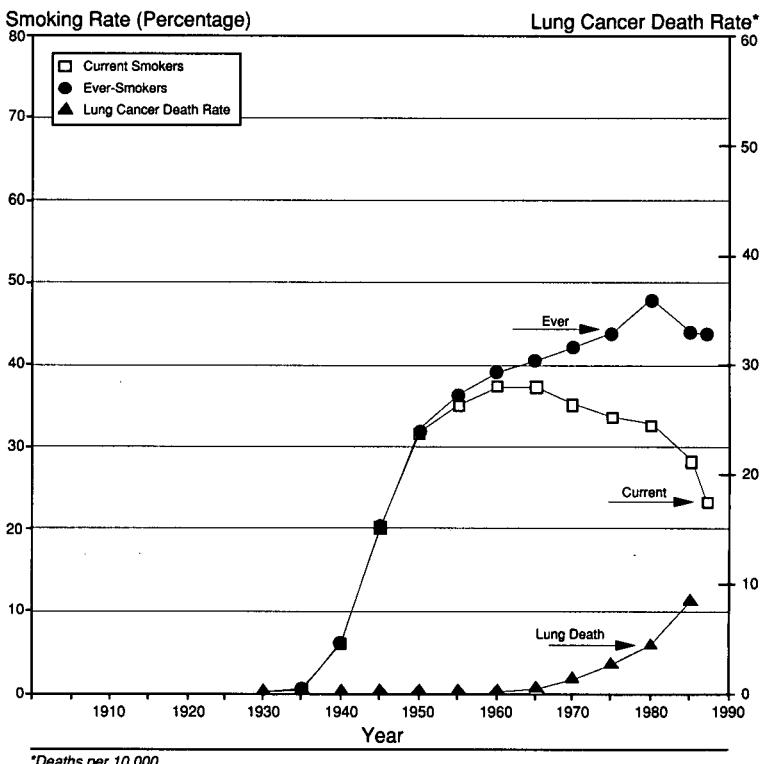
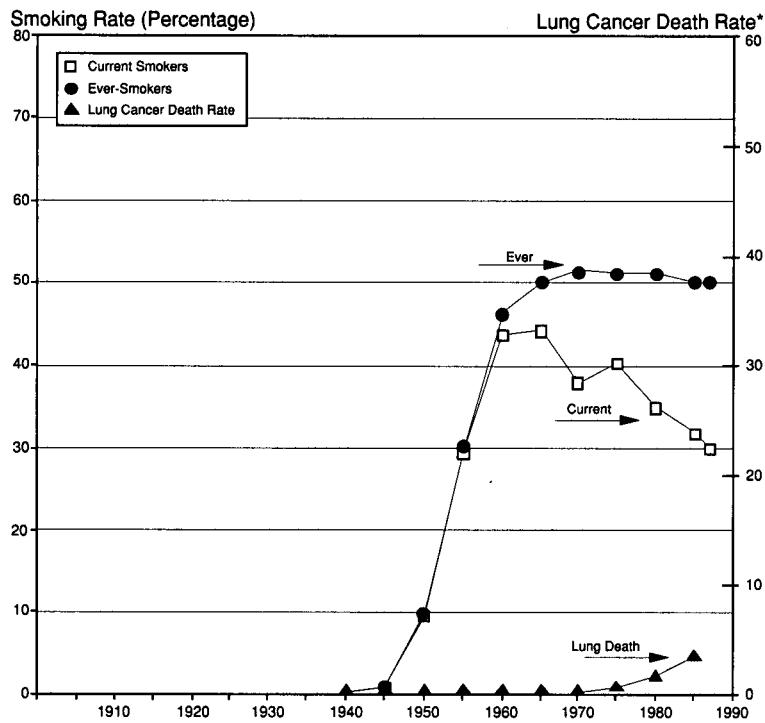
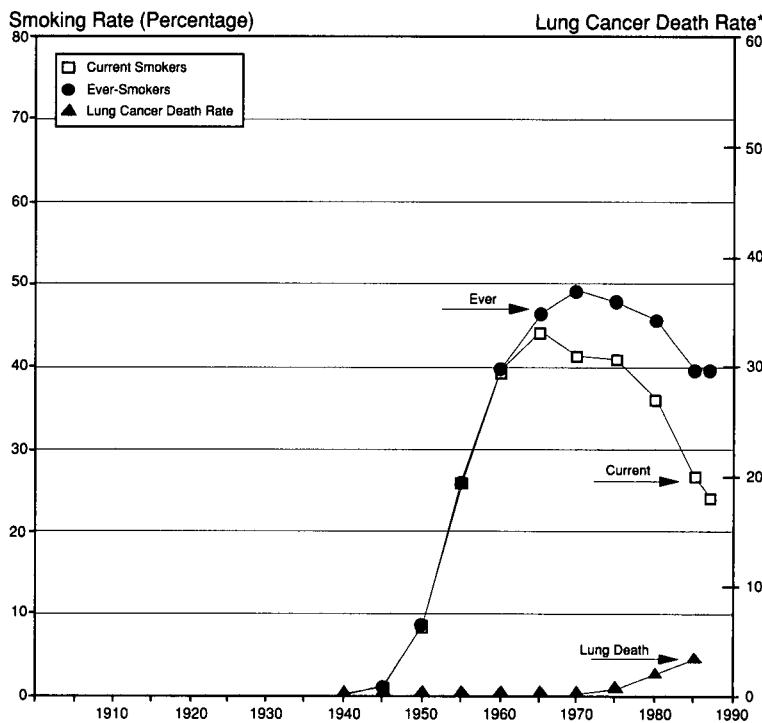


Figure 30
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1931 to 1940



*Deaths per 10,000

Figure 31
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1931 to 1940



*Deaths per 10,000

Figure 32
Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1941 to 1950

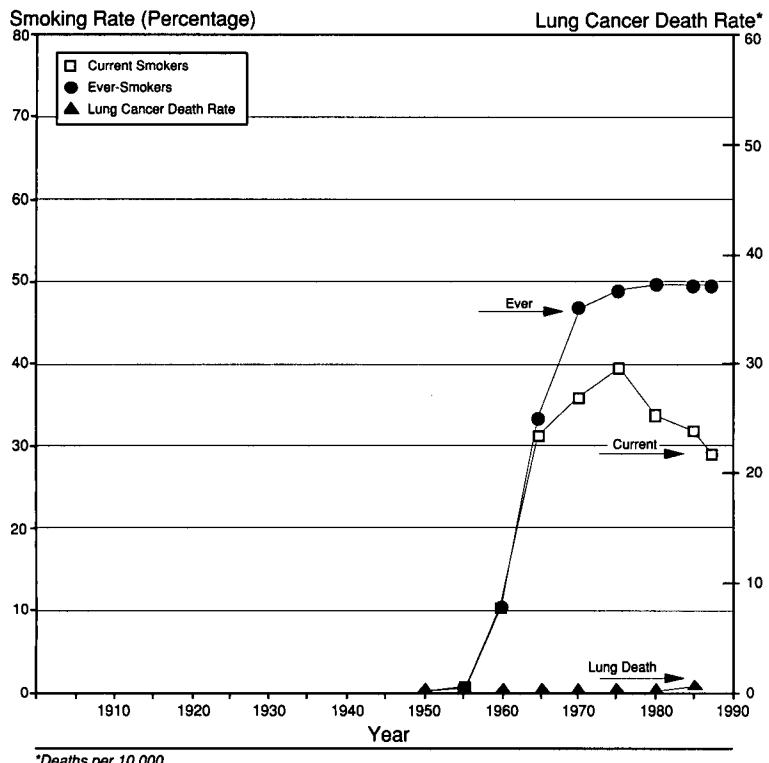
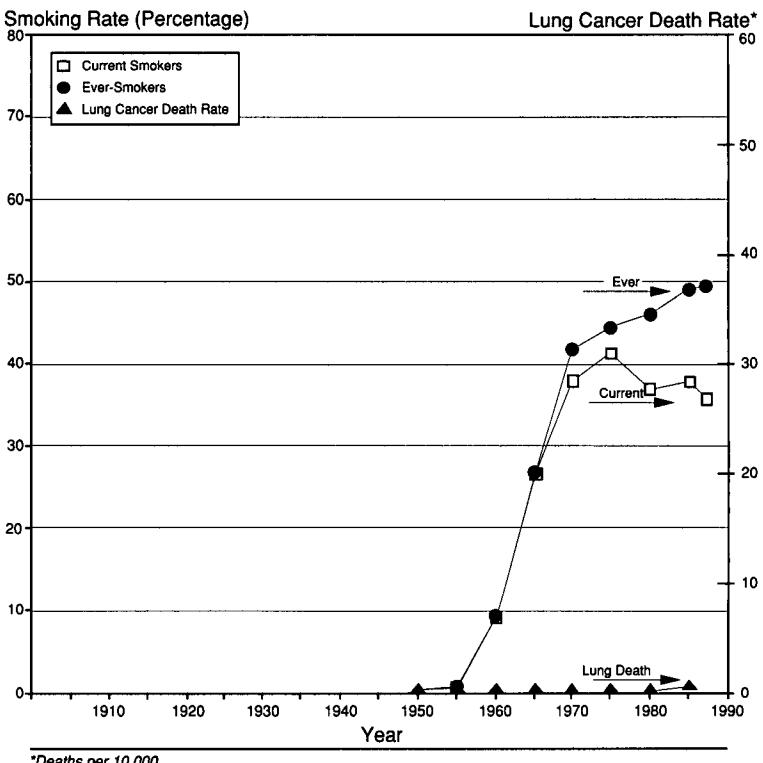


Figure 33
Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1941 to 1950



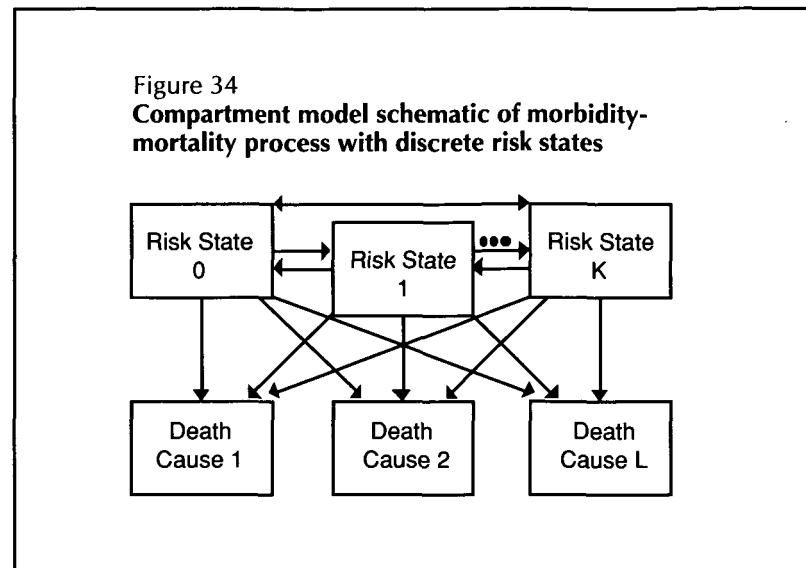
Use of Birth Cohort Smoking Behaviors To Predict Lung Cancer Death Rates

the percentages of ever-smokers reached comparable levels for black women and white women. Lung cancer death rates for all cohorts are approximately the same for white and black females, even though smoking rates are lower for black females in the earliest two cohorts. As smoking rates converged for white and black females in later cohorts, lung cancer death rates remained approximately equivalent for the two races. The equivalent lung cancer rates for white and black females in earlier cohorts, despite lower smoking rates among black females, may again suggest a lung cancer risk that is not attributable to smoking.

Understanding the effects that shifts in the distribution of risk factors (such as smoking patterns) have on disease occurrence and associated health care costs is fundamental to evaluating trends and formulating public policy. In the public policy domain, the determination of which health care programs or projects receive what proportion of limited resources requires analysis of the future costs and benefits of those programs. In assessing health trend effects, changes in either risk factor exposure or the treatment of disease may affect the incidence of disease, the prevalence of chronic conditions, and/or the mortality rates.

The efficacy of a health program in preventing a disease with a long latency period may not be quickly manifest by the usual morbidity and mortality estimates. Primary prevention programs are directed at reducing risk factor exposures, and for many diseases the benefits of altering a risk factor as measured by reductions in mortality or disability require time to emerge. Individuals who already have a disease, including those at preclinical stages, may not benefit from alteration of risk factors and will often continue to progress through the disease course. Thus, intervention studies frequently require 5 to 10 years to show significantly reduced morbidity and mortality risks. During these lengthy periods, the demographic profile of the beneficiary population may shift (e.g., the population may become younger with time) or those with adverse risk factor values may die earlier. In such cases, some of the observed benefits are not the result of interventions but of population shifts in the distribution of risk factors. A health program may reduce the age-specific mortality rates, but this reduction would only partly offset the increase in death rates that accompanies the aging of individuals. Thus, determining the benefits of a risk factor management program requires separating benefits attributable to risk factor modification from benefits attributable to demographic shifts, changes in susceptibility, and mortality selection.

To assess the effects of risk factor interventions on health trends, standard increment-decrement life-table models are generalized to "compartment" models (i.e., discrete state-discrete



time models of health processes) to represent movement between risk factor states. The states in the compartment model can represent death, disability, or an adverse (or beneficial) risk factor status. In the current analysis, the primary risk factor is duration of smoking. Interventions are represented by changes in risk factor states; that is, interventions modify transition rates between certain risk factor and mortality states and change the number of individuals in those states. For example, decreases in the initiation of smoking rates and/or increases in the smoking cessation rates could represent effects of a health intervention in the population. The benefits of this intervention are calculated from incidence and prevalence rates calculated for each compartment and summed across the population.

A DISCRETE STATE MODEL OF HEALTH INTERVENTION

A compartment model of morbidity-mortality processes is illustrated in Figure 34. An individual resides in only one risk factor state, although he or she can move to any other state at time t . The risk factor states can represent chronic illness, disability, and risk factor exposure (e.g., smoker versus non-smoker, hypertensive versus not hypertensive). The "well" state is defined as the state with no risk factors. Though an individual can be in only one state at any time, the *definitions* of states need not be exclusive; e.g., an individual may be in a hypertensive state, a smoking state, or a hypertensive *and* smoking state. We define the following terms:

- t = time measured in years ($t = 1, 2, \dots, T$).
- K = number of risk factor states (besides the well state). Risk factor state 0 is the "well" state.

L	=	number of causes of death ($l = 1, 2, \dots, L$).
a	=	index for age groups.
$n_k(a,t)$	=	number of individuals in age group a at beginning of t in state k .
$q_k(a,t)$	=	probability that a person in age group a state at t will die of cause l during the year.
$q_l(a,t)$	=	probability that a person in age group a at t dies of cause l ,
	=	$\Sigma q_{k2}(a,t)n_k(a,t) / \Sigma n_k(a,t)$ (1)

The Markov Assumption

Multiple increment-decrement life tables are special cases of the compartment model seen in Figure 34. Consequently, methods to estimate multiple decrement life-table parameters are easily extended to the compartment model. However, applying those methods for many risk factor states and causes of death requires a huge quantity of data. Problems in evaluating mortality functions arise because (1) all possible pathways that result in the contingent event of interest must be determined, and (2) the probabilities associated with each of these pathways must be assessed. The problems are simplified if the model in Figure 34 can be assumed to be Markovian; i.e., the probability of changing states depends only on the two states (the state the individual is coming from and the state he or she is going to) and not on any previous states the individual has been in or length of time in the current state.

The Markov assumption seems unreasonable, since a person's age and the length of time he or she smoked are determinants of the risks of many causes of death and disease. The Markov assumption can be made more reasonable by defining risk factor states as length of time with a particular risk factor. For example, a person enters the "smoked 0 to 5 years" risk state when smoking begins. In 5 years, the individual moves to a "smoked 5 to 10 years" risk state if he or she still smokes and has not died. Or, the person may enter a "hypertensive and smoked 5 to 10 years" state if the blood pressure rises and he or she continues to smoke. Alternatively, the person who stops smoking may enter the "smoked only 5 years" state. Age can be treated similarly; that is, Figure 34 can be viewed as applicable to a specific age group with risk factor states defined for each subsequent age group. Individuals move between states as they age.

Assuming that the Markov assumption holds for Figure 34, movement between states can be described by a matrix of transition probabilities. If π_{ij} is the probability of moving from state i to state j in a year, the transition matrix is

$$\Pi = \begin{pmatrix} \pi_{00} & \pi_{01} & \dots & \pi_{0R} \\ \vdots & & & \\ \vdots & & & \\ \pi_{R0} & \pi_{R1} & \dots & \pi_{RR} \end{pmatrix}, \quad (2)$$

where the total number of states is $R + l = K + L + l$, including the "well" and death states. The π_{ij} are determined from $n_k(a,t)$ and $q_{kl}(a,t)$. To determine the population in each state after m years, let n_i be the number of individuals in state i at time 0. The row vector $N = (n_0, n_1, \dots, n_l)$ of these counts is called the state vector. The vector $N^{(m)}$ of counts in each state after t years is

$$N^{(t)} = N\Pi^t \quad (3)$$

where Π^t is the product of Π with itself $t - 1$ times (i.e., the " t^{th} " power of Π). The vector $N^{(t)}$, $t = 1, 2, \dots$, is the basis for all discrete survival functions where $N^{(t)} = (N_0(t), N_1(t), \dots, N_R(t))$. The model is useful for forecasting future contingent outcomes and evaluating functions associated with morbidity and mortality outcomes under various interventions or changes in the population.

Because the current model is more biologically plausible than simply "alive-dead" and "standard-substandard risk" classifications, forecast estimates will be more accurate. By selecting a sufficient number of risk factor and mortality states, one can model any finite combination of risk factors. A model representing the interactions of risk factors and chronic conditions is more defensible than risk scoring methods that do not represent those interactions (see Cummins et al., 1983). In this chapter, the above model is used to forecast lung cancer mortality patterns.

Previous Forecast Methods

Several researchers have presented models for forecasting mortality patterns for lung cancer. The simplest method is to assume that the age-specific mortality rates will remain constant and then predict the number of deaths in the future from the number of individuals expected in each age group. A sophisticated version of this model is given by Brown and Kessler (1988), in which the differential cohort effects and differential smoking patterns are included in estimating the age-specific lung cancer mortality rate. The Brown and Kessler model also used the number of cigarettes and the tar per cigarette as regressor variables for the period effects. The model does not explicitly include the length of time that people smoked. Forecasts are based on estimated effects of cohort, age, smoking status, and "dose" (as measured by two variables, average cigarettes and tar levels). The model adjusts for smoking duration and for any competing risks of deaths only

implicitly; that is, insofar as these two variables are reflected in the mortality risks of lung cancer in the observed data used to fit the model, this same relationship is maintained in the forecasting formula.

Hakulinen and Pukkala (1981) use a similar method but make explicit adjustments for subjects' length of smoking and time since they last smoked. Although this model is more sophisticated in the use of smoking duration, it does not estimate the cohort effects from observed lung cancer mortality over time as the Brown and Kessler model does. The model also adjusts for the competing risks implicitly, by assuming that the mortality risks used contained the appropriate adjustment.

The model proposed in this chapter extends these models in two ways. First, explicit adjustment of the competing risks is taken into account. Because current and past smoking patterns have a differential effect on both lung cancer and other competing risks, forecasting the effects of changes in the smoking patterns over the last 10 years and the anticipated smoking patterns on future lung cancer mortality requires "unbundling" the different mortality risks. Second, the model uses the mortality risk explicitly as a function of smoking initiation and cessation rates in a Markov model. Explicit identification of these components provides the forecaster more freedom in altering the constituent parts of the model to examine the long-term effects of interventions and health promotion programs on mortality outcome. As in the models described above, the current model does provide a cohort-specific, smoking-duration-based model. However, rather than examine the trends of the mortality risks over the last two decades, as Brown and Kessler have done, this model assumes that the underlying causes of these trends are represented by the risk factor and population dynamics used in the model.

Building the Model

The Risk Factor States

To build a model, estimates of the transition probabilities are required. Tolley and Manton (in press) have described how the various types of health statistics can be used to determine estimates. In this section, the estimation of these transition probabilities is briefly described, and the data sources for making the estimates are presented.

The first step in the estimation is to determine the number of individuals in each of the risk factor states. Naturally, the primary risk factor state here is smoking status: whether or not the individual is or has been a smoker and, if a smoker, the duration of smoking. The initiation and cessation rates over time for birth cohorts of black and white males and females can be estimated from the NHIS data presented in the first part of this chapter. From these estimates, estimates of the number of individuals who are current smokers with a smoking

duration of 5 years, 10 years, and so forth, can be obtained for both races and sexes for the entire Nation. In addition, estimates of the number of individuals who have never smoked, and the number of ex-smokers who smoked 5 years, 10 years, and so on, can be obtained. All of these estimates of smoking duration are specific to various birth cohorts beginning with the 1901 to 1910 cohort and including birth cohorts up to the 1951 to 1960 cohort.

Table 14 gives the distribution of each cohort in terms of their current smoking status in 1980. Naturally, these three smoking states can be subdivided. For the current model, the risk factor states for smoking are "never smoked," "current smoker" (divided into 5-year duration intervals up to "smoked over 70 years"), and "ex-smoker," which also is divided into 5-year duration intervals. This gives 31 smoking states.

The data given in the first section of this chapter show different patterns of initiation and cessation in various birth cohorts; therefore, the model here is developed through separate treatment of each of the 10-year birth cohorts. The oldest cohort considered in this study is the 1901 to 1910 cohort, and the youngest is the 1951 to 1960 cohort.

Although risk factors such as hypertension, elevated blood cholesterol, alcohol consumption, and obesity are also important in the assessment of the future mortality patterns, current data on these patterns and how these patterns are expected to change in the future are limited. Therefore, these risk factors are disregarded in the current model, reflecting an assumption that, whatever the current patterns are, they will remain unchanged in the next three decades.

Causes of Death

The reason for including causes of death other than lung cancer is to adjust for their competing effects. Those causes of death that have smoking as a major risk factor must be considered as separate states in the model. Changes in smoking patterns will then be adjusted for in each such competing risk. All causes of death that do not have smoking as a primary risk factor can be grouped together as a "death by all other causes" state. Table 15 lists all causes other than lung cancer that are assumed (in this model) to have smoking as a major risk factor.

Relative Risks

The second step is to determine the relative risk associated with each risk factor level. For all causes of death except lung cancer, this model assumes that the relative risk is independent of the length of time that subjects smoked. Models relating smoking duration to coronary heart disease death and chronic obstructive pulmonary disease death are less established; therefore, they have not been included. Relative risks for current smokers and ex-smokers, both males and females, have been given in the Surgeon General's Report (US DHHS, 1989).

Table 14
**Distribution of nonsmokers, smokers, and ex-smokers in 1980,
 by race, gender, and birth cohort**

	Never-Smokers	Current Smokers	Ex-Smokers
Born 1901-1910			
White male	.36	.19	.45
White female	.72	.15	.13
Black male	.52	.22	.26
Black female	.82	.06	.12
Born 1911-1920			
White male	.28	.30	.42
White female	.57	.26	.17
Black male	.34	.40	.26
Black female	.64	.23	.13
Born 1921-1930			
White male	.24	.40	.36
White female	.54	.31	.15
Black male	.32	.47	.21
Black female	.52	.34	.14
Born 1931-1940			
White male	.29	.42	.29
White female	.49	.35	.16
Black male	.33	.49	.18
Black female	.54	.36	.10
Born 1941-1950			
White male	.34	.43	.23
White female	.50	.34	.16
Black male	.37	.47	.16
Black female	.54	.37	.07
Born 1951-1960			
White male	.49	.39	.12
White female	.56	.33	.11
Black male	.46	.45	.09
Black female	.62	.33	.05

Estimates of relative risks, reproduced in Tables 15 and 16, are used here. Note that since these risks are not race-specific, the same relative risks are used for both blacks and whites.

Table 15
Relative risks of death for current and former smokers (males)

	ICD Code ^a	Age	Current Smokers	Former Smokers
Cause of Death^b				
CHD	(410-414)	35 - 64	2.81	1.75
		65+	1.62	1.29
Other heart	(390-398, 401-405)		1.85	1.32
CVD	(430-438)	35 - 64	3.67	1.38
		65+	1.94	1.27
Other vascular	(440-448)		4.06	2.33
COPD	(490-492, 496)		9.65	8.75
Other pulmonary	(010-012, 480-489, 493)		1.99	1.56
Oral cancers	(140-149)		27.48	8.80
Bladder cancer	(188)		2.86	1.10
Kidney cancer	(189)		2.95	1.95
Pancreatic cancer	(157)		2.14	1.12
Esophageal cancer	(150)		7.60	5.83

^aICD, International Classification of Disease.

^bCHD, coronary heart disease; CVD, cerebrovascular disease; COPD, chronic obstructive pulmonary disease.

Several authors have posited models relating the mortality from lung cancer to age and duration of smoking. Peto (1986) proposed a model that related smoking duration to risk of lung cancer. Peto's model included smoking dose in two ways: first, there is a specific model for heavy smokers and moderate smokers; second, the cumulative dose, as measured by smoking duration, is explicitly included in determination of the risk. The models by Gaffney and Altshuler (1988) and those by Moolgavkar et. al (1989) are more sophisticated in their use of dose in determining relative risks of lung cancer instantiation. Although this second set of dose-related models seems to offer many strengths, the data available from the NHIS set sample provide good information on duration of smoking only and not explicitly on dose.

Because of data limitations, the model used here for determining risk of lung cancer is that given by Peto. The probability of death by lung cancer for a person aged "a" who has smoked for "y" years is given by

$$\text{Prob (of death by lung cancer)} = 10^{-11}a^4 + 10^{-9}y^4.$$

Table 16
Relative risks of death for current and former smokers (females)

	ICD Code ^a	Age	Current Smokers	Former Smokers
Cause of Death^b				
CHD	(410-414)	35 - 64	3.00	1.43
		65+	1.60	1.29
Other heart	(390-398, 401-405)		1.69	1.16
CVD	(430-438)	35 - 64	4.80	1.41
		65+	1.47	1.01
Other vascular	(440-448)		3.00	1.34
COPD	(490-492, 496)		10.47	7.04
Other pulmonary	(010-012, 480-489, 493)		2.18	1.38
Oral cancers	(140-149)		5.59	2.88
Bladder cancer	(188)		2.58	1.85
Kidney cancer	(189)		1.41	1.16
Pancreatic cancer	(157)		2.33	1.78
Esophageal cancer	(150)		10.25	3.16

^aICD, International Classification of Disease.

^bCHD, coronary heart disease; CVD, cerebrovascular disease; COPD, chronic obstructive pulmonary disease.

Before using the Peto model, we must modify it for several reasons: First, the aggregation of moderate and heavy smokers into the same group, necessitated by the NHIS data format, is problematic; we expect that the "average" probability of lung cancer death would be higher than predicted by the model. Second, since the model was derived from a subpopulation of smokers in Britain, the toxicity of the smoked material and the method of smoking may differ from those characteristics in the United States. Third, the more prevalent use of filters on cigarettes in the last two decades may cause the model to estimate incorrectly the likelihood of death for more recent birth cohorts.

The adjustment of the Peto model is as follows: We assume that for each gender- and race-specific birth cohort, the model for the probability of lung cancer can be determined from the Peto model by a scaling equation (4) as follows:

$$\text{Prob(of death by lung cancer for nonsmoker)} = S10^{-11}a^4$$

$$\begin{aligned} \text{Prob(of death by lung cancer for a current smoker)} \\ = S10^{-11}a^4 + S10^{-8}y^5 \end{aligned}$$

$$\begin{aligned} \text{Prob(of death by lung cancer for a former smoker)} \\ = S10^{-11}a^4 + SS10^{-9}y^4 \end{aligned}$$

Calculating Transition Probabilities

In these equations, the unknown parameter S is a scale parameter. This parameter is determined by calculation of the observed number of deaths by lung cancer in 1980 for each birth cohort-gender-race combination, and comparison to the number predicted from the above equations. The value of S for each cohort-gender-race combination is the value that equates the predicted with the observed number of deaths.

The probability of transitioning to one of the cause-of-death states (except death by lung cancer) from the never-smoked state for a particular age group is given by the following equation:

$$q_{01}(a,0) = \frac{\text{[Number of observed deaths from cause l]}}{[n_0(a,0) + R1_{k_1}n_{k_1}(a,0) + R2_{k_2}n_{k_2}(a,0)]}$$

In this equation, $R1$ is the relative risk of the current smokers for the particular cause of death, and $R2$ is the relative risk of the ex-smokers for the same cause of death. The indexes k_1 and k_2 refer to current smoker and ex-smoker states, respectively. The transition probabilities for the particular cause of death for current smokers and ex-smokers are given by

$$\begin{aligned} q_{11}(a,0) &= R1 q_{01}(a,0) \\ q_{21}(a,0) &= R2 q_{01}(a,0). \end{aligned}$$

Calculation of the probability of transition from the "never-smoked" state to death by lung cancer is calculated similarly; however, in this case, each of the smoking levels has a different relative risk, as calculated by the modified Peto model (above).

The transition probabilities for transitioning from the "never-smoked" to the "smoked-5-years-or-less" state are determined from the past initiation patterns. These probabilities are assumed to be age-dependent and cohort-dependent; however, because forecasting what pattern the younger cohorts will follow in the future is difficult, a single table for all cohorts for future initiation as a function of age was estimated. Table 17 is estimated from the initiation rates of the older cohorts and gives the estimated initiation rates, by age group. How current awareness of the detrimental effects of smoking will reduce these initiation rates can only be guessed.

Future cessation patterns, like future initiation patterns, are affected by the recent health trends in the United States. The estimated cessation rates, as a function of duration of smoking, are given in Table 18. These rates are determined by the experience of older cohorts and modified by recent trends toward better health.

Table 17
Probability of initiating smoking in future as a function of age
(5-year rate)

	White Male	White Female	Black Male	Black Female
Age Group				
20 - 24 years	.20	.05	.16	.09
25 - 29	.37	.20	.30	.18
30 - 34	.30	.17	.25	.20
35 - 39	.10	.08	.10	.08
40 - 44	.03	.05	.05	.07
45 - 49	.02	.03	.04	.05
50 - 54	.01	.015	.02	.03
55 - 59	.01	.015	.01	.01
60 - 64	.005	.005	.005	.01
65 +	0	0	0	0

Table 18
Probability of termination of smoking during 5-year period,
by 5-year duration

	White Male	White Female	Black Male	Black Female
Duration of Smoking				
< 5 years	.05	.05	.05	.08
5 - 10	.08	.10	.08	.07
10 - 15	.10	.10	.08	.06
15 - 20	.10	.08	.06	.05
20 - 25	.10	.10	.05	.04
25 - 30	.15	.08	.05	.04
30 - 35	.15	.05	.04	.03
35 - 40	.10	.05	.03	.03
40 - 45	.05	.05	.03	.03
45 +	.05	.05	.03	.03

Results and Forecasts

The parameters estimated above can now be placed in the model described previously, to forecast mortality outcomes for each race and gender. These forecasts are summarized in Tables 19 through 22 for each race and gender combination. Entries in the tables are the age-specific annual mortality rates per 100,000 individuals.

Examining the values in these tables, we see several important points. One point of interest is that, for white males and white females, the age-specific lung cancer mortality rate drops

Table 19
**Forecast mortality rates* for select causes of death, white males,
ages 55 to 84**

Year	Lung Cancer	Other Cancers	Coronary Heart Disease	All Other Causes
Age group 55 - 64				
1980	208.76	78.98	585.48	858.48
1985	181.34	81.56	602.48	873.19
1995	100.69	74.89	563.55	854.46
2005	26.91	70.62	536.02	831.36
2015	14.97	77.45	578.38	856.19
Age group 65 - 74				
1980	375.79	162.06	1,384.57	2,088.08
1985	385.37	169.00	1,412.82	2,124.37
1995	321.03	175.53	1,443.87	2,163.87
2005	178.69	162.94	1,399.21	2,115.59
2015	49.13	155.46	1,357.07	2,056.93
Age group 75 - 84				
1980	476.60	242.20	2,554.47	4,169.47
1985	508.34	393.92	3,246.97	5,966.54
1995	516.52	429.99	3,350.83	6,192.03
2005	451.04	458.14	3,440.06	6,403.72
2015	254.08	421.76	3,348.47	6,195.09

* Deaths per 100,000; 1980 data are actual, not forecast.

rather quickly for the younger age groups because of the low peak prevalence rates in more recent cohorts. For older age groups, this reduction occurs much more slowly. Note that the forecast model begins with the actual data for 1980; however, the values for 1985 and subsequent years are predicted from 1980 mortality rates combined with the estimated smoking rates and the relative risks—as calculated with the Peto model.

Although the mortality risks from coronary heart disease and from cancers other than lung are notably higher for smokers, as evidenced in Tables 15 and 16, the observed mortality rates for these causes are forecast to change very little over the next 25 years. One reason for this is that the age-specific mortality rates for different years are determined by the experience of different birth cohorts. Although the age-specific mortality rate for the “never-smoked” individuals is constant over time, the percentage of the population in each smoking state differs for each cohort. As a consequence, the number of individuals who are current smokers and ex-smokers and the

Table 20
**Forecast mortality rates* for select causes of death, white females,
ages 55 to 84**

Year	Lung Cancer	Other Cancers	Coronary Heart Disease	All Other Causes
Age group 55 - 64				
1980	71.29	34.62	177.87	591.89
1985	77.82	35.74	185.10	601.68
1995	67.28	36.53	186.19	600.72
2005	30.57	35.82	178.18	588.91
2015	14.80	38.80	193.10	605.65
Age group 65 - 74				
1980	98.11	70.75	597.32	1,293.86
1985	126.22	76.04	623.35	1,324.53
1995	150.88	78.17	637.81	1,343.84
2005	130.33	80.32	640.43	1,341.47
2015	60.00	79.60	624.12	1,313.48
Age group 75 - 84				
1980	104.40	106.11	1,410.84	2,571.00
1985	126.22	140.30	1,972.20	3,465.08
1995	199.74	160.30	2,096.18	3,619.20
2005	239.28	165.62	2,145.72	3,689.71
2015	208.90	170.37	2,155.74	3,681.28

* Deaths per 100,000; 1980 data are actual, not forecast.

number in each duration state are different. Differential effects of lung cancer as a competing risk and the differences in the number of smokers both will alter the mortality rates for these other causes.

The forecast of the overall lung cancer rate is given in Table 23, where the age-standardized rate per 100,000 population between the ages of 55 and 84 is given for each of the four general causes of death. The rates in this table are substantially higher than the overall age-adjusted death rates because they are only for those between the ages of 55 and 84 rather than being age-standardized for the entire population. The population used for age standardization is the 1980 U.S. population. Note that although the lung cancer mortality rate for white males is forecast to increase through 2005 for older ages and decrease for younger ages, the age-standardized rate is forecast to decrease. However this decrease is relatively slower than age-specific decreases in younger ages, being almost constant

Table 21
**Forecast mortality rates* for select causes of death, black males,
ages 55 to 84**

Year	Lung Cancer	Other Cancers	Coronary Heart Disease	All Other Causes
Age group 55 - 64				
1980	314.76	168.86	588.33	1,794.73
1985	328.73	170.68	597.34	1,810.84
1995	259.30	165.37	580.66	1,790.37
2005	113.31	162.05	564.10	1,756.58
2015	95.30	176.18	601.21	1,793.03
Age group 65 - 74				
1980	452.74	224.42	1,195.15	3,244.99
1985	554.03	242.24	1,232.01	3,309.03
1995	600.65	244.18	1,238.17	3,325.57
2005	473.81	236.98	1,221.15	3,289.64
2015	215.75	233.29	1,202.22	3,226.78
Age group 75 - 84				
1980	488.59	239.95	1,956.85	5,409.63
1985	523.15	394.34	2,438.00	6,794.00
1995	759.31	471.70	2,575.20	7,104.08
2005	823.01	475.54	2,589.97	7,142.38
2015	652.22	458.10	2,559.84	7,062.83

* Deaths per 100,000; 1980 data are actual, not forecast.

until 1995. For all other gender-race combinations, the age-standardized lung cancer mortality rates increase until around 2000 and then decrease. Thus, the decreases in smoking patterns that have occurred prior to the current time will have little effect on decreasing age-standardized rates until 2005 for all but white males.

Potential Reduction In Lung Cancer

The mortality rates forecast by the model assume that current patterns of initiation and cessation will continue over the next 25 years. The impact of improved smoking control strategies can be estimated with this model. If one assumes that implementation of the comprehensive smoking control strategies described in this volume would double current rates of cessation, then the impact of these improvements can be calculated, as presented in Table 24. The lung cancer mortality estimates in Table 24 can be compared with those in the first columns of Tables 19 through 22.

Table 22
**Forecast mortality rates* for select causes of death, black females,
ages 55 to 84**

Year	Lung Cancer	Other Cancers	Coronary Heart Disease	All Other Causes
Age group 55 - 64				
1980	73.32	62.40	315.95	1,102.76
1985	94.79	67.65	339.88	1,126.56
1995	95.99	68.35	343.61	1,129.22
2005	38.66	70.55	349.36	1,125.35
2015	45.73	76.99	376.51	1,155.40
Age group 65 - 74				
1980	85.69	99.60	729.56	2,140.22
1985	115.24	115.82	779.26	2,217.30
1995	183.92	127.46	806.21	2,238.60
2005	186.36	128.32	807.08	2,239.14
2015	77.84	132.42	808.50	2,217.33
Age group 75 - 84				
1980	86.81	127.68	1,381.49	3,657.17
1985	96.44	150.15	1,759.85	4,449.39
1995	178.13	185.61	1,916.42	4,671.24
2005	288.34	203.44	1,974.39	4,722.32
2015	292.83	205.21	1,977.33	4,727.77

* Deaths per 100,000; 1980 data are actual, not forecast.

For white males, there is a dramatic change in the predicted lung cancer mortality pattern, with approximately a 50 percent reduction in age-specific lung cancer death rates for all age groups by the year 2015. It is important that this reduction is *in addition to* the benefits to be expected from current smoking control efforts.

The results for the other racial and gender groups are more modest but still impressive. The more modest reductions reflect the lower current rates of cessation in those groups and, therefore, dramatically underestimate the benefits that could be achieved if the cessation patterns occurring among white males can be replicated in the other racial and gender groups.

CONCLUSIONS

- Males born early in this century became cigarette smokers earlier in life and in greater percentages than females. The pattern of initiation and peak prevalence of smoking is similar for males and females born into the most recent birth cohorts.

Table 23
Forecast age-standardized mortality rates,* based on 1980 population

Year	Lung Cancer	Other Cancers	Coronary Heart Disease	Other Causes
White male				
1980	310.6154	134.8752	1,192.714	1,841.914
1985	305.7283	164.9100	1,331.260	2,174.659
1995	245.9573	170.0526	1,340.338	2,217.751
2005	150.9946	168.6916	1,327.521	2,227.296
2015	67.95557	163.2606	1,318.622	2,183.843
White female				
1980	88.18845	63.94307	616.6047	1,305.564
1985	105.5464	74.50172	765.1922	1,537.934
1995	127.0899	80.41854	800.6575	1,581.471
2005	114.2955	82.12020	810.1826	1,592.848
2015	77.01571	84.31496	813.6352	1,588.735
Black male				
1980	389.3818	199.0883	1,016.176	2,874.051
1985	435.8217	231.4099	1,112.363	3,131.886
1995	455.4529	242.1545	1,128.678	3,178.280
2005	350.4382	238.7241	1,117.134	3,155.673
2015	227.2963	241.7119	1,124.491	3,139.918
Black female				
1980	80.22296	88.16579	671.2568	1,970.012
1985	102.0179	100.6025	775.6823	2,167.45
1995	142.2724	112.0328	818.2055	2,220.809
2005	139.0346	116.9478	832.8903	2,229.558
2015	106.6173	121.6528	846.4619	2,237.143

*Deaths per 100,000; 1980 data are actual, not forecast.

- White males began to quit smoking in substantial numbers during the 1950's, but black males, white females, and black females did not begin to quit in substantial numbers until the late 1960's.
- In general, the birth cohort pattern of cigarette smoking closely matches the pattern of lung cancer death rates within each racial and gender grouping, but black males and females appear to have higher rates of lung cancer than white males and females, even after consideration of the differences in their smoking behaviors.

Table 24
**Forecast age-specific lung cancer mortality rates,* assuming
 cessation rates are doubled**

Year	White Male	White Female	Black Male	Black Female
Age group 55 - 64				
1980	208.76	71.29	314.76	73.32
1985	170.67	75.04	321.54	92.82
1995	73.49	57.46	235.19	88.38
2005	15.49	21.60	91.20	32.29
2015	7.30	8.58	65.24	33.26
Age group 65 - 74				
1980	375.79	98.11	452.74	85.69
1985	376.39	122.73	544.93	113.27
1995	276.21	134.41	559.70	171.67
2005	115.14	101.44	404.11	162.25
2015	24.66	38.41	162.14	61.03
Age group 75 - 84				
1980	476.60	104.40	488.59	86.81
1985	502.75	123.99	517.38	95.38
1995	485.26	185.24	721.70	168.96
2005	364.44	201.04	732.67	257.39
2015	150.83	152.14	525.41	242.49

*Deaths per 100,000; 1980 data are actual, not forecast.

- A model of future lung cancer death rates based on trends in smoking behavior presented in this chapter predicts that the lung cancer death rates for white males will begin to fall by 1995, with declines in lung cancer death rates occurring later among the other racial and gender groups.
- A doubling of the effectiveness of current smoking control programs could result, by the year 2015, in up to a 50 percent reduction in lung cancer death rates from those that will occur if current trends continue.

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Appendix A

Data Points for Figures in Chapter 3

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Figure 1. U.S. per capita cigarette consumption for adults, aged 18 and older (1900 to 1990)

Year	Per Capita	Year	Per Capita
1900	54	1945	3,449
1901	53	1946	3,446
1902	60	1947	3,416
1903	64	1948	3,505
1904	66	1949	3,480
1905	70	1950	3,522
1906	86	1951	3,744
1907	99	1952	3,886
1908	105	1953	3,778
1909	125	1954	3,546
1910	151	1955	3,597
1911	173	1956	3,650
1912	223	1957	3,755
1913	260	1958	3,953
1914	267	1959	4,073
1915	285	1960	4,171
1916	395	1961	4,266
1917	551	1962	4,265
1918	697	1963	4,345
1919	727	1964	4,195
1920	665	1965	4,259
1921	742	1966	4,287
1922	770	1967	4,280
1923	911	1968	4,186
1924	982	1969	3,993
1925	1,085	1970	3,985
1926	1,191	1971	4,037
1927	1,279	1972	4,043
1928	1,366	1973	4,148
1929	1,504	1974	4,141
1930	1,485	1975	4,123
1931	1,399	1976	4,092
1932	1,245	1977	4,051
1933	1,334	1978	3,967
1934	1,483	1979	3,861
1935	1,564	1980	3,851
1936	1,754	1981	3,840
1937	1,847	1982	3,753
1938	1,830	1983	3,502
1939	1,900	1984	3,461
1940	1,976	1985	3,370
1941	2,236	1986	3,274
1942	2,585	1987	3,197
1943	2,956	1988	3,096
1944	3,039	1989	2,926
		1990	2,828

Figure 2. Changes in prevalence of cigarette smoking among successive birth cohorts of U.S. males, 1900 to 1987

X Data	1901- 1910	1911- 1920	1921- 1930	1931- 1940	1941- 1950	1951- 1960	1961- 1970
1900	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0
1910	0.4	0	0	0	0	0	0
1915	2.9	0	0	0	0	0	0
1920	16.2	0.2	0	0	0	0	0
1925	39.9	2.6	0	0	0	0	0
1930	56.7	17.4	0.4	0	0	0	0
1935	61.3	44.3	2.8	0	0	0	0
1940	61.8	62.0	17.8	0.3	0	0	0
1945	61.3	65.9	49.4	2.6	0	0	0
1950	58.9	65.2	65.8	18.7	0.1	0	0
1955	55.8	62.8	66.1	47.0	2.3	0	0
1960	51.8	59.6	63.5	61.8	19.1	0.2	0
1965	45.0	53.6	57.7	59.0	44.7	2.6	0
1970	32.0	42.1	45.9	47.4	48.5	17.7	0.3
1975	25.4	39.8	48.1	48.1	52.3	39.4	3.7
1980	18.6	30.5	40.3	42.5	43.3	39.6	18.7
1985	15.3	19.8	32.5	35.7	39.5	36.1	32.4
1987	14.3	17.3	29.5	32.3	35.7	32.1	30.0

Figure 3. Changes in prevalence of cigarette smoking among successive birth cohorts of U.S. females, 1900 to 1987

X Data	1901- 1910	1911- 1920	1921- 1930	1931- 1940	1941- 1950	1951- 1960	1961- 1970
1900	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0
1910	0.4	0	0	0	0	0	0
1915	0.1	0	0	0	0	0	0
1920	0.9	0	0	0	0	0	0
1925	5.7	0.2	0	0	0	0	0
1930	13.0	4.0	0.1	0	0	0	0
1935	18.0	15.8	0.4	0	0	0	0
1940	21.5	28.2	5.4	0	0	0	0
1945	23.9	33.5	23.1	0.8	0	0	0
1950	25.1	35.9	37.2	9.4	0	0	0
1955	25.4	36.8	41.8	28.9	0.6	0	0
1960	25.4	37.2	42.5	42.9	10.1	0.1	0
1965	24.3	36.0	41.6	43.9	30.5	1.1	0
1970	20.7	31.8	37.3	38.0	35.8	12.0	0.3
1975	15.4	28.5	35.5	40.0	39.3	32.7	3.2
1980	13.6	24.9	30.5	34.9	33.6	32.7	20.1
1985	7.6	17.6	27.5	30.7	32.0	33.6	29.2
1987	7.3	16.3	24.7	28.8	29.4	30.5	25.9

Figure 4. Changes in prevalence of cigarette smoking among successive birth cohorts of white U.S. males, 1900 to 1987

X Data	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950	1951-1960	1961-1970
1900	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0
1910	0.4	0	0	0	0	0	0
1915	3.0	0	0	0	0	0	0
1920	16.5	0.2	0	0	0	0	0
1925	40.8	2.6	0	0	0	0	0
1930	58.0	17.5	0.5	0	0	0	0
1935	62.6	45.0	2.9	0	0	0	0
1940	62.9	62.9	18.1	0.3	0	0	0
1945	62.4	66.8	50.0	2.6	0	0	0
1950	59.9	66.0	66.8	19.0	0.2	0	0
1955	56.5	63.5	67.0	47.9	2.5	0	0
1960	52.4	60.2	64.0	62.4	19.7	0.2	0
1965	45.3	53.6	57.9	59.3	45.3	2.6	0
1970	31.8	41.9	45.5	47.1	48.0	18.3	0.4
1975	24.8	39.3	47.7	47.7	51.6	39.6	4.2
1980	18.0	29.7	39.5	42.0	42.9	39.0	20.2
1985	14.5	19.0	30.7	35.0	39.5	34.4	33.7
1987	13.5	16.4	27.6	31.4	35.6	30.8	31.0

Figure 5. Changes in prevalence of cigarette smoking among successive birth cohorts of black U.S. males, 1900 to 1987

X Data	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950	1951-1960	1961-1970
1900	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0
1910	0.5	0	0	0	0	0	0
1915	1.7	0	0	0	0	0	0
1920	12.7	0.2	0	0	0	0	0
1925	30.9	2.7	0	0	0	0	0
1930	42.1	15.8	0.2	0	0	0	0
1935	46.6	38.7	2.2	0	0	0	0
1940	48.3	54.1	15.8	0.2	0	0	0
1945	48.6	57.6	44.3	2.5	0	0	0
1950	48.9	59.6	55.0	16.3	0	0	0
1955	47.8	55.8	57.2	39.4	1.0	0	0
1960	46.1	54.9	58.0	57.1	15.5	0.3	0
1965	43.6	54.0	55.7	56.5	41.3	2.2	0
1970	34.7	45.3	50.0	51.0	55.0	14.1	0
1975	33.9	47.8	51.1	55.3	57.9	39.2	1.5
1980	24.8	40.4	46.9	47.8	47.0	44.6	12.0
1985	25.3	29.4	42.3	47.8	45.5	46.1	28.5
1987	25.3	28.3	39.3	45.5	41.6	40.3	28.4

Figure 6. Changes in prevalence of cigarette smoking among successive birth cohorts of white U.S. females, 1900 to 1987

X Data	1901- 1910	1911- 1920	1921- 1930	1931- 1940	1941- 1950	1951- 1960	1961- 1970
1900	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0
1910	0	0	0	0	0	0	0
1915	0.1	0	0	0	0	0	0
1920	0.8	0	0	0	0	0	0
1925	5.6	0.2	0	0	0	0	0
1930	13.2	4.2	0.1	0	0	0	0
1935	18.5	16.5	0.4	0	0	0	0
1940	22.2	29.5	5.4	0	0	0	0
1945	24.6	34.9	23.5	0.8	0	0	0
1950	25.9	37.4	38.0	9.6	0	0	0
1955	26.2	38.2	42.7	29.5	0.6	0	0
1960	26.2	38.8	43.3	43.7	10.3	0.1	0
1965	25.0	37.4	42.2	44.2	31.2	1.1	0
1970	21.2	33.0	37.7	37.9	35.9	12.4	0.4
1975	16.1	29.2	35.9	40.3	39.5	33.6	3.6
1980	14.5	25.3	30.5	35.0	33.7	33.0	22.0
1985	7.5	17.9	28.0	31.9	31.8	33.4	30.4
1987	7.5	16.6	25.3	30.0	29.1	30.1	26.9

Figure 7. Changes in prevalence of cigarette smoking among successive birth cohorts of black U.S. females, 1900 to 1987

X Data	1901- 1910	1911- 1920	1921- 1930	1931- 1940	1941- 1950	1951- 1960	1961- 1970
1900	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0
1910	0	0	0	0	0	0	0
1915	0.6	0	0	0	0	0	0
1920	2.4	0	0	0	0	0	0
1925	6.6	0.6	0	0	0	0	0
1930	10.7	3.2	0.1	0	0	0	0
1935	13.2	9.4	0.4	0	0	0	0
1940	14.6	16.1	6.1	0	0	0	0
1945	17.0	20.4	20.3	1.0	0	0	0
1950	17.3	23.1	31.7	8.4	0.1	0	0
1955	17.0	24.6	35.0	25.9	0.5	0	0
1960	17.3	24.1	37.4	39.4	9.3	0.2	0
1965	16.7	23.3	37.4	44.3	26.6	0.9	0
1970	14.5	21.6	35.2	41.3	37.9	9.8	0.1
1975	8.1	23.8	33.6	41.0	41.3	28.5	1.7
1980	6.2	22.9	32.7	36.0	36.9	32.7	12.7
1985	9.7	12.7	28.3	26.7	37.8	37.4	23.5
1987	8.9	12.2	23.3	24.1	35.7	35.4	22.3

Figure 8. Age-adjusted cancer mortality rates, all males

X Data	All Sites Combined	Lung Cancer	All Other Cancers
1950	171.9	22.2	149.7
1955	182.9	34.6	148.3
1960	187.9	39.3	148.5
1965	197.8	48.7	149.1
1970	190.2	55.9	134.3
1975	212.2	66.7	145.5
1980	221.3	73.3	148.0
1985	218.8	73.9	144.9
1987	219.4	74.9	144.5

Figure 9. Age-adjusted cancer mortality rates, white males

X Data	All Sites Combined	Lung Cancer	All Other Cancers
1950	173.3	22.6	150.7
1955	183.1	35.2	147.9
1960	186.8	39.3	147.5
1965	196.2	48.8	147.4
1970	194.4	57.5	136.9
1975	207.7	65.7	142.0
1980	215.6	71.8	143.8
1985	212.5	72.2	140.3
1987	213.4	73.2	140.2

Figure 10. Age-adjusted cancer mortality rates, nonwhite males

X Data	All Sites Combined	Lung Cancer	All Other Cancers
1950	151.7	16.2	135.5
1955	176.9	27.3	149.6
1960	196.3	38.7	157.6
1965	211.9	47.0	164.9
1970	161.7	44.6	117.1
1975	252.0	74.9	177.2
1980	271.7	85.7	186.0
1985	271.3	87.3	184.0
1987	269.2	88.5	180.6

Figure 11. Age-adjusted cancer mortality rates, all females

X Data	All Sites Combined	Lung Cancer	All Other Cancers
1950	151.7	5.06	146.7
1955	145.6	5.92	139.7
1960	140.0	5.83	134.2
1965	136.4	7.78	128.7
1970	143.2	11.80	131.5
1975	134.2	15.60	118.6
1980	138.0	21.40	116.6
1985	139.3	26.40	112.9
1987	139.5	28.20	111.3

Figure 12. Age-adjusted cancer mortality rates, white females

X Data	All Sites Combined	Lung Cancer	All Other Cancers
1950	151.2	5.0	146.1
1955	145.1	5.8	139.2
1960	138.6	5.8	132.8
1965	135.1	7.6	127.5
1970	148.0	12.2	135.8
1975	132.3	15.6	116.6
1980	136.4	21.5	115.0
1985	138.2	26.8	111.4
1987	138.1	28.5	109.6

Figure 13. Age-adjusted cancer mortality rates, nonwhite females

X Data	All Sites Combined	Lung Cancer	All Other Cancers
1950	150.4	4.10	146.4
1955	144.1	6.10	137.9
1960	149.6	6.10	143.5
1965	145.2	7.50	137.7
1970	110.1	8.82	101.2
1975	156.5	16.00	140.5
1980	149.0	20.50	128.5
1985	146.9	23.20	123.7
1987	148.6	25.50	123.1

Figure 14. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1901 to 1910

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0.4	0.4	0
1915	3.0	3.0	0
1920	16.5	16.7	0
1925	40.8	41.4	0
1930	58.0	59.2	0
1935	62.6	64.5	0
1940	62.9	66.1	0
1945	62.4	66.9	0
1950	59.9	67.1	1.7
1955	56.5	67.2	4.7
1960	52.4	67.4	9.0
1965	45.3	67.7	15.9
1970	31.8	67.8	26.0
1975	24.8	65.7	36.5
1980	18.0	64.3	47.4
1985	14.5	62.6	56.8
1987	13.4	62.6	

Figure 15. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1901 to 1910

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0.5	0.5	0
1915	1.7	1.7	0
1920	12.7	12.7	0
1925	30.9	31.5	0
1930	42.1	43.3	0
1935	46.6	48.2	0
1940	48.3	50.3	0
1945	48.6	51.1	0
1950	48.9	52.1	1.6
1955	47.8	52.3	5.4
1960	46.1	52.7	10.0
1965	43.6	53.0	15.9
1970	34.7	53.0	25.8
1975	33.9	52.1	34.8
1980	24.8	48.4	44.5
1985	25.3	70.8	51.2
1987	25.3	70.8	

Figure 16. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1911 to 1920

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0.2	0.2	0
1925	2.6	2.6	0
1930	17.5	17.7	0
1935	45.0	45.5	0
1940	62.9	64.0	0
1945	66.8	69.2	0
1950	66.0	70.7	0
1955	63.5	71.1	0
1960	60.2	71.3	2.3
1965	53.6	71.5	5.7
1970	41.9	71.6	11.5
1975	39.3	73.8	19.4
1980	29.7	72.2	30.1
1985	19.0	72.3	41.0
1987	16.4	72.3	

Figure 17. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1911 to 1920

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0.2	0.2	0
1925	2.7	2.7	0
1930	15.8	15.8	0
1935	38.7	38.7	0
1940	54.1	54.7	0
1945	57.6	58.7	0
1950	56.8	59.6	0
1955	55.8	59.6	0
1960	54.9	60.0	3.7
1965	54.0	60.5	7.7
1970	45.3	62.7	16.6
1975	47.8	68.0	26.2
1980	40.4	65.7	37.5
1985	29.4	65.0	47.5
1987	28.3	65.0	

Figure 18. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1921 to 1930

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0.5	0.5	0
1935	2.9	2.9	0
1940	18.1	18.2	0
1945	50.0	50.6	0
1950	66.8	69.0	0
1955	67.0	71.5	0
1960	64.0	72.0	0
1965	57.9	72.3	1.2
1970	45.5	72.5	3.3
1975	47.7	75.7	6.9
1980	39.5	75.8	12.8
1985	30.7	73.8	21.2
1987	27.6	73.9	

Figure 19. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1921 to 1930

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0.2	0.2	0
1935	2.2	2.2	0
1940	15.8	15.7	0
1945	44.3	44.8	0
1950	55.0	56.4	0
1955	57.2	60.0	0
1960	58.0	61.6	0
1965	55.7	62.0	2.2
1970	50.0	62.5	5.9
1975	51.1	68.6	11.7
1980	46.9	68.1	19.5
1985	42.3	74.7	28.9
1987	39.3	74.7	

Figure 20. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1931 to 1940

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0.3	0.3	0
1945	2.6	2.6	0
1950	19.0	19.2	0
1955	47.9	48.9	0
1960	62.4	65.4	0
1965	59.3	67.8	0
1970	47.1	68.5	0
1975	47.7	69.9	1.3
1980	42.0	70.9	3.1
1985	35.0	69.8	6.2
1987	31.4	69.8	

Figure 21. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1931 to 1940

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0.2	0.2	0
1945	2.5	2.5	0
1950	16.3	16.3	0
1955	39.4	39.8	0
1960	57.1	57.6	0
1965	56.5	60.2	0
1970	51.0	62.1	0
1975	55.3	68.7	2.4
1980	47.8	67.4	5.5
1985	47.8	61.0	10.0
1987	45.5	61.0	

Figure 22. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. males born 1941 to 1950

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0	0	0
1945	0	0	0
1950	0.2	0.2	0
1955	2.5	2.5	0
1960	19.7	19.9	0
1965	45.3	47.4	0
1970	48.0	61.4	0
1975	51.6	65.9	0
1980	42.9	66.2	0
1985	39.5	65.2	0.9
1987	35.6	65.3	

Figure 23. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. males born 1941 to 1950

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0	0	0
1945	0	0	0
1950	0	0	0
1955	1	1	0
1960	15.5	15.6	0
1965	41.3	42.4	0
1970	55.0	60.3	0
1975	57.9	64.7	0
1980	47.0	63.1	0
1985	45.5	64.1	1.7
1987	41.6	64.1	

Figure 24. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1901 to 1910

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0.1	0.1	0
1920	0.8	0.9	0
1925	5.6	5.7	0
1930	13.2	13.4	0
1935	18.5	18.8	0
1940	22.2	22.8	0
1945	24.6	25.6	0
1950	25.9	27.5	0.35
1955	26.2	28.4	0.68
1960	26.2	29.4	1.2
1965	25.0	29.8	2.2
1970	21.2	30.2	4.1
1975	16.1	27.9	6.5
1980	14.5	27.5	10.3
1985	7.5	20.1	13.6
1987	7.2	20.1	

Figure 25. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1901 to 1910

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0.6	0.6	0
1920	2.4	2.4	0
1925	6.6	6.6	0
1930	10.7	10.7	0
1935	13.2	13.2	0
1940	14.6	14.6	0
1945	17.0	17.2	0
1950	17.3	18.9	0.4
1955	17.0	19.7	1.1
1960	17.3	20.5	1.3
1965	16.7	20.6	2.4
1970	14.5	21.3	3.5
1975	8.1	17.0	7.9
1980	6.2	18.1	8.4
1985	9.7	17.2	10.1
1987	8.9	17.2	

Figure 26. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1911 to 1920

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0.2	0.2	0
1930	4.2	4.2	0
1935	16.5	16.6	0
1940	29.5	30.0	0
1945	34.9	35.9	0
1950	37.4	39.3	0
1955	38.2	41.0	0
1960	38.8	42.6	0.6
1965	37.4	43.4	1.4
1970	33.0	44.0	3.0
1975	29.2	42.9	5.5
1980	25.3	42.8	9.3
1985	17.9	37.4	14.6
1987	16.6	37.4	

Figure 27. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1911 to 1920

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0.6	0.6	0
1930	3.2	3.2	0
1935	9.4	9.6	0
1940	16.1	16.5	0
1945	20.4	20.9	0
1950	23.1	24.0	0
1955	24.6	25.9	0
1960	24.1	26.7	0.7
1965	23.3	26.8	1.5
1970	21.6	27.7	3.0
1975	23.8	33.7	4.6
1980	22.9	36.1	8.0
1985	12.7	26.0	10.9
1987	12.2	26.0	

Figure 28. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1921 to 1930

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0.1	0.1	0
1935	0.4	0.4	0
1940	5.4	5.4	0
1945	23.5	24.1	0
1950	38.0	39.4	0
1955	42.7	44.8	0
1960	43.3	46.8	0
1965	42.2	48.2	0.4
1970	37.7	48.8	1.2
1975	35.9	47.3	2.7
1980	30.5	46.3	5.2
1985	28.0	47.5	9.2
1987	25.3	47.5	

Figure 29. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1921 to 1930

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0.1	0.1	0
1935	0.4	0.4	0
1940	6.1	6.1	0
1945	20.3	20.3	0
1950	31.7	32.0	0
1955	35.0	36.3	0
1960	37.3	39.1	0
1965	37.4	40.5	0.6
1970	35.2	42.2	1.5
1975	33.6	43.7	2.8
1980	32.7	47.8	5.6
1985	28.3	43.9	8.8
1987	23.3	43.9	

Figure 30. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1931 to 1940

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0	0	0
1945	0.8	0.8	0
1950	9.6	9.7	0
1955	29.5	30.2	0
1960	43.7	46.3	0
1965	44.2	50.0	0
1970	37.9	51.5	0
1975	40.3	51.1	0.7
1980	35.0	51.2	1.7
1985	31.9	50.1	3.5
1987	30.0	50.1	

Figure 31. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1931 to 1940

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0	0	0
1945	1.0	1.0	0
1950	8.4	8.5	0
1955	25.9	26.0	0
1960	39.4	39.9	0
1965	44.3	46.4	0
1970	41.3	49.1	0
1975	41.0	47.8	0.8
1980	36.0	45.7	2.0
1985	26.7	39.5	3.3
1987	24.1	39.5	

Figure 32. Changes in current smokers, ever-smokers, and lung cancer deaths, for white U.S. females born 1941 to 1950

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0	0	0
1945	0	0	0
1950	0	0	0
1955	0.6	0.6	0
1960	10.3	10.5	0
1965	31.2	33.3	0
1970	35.9	46.9	0
1975	39.5	49.0	0
1980	33.7	49.7	0
1985	31.8	49.4	0.6
1987	29.1	49.5	

Figure 33. Changes in current smokers, ever-smokers, and lung cancer deaths, for black U.S. females born 1941 to 1950

X Data	Current	Ever	Lung Death
1900	0	0	0
1905	0	0	0
1910	0	0	0
1915	0	0	0
1920	0	0	0
1925	0	0	0
1930	0	0	0
1935	0	0	0
1940	0	0	0
1945	0	0	0
1950	0.1	0.1	0
1955	0.5	0.5	0
1960	9.3	9.3	0
1965	26.6	26.9	0
1970	37.9	41.8	0
1975	41.3	44.4	0
1980	36.9	46.0	0
1985	37.8	49.1	0.6
1987	35.7	49.4	

Chapter 4

Approaches Directed to the Individual

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Chapter 4

Approaches Directed to the Individual

INTRODUCTION

The goal of any smoking control strategy is to influence individuals to choose nonsmoking status. Early efforts attempted to promote changes within the individual that would allow people to alter their behavior regardless of the social and environmental influences promoting smoking. More recently, public health professionals have recognized the need to change the smoking environment to provide persistent messages to quit and to encourage those who have quit not to relapse. Regardless of the smoking control strategy adopted, however, change must begin with the individual's choices. As a result, a major effort of any comprehensive smoking control strategy should be focused directly on the individual.

Three major approaches to the individual can be identified: (1) The first consists of public information campaigns that inform the smoker of the disease risks associated with smoking and continually present this information as a motivation for smoking cessation. (2) The second is the delivery of school-based health education curricula designed to prevent initiation of tobacco use by adolescents. (3) The third is the development of programs and clinics that smokers can use individually or in groups to improve the likelihood of long-term success with cessation attempts. Each of these approaches has important effects on the social environment and contributes synergistically to other components of a comprehensive smoking control effort; however, their major focus is on the individual.

PUBLIC INFORMATION CAMPAIGNS

The changing role of the media in portraying cigarettes reflects the evolution of mass communication. The severe deleterious impact of smoking on health makes cigarette advertising a special concern. The past and present influence of tobacco companies, expressed through billions of advertising dollars, has both promoted tobacco use and effectively censored information on the adverse health consequences of tobacco use in most print media (Wallack, 1989; Warner, 1981 and 1985). This section reviews the historical role of the mass media and describes how cigarettes have been portrayed to the public by both protobacco and antitobacco groups. Modern antismoking media campaigns also are analyzed and discussed.

Hand-rolled, paper-wrapped cigarettes were first heavily marketed at the beginning of the 20th century, partly in response to public health campaigns against chewing tobacco. Such campaigns alleged that the practice of spitting tobacco

juice and wads onto streets and into cuspidors was a major contributor to the spread of tuberculosis and other communicable diseases. During this time, a new strain of tobacco that was much milder than cigar tobacco appeared on the market. For economic reasons and to expand their markets, the tobacco companies promoted a new milder cigarette as an alternative to chewing tobacco and as a product that offered a lower dose of nicotine. The development of cigarette rolling machines made the mass production of cigarettes more efficient and the products more available (Consumers Union, 1972).

Anticigarette campaigns were sponsored by educators, reformers, business leaders, and respected public figures in reaction to the marketing of the new milder, paper-wrapped cigarettes. In particular, the campaigns were designed to prevent smoking by women and children (Diehl, 1969; Troyer and Markle, 1983).

Although some groups opposed smoking for health reasons, others attacked smoking as a moral issue. They claimed that cigarette smoking affected the brain and therefore contributed to degeneracy. Ultimately, the campaigns resulted in legislation that prohibited or limited cigarette smoking in most states by the early 1920's. The impact of the laws on behavior was negligible, however. By 1927, the few states that still had smoking prohibition laws simply restricted sales to minors.

Early Presentation Of Smoking's Hazards

Medical evidence that linked the increasing number of lung cancer deaths to smoking began to emerge in the United States in the late 1930's. Several researchers investigated the relationship between the tobacco industry's expenditures on mass media and the media's coverage of the risks of smoking. Even though the evidence linking smoking to lung cancer was newsworthy and was presented at press conferences, most newspapers and magazines censored the information, possibly because they feared the loss of advertising revenue (Bagdikian, 1983; Cirino, 1972; Consumers Union, 1972). Two major New York daily newspapers that carried limited information about the evidence restricted their stories to a few paragraphs placed inconspicuously in the middle or back of the paper (Bagdikian, 1983).

The revenue provided by tobacco advertisers has continued to suppress the presentation of the strong empirical relationship between smoking and health problems (Warner, 1985). Cirino (1972) reported that, from 1938 to 1955, only limited coverage was given to scientific evidence of the suspected link between smoking and lung cancer. At that time, the tobacco industry was a leading advertiser in newspapers and magazines in the United States. The tobacco companies

Counter-advertising In the 1960's

routinely screened magazines and newspapers prior to publication to find articles dealing with the relationship between smoking and health, and they withheld advertising from issues that contained information on the negative health effects of smoking (Warner, 1985).

The publication of the Surgeon General's Report in 1964 was accompanied by substantial media exposure. The impact of the mass media coverage was a 15 to 20 percent fall in cigarette sales across the United States within a few weeks of the report's release (Consumers Union, 1972); however, that impact was short-lived.

Cigarette consumption returned almost to pre-1964 levels within 1 year after the release of the Surgeon General's Report. Public health agencies launched several television-based anti-smoking campaigns between 1964 and 1970. The Consumers Union (1972) reported that mass media campaigns launched subsequent to the 1964 Surgeon General's Report had the following objectives: (1) to increase awareness of the negative health effects of smoking, (2) to promote abstinence among teenagers, and (3) to motivate current smokers to quit.

Several conclusions have been drawn from reviews of the early mass media campaigns against cigarettes and the influence of cigarette advertising (Consumers Union, 1972; Flay, 1987; Warner, 1981). The consensus was that mass media campaigns enhanced awareness of the detrimental effects of smoking on health. Such campaigns were found to motivate nonsmokers to abstain from smoking, at least temporarily. However, the antismoking educational campaigns seemed to have little sustained effect on changing the behavior of habitual smokers. Cigarette advertising was suggested to have a substantial influence on a young person's decision to start smoking.

Persuasion Approaches of The 1970's and 1980's

Cigarette advertising associates smoking with enjoyment of life. Specifically, the advertising connects smoking with popular music, enhanced sexuality, popularity, and general happiness—overall, a very appealing message to adolescents. Furthermore, low-tar, low-nicotine cigarettes have been promoted by tobacco companies as less harmful alternatives to brands that have higher tar and nicotine concentrations. These advertising campaigns were found to be effective in motivating individuals who are concerned about their health to switch brands rather than to quit smoking. Almost 15 to 20 years later, the earlier conclusions presented by the Consumers Union have been replicated by additional research on the mass media, the tobacco industry, and advertising (Flay, 1987; Wallack, 1989; Warner, 1985; Warner et al., 1986).

To counter the financially and politically powerful tobacco industry, professionals in public health, communications, and education and political lobbying groups have conducted numerous mass media campaigns and interventions during the past 30 years. More sophisticated appeals, designed to promote abstinence or facilitate cessation, evolved from initial educational campaigns of the late 1960's and early 1970's. However, cigarette advertising and promotion expenditures also increased, from approximately \$491 million in 1975 to more than \$3 billion in 1988 in the United States (Centers for Disease Control, 1990).

The results of the U.S. public health campaigns conducted from 1967 to 1970 suggested sustained counteradvertising did affect the smoking-related beliefs and behaviors of many cigarette smokers (Warner, 1981). The results also suggested a dose-response relationship: As counteradvertising was increased and maintained, smoking prevalence decreased (Flay, 1987).

Flay (1987) reviewed 40 mass media programs and campaigns conducted in the past 30 years, evaluating their relative effectiveness in changing smoking prevalence rates and in sustaining quit rates. Comparing the programs and campaigns, however, was problematic. Most evaluations utilized posttest-only or single-group designs without randomization, and quasi-experimental designs made it difficult to attribute changes in smoking status to the program or campaign. However, several criteria were noted to maximize the effects of media campaigns against cigarettes (Flay, 1987), including the presentation of several different messages over a short time, widespread dissemination of information among the target audience, frequent airing of the messages, and long-term implementation of the advertising campaign.

Flay concluded that viewing a cessation program message on television was as effective for viewers as the American Lung Association self-help manuals were for requestors. The television programs, in combination with the manuals, were found to be more effective than the American Lung Association manuals alone. Moreover, the media viewing plus social support condition was found to be the most effective mass media condition in that study.

Using their integration of prevailing theory, Flay and Burton (1988) proposed the following six necessary and interrelated conditions for an effective campaign: (1) The campaign should include high-quality messages, information sources, and media channels. (2) The message must be disseminated to the target audience and presented frequently, with some variety, over a long duration and at optimal viewing times.

(3) The campaign must retain the audience's attention by ensuring the quality of the message, providing appropriate and supportive media channels, and ensuring that the message corresponds to audience characteristics. (4) Interpersonal communication among members of the target audience should be encouraged. Groups with opposing viewpoints should be encouraged to exchange dialogue that might influence social norms. (5) The campaign should facilitate changes in individuals in the target audience. For example, dialogue between smokers and nonsmokers could enhance smokers' awareness of their behavior's undesirable effects on others. (6) The campaign should influence social norms against smoking. Social norms might also be influenced by dialogue between legislators and their constituents; voter support of an increase in the excise tax on cigarettes might be one example.

A strategy often neglected in mass media campaigns has been to provide smokers with the requisite skills to quit smoking and to provide nonsmokers with the skills needed to remain abstinent (McAlister et al., 1989). Campaigns that have attempted to address these issues have done so primarily through applications of Bandura's social learning theory (i.e., the concepts of modeling, self-efficacy, and social support; Bandura, 1977). Television has been a popular medium for demonstration programs in which celebrities or trained individuals serving as role models provide specific instructions and demonstrate skills that the audience is encouraged to emulate (Flay, 1987; McAlister et al., 1989).

Three examples of such demonstration programs were discussed by McAlister and associates (1989). Each demonstration was a large-scale project, one of which was implemented on a national level throughout Finland. The remaining programs were community programs—one in the county of North Karelia, Finland, and the other in Houston, Texas. The results of the Finnish national program were reported in detail by Puska and colleagues (1979). In brief, the national project was a television-based program that featured a role model who was trained to facilitate successful coping strategies and who then guided a group of smokers through the stages of smoking cessation. The authors reported that, of the 30,000 to 40,000 smokers who participated in the televised series, approximately 10,000 former smokers credited the first year of their nonsmoking status to the program.

The community projects carried the mass media approach to smoking cessation a step further. In North Karelia, a comprehensive program for cardiovascular risk reduction included a smoking cessation component. In addition to a televised cessation series, the program included recruitment and training of 805 volunteers to provide social reinforcement to individuals

trying to quit smoking. The volunteers were also given self-help manuals to distribute to those individuals, and they reported success in helping approximately 500 smokers to quit (McAlister et al., 1989).

The Houston project ran concurrently with the American Cancer Society's Great American Smokeout. The media outlets used included the most widely viewed television station in Houston and one of the two city newspapers. Trained role models, who volunteered to attempt to quit smoking, were presented in specific programs, news announcements, and public service announcements. The role models were videotaped not only during group counseling sessions but also as they went about their daily activities. As part of the project's comprehensive approach, newspaper announcements featured motivational statements and specific instructions for cessation, and printed materials were distributed by local pharmacies and grocery stores (McAlister et al., 1989). Brief training and printed materials were also provided to community public schools and large businesses. The results indicated that 20,000 to 40,000 individuals quit smoking as a result of this campaign.

EVOLUTION OF SCHOOL-BASED INTERVENTIONS

There have been a number of excellent reviews of school-based programs to prevent smoking published in the last dozen years (Bell and Battjes, 1985; Best et al., 1988; Botvin, 1986; Cleary et al., 1988; Flay, 1985; Flay et al., 1983; Glynn and Haenlein, 1988; Glynn et al., 1983; Goodstadt, 1978; Leventhal and Cleary, 1980; Schaps et al., 1981; Snow et al., 1985; Sussman, 1989; Thompson, 1978; Tobler, 1986; US DHEW, 1979; US DHHS, 1989). These reviews provide careful methodological critiques of published studies that must precede any attempt to draw general conclusions from such varied and extensive literature. Although they differ in their enthusiasm for the interventions tested to date, the reviewers agree that the so-called traditional approaches to smoking prevention are largely ineffective and that approaches based on the social-psychological models are at least modestly effective across a variety of settings, times, and populations.

The interventions reviewed here are presented in historical sequence and grouped by common concepts, and their similarities and differences are noted. Several of the intervention methods discussed here are now under study in projects too recent to have been included in previous reviews or to have published results.

Traditional Approaches Information Model

The information model presumes that teaching adolescents that smoking is harmful will modify their attitudes and beliefs, which in turn will alter their smoking behavior. Information programs use various methods, including films, lectures, discussions, posters, pamphlets, newspaper articles, and

guest speakers, to provide factual information on what tobacco products consist of, how they are used, and what effect they have on health, especially long-term health outcomes (Goodstadt, 1978; Schaps et al., 1981; Thompson, 1978; US DHEW, 1979).

Although there is substantial evidence linking beliefs and attitudes with behavior (Fishbein, 1967; Fishbein and Ajzen, 1975; Hovland et al., 1953; McGuire, 1964 and 1969), the information model presumes that knowledge is the major determinant of behavior and thereby ignores the many complex social and personal factors that play an important role in the development of smoking among adolescents. The two major reviews of the smoking prevention literature based on the information model concluded that it was largely ineffective (Goodstadt, 1978; Thompson, 1978). In spite of these findings, the information model continues to predominate in school-based programs for smoking prevention outside the research milieu (Murray et al., 1988).

Affective Model

The affective model assumes that tobacco use is influenced largely by attitudes. Programs based on the affective model attempt to enhance self-esteem and self-image, to teach stress management and stress reduction, to clarify the student's values and show that tobacco use is inconsistent with those values, to improve decisionmaking, and to encourage greater achievement through goal-setting. Such programs often do not include specific information about tobacco or drug use (Durell and Bukoski, 1984; Goodstadt, 1978). The affective model evolved as educators and researchers recognized that the information model was inadequate and that youth who became involved with smoking or drugs often had a negative self-image, were poor achievers, had trouble making healthy decisions, and were under multiple stressors from their social environments.

Although attitude change can be an important component of behavior change, there is substantial evidence that the individual must also possess the skills to carry out the desired behaviors and believe that he or she can successfully execute those behaviors and that the behaviors will have the desired effect (Bandura, 1977; Maiman and Becker, 1974). There is little evidence that programs based only on the affective model have any beneficial effect on behavior with respect to tobacco or drug use (Hansen et al., 1988; Schaps et al., 1981; Tobler, 1986).

Development and Application of Psychosocial Approaches

Three major social-psychological approaches have evolved as alternatives to the traditional approaches described above. These psychosocial models are the social influences model, the cognitive behavioral model, and the life skills model.

The *social influences model* recognizes smoking in adolescence as primarily a social behavior. This model includes the following four components: (1) information on the negative social effects and short-term physiological consequences of tobacco use; (2) information on the social influences that encourage smoking among adolescents, particularly peer, parent, and mass media influences; (3) correction of inflated normative expectations of the prevalence of adolescent smoking; and (4) training, modeling, rehearsing, and reinforcing of methods to resist those influences and to communicate that resistance to others, particularly peers (Evans, 1976, 1983, and 1984; Evans et al., 1978, 1981, and 1984; Evans and Raines, 1982).

The initial effort also employed older peer leaders as facilitators and included a public commitment by the adolescent to not become a regular smoker (McAlister et al., 1979 and 1980; Perry et al., 1980a; Telch et al., 1982) or employed same-age peer leaders to increase the utility and visibility of leaders outside the formal classroom sessions (Hurd et al., 1980; Luepker et al., 1983). Jason (1979) experimented with modeling and rehearsing of pressure resistance skills but did not include the other elements of the social influences model and involved a single focus group of ninth graders. Evans (1976, 1982, 1984, and 1990) describes the social influences model as *social inoculation*. This model involves increasing children and adolescents' resistance to social influences that promote smoking by "inoculating" youth with knowledge and social skills for resisting such pressures. Furthermore, social inoculation includes training to understand and cope with not only *overt* social influences to smoke but also more subtle influences, such as smoking models in cigarette advertisements or individual perceptions of peer group smoking norms.

The *cognitive behavioral model* assumes that smoking is the result of both social and psychological factors, and therefore tobacco use is learned as an approach to meeting social needs (e.g., stress reduction, conversation supplement, transition marking). The cognitive behavioral model differs from the social influences model by including several intervention components that address belief-attitude-behavior structures that may increase adolescents' risk for tobacco use, and by using other than tobacco-related examples and settings as part of its generic social skills training. The earliest examples drew heavily on problem behavior theory (Jessor and Jessor, 1977) and cognitive behavior therapy (Kendall and Hollon, 1979).

The cognitive behavioral approach adopts the basic social influences model and adds role-playing, rehearsal, and reinforcement of pressure resistance skills. It includes problem-solving, decision-making, and self-control methods (Kendall

and Hollon, 1979) to teach adolescents how to recognize risks and manage initial impulses until they are able to evaluate options and select appropriate responses. It also includes self-reward methods (Bandura, 1977) to improve self-efficacy and to teach students to reward themselves for correct decisions. Early studies, like those based on the social influences model, showed positive results (Gilchrist et al., 1979; Schinke and Blythe, 1981; Schinke and Gilchrist, 1983) but were subject to a number of methodological limitations (for a discussion, see Flay, 1985).

The *life skills model* incorporates the four elements of the social influences model; the decision-making, problem-solving, self-control, and self-reward strategies from the cognitive behavioral model; and methods to develop greater autonomy, self-esteem, and self-confidence from the affective model. Even more than the cognitive behavioral model, the life skills model provides training to help adolescents cope with social challenges, including those that involve tobacco.

The life skills training program used a social-psychological approach and had promising results. A 10-session life skills training program reduced the incidence of new smoking by 75 percent in one study involving 8th, 9th, and 10th graders (Botvin et al., 1980). Botvin and Eng (1982), in a 12-session life skills training program involving only seventh graders, showed students smoking less at 1-year followup, reducing new smoking by a significant 58 percent. The 12-session life skills training program is described in Table 1.

Table 2 presents a comparison of some psychosocial school-based interventions. Included are the intervention grades, frequency and number of sessions, the intervention administrator, and size of the study population.

The following sections summarize subsequent work on the three psychosocial models, especially refinements and applications along the following four dimensions: (1) program variations, involving the type of instructor, the timing and spacing of the sessions, the targeted age group, and use of media supplements; (2) the addition of complementary delivery channels such as mass media, community organizations, and parent involvement; (3) the addition of complementary target outcomes such as substance use, nutrition, physical activity, and other health behaviors; and (4) long-term followup studies. For each model, the concluding paragraphs describe current and planned activities. It is notable that, in the course of continued development, there has been a gradual merging of the components of three psychosocial models.

Table 1
A 12-session life skills training program

Session	Topics
Orientation	General introduction, saliva collection, pretest questionnaires
Smoking: myths and realities	Common attitudes and beliefs about smoking, prevalence of smoking, reasons for and against smoking, process of becoming addicted, decreasing social acceptance of smoking
Smoking and biofeedback	Effects of smoking on carbon monoxide levels and heart rate
Self-image and self-improvement	Self-image and how it is formed, self-image and behavior, importance of positive self-image, improving self-image
Decision-making and independent thinking	General decision-making strategies, sources of influence affecting decisions, resisting persuasive tactics, importance of independent thinking
Advertising techniques	Use and function of advertising, ad techniques, identifying ad techniques in cigarette ads and how they affect consumers' behavior, alternate ways to respond to these ads
Coping with anxiety	Situations causing anxiety, demonstration and practice of techniques for coping with anxiety
Communications skills	Verbal and nonverbal communication, learning to communicate effectively, techniques for avoiding misunderstanding
Social skills A	Overcoming shyness, initiating social contacts, giving and receiving compliments, basic conversational skills
Social skills B	Boy-girl relationships, nature of attraction, conversing with the opposite sex, asking someone for a date
Assertiveness	Situations calling for assertiveness, reasons for not being assertive, verbal and nonverbal assertive skills, resisting peer pressure to smoke
Conclusion	Review, conclusions, saliva collection, posttest questionnaires

Adapted from Botvin and Eng (1982). Sessions were 1 hour in length, and there was one session per week for 12 weeks.

Social Influences Model

Program variations. Variations in the programs consist of changes in delivery of the instructional material, age of the students, use of media supplements, involvement of parents, and rewards for low smoking rates. Positive effects have been reported when the social influences model was delivered by project staff (rather than classroom teachers) (Coe et al., 1982; Dielman et al., 1985; Jason et al., 1982; Shaffer et al., 1983; Spitzzeri and Jason, 1979). Coe and colleagues (1982) used freshman medical students, who learned the intervention

Table 2
A comparison of some psychosocial school-based interventions

	Intervention Grades	Number of Sessions	Frequency of Sessions	Intervention Administrator	Booster Sessions	Study Population
Investigators						
<i>Social Influences Model</i>						
Coe et al., 1982	7 or 8	8	Weekly or twice weekly	Program staff	No	30-40
Jason et al., 1982	9	7	Weekly	Program staff	No	149
Spittzeri and Jason, 1979	9	10	Weekly	Program staff	No	61
Evans, 1976	7	4	Consecutive days	Peers	No	750
Pentz et al., 1989b	6-7	10		Peers, parents, and teachers	Yes	1,122
Ellickson and Bell, 1990	7-8	8	Weekly	Health educators, peers, and teachers	Yes	3,852
Best et al., 1984	6	6	Weekly	Program staff	Yes	654
Flay et al., 1983	6	6	Weekly	Program staff	Yes	653
Flay et al., 1987	7	5	Consecutive days	Teacher	No	4,891
<i>Cognitive Behavioral Model</i>						
Gilchrist et al., 1986	5-6	8		Peers and program staff	No	741
Schinke et al., 1985a	6	10	Weekly	Program staff	No	689
Schinke and Gilchrist, 1984	6	8	Semiweekly	Program staff	No	234
Gilchrist et al., 1989	6	10		Health educators	No	882
<i>Life Skills Model</i>						
Tell et al., 1984	5-7	10	Over 2 years	Peers and program staff	No	298
Botvin et al., 1983	7	15	Weekly or daily	Teachers	Yes	902
Bush et al., 1989	4-6	4	Over school year	Teachers	No	1,234
Botvin et al., 1980	8-10	10	Weekly	Program staff	No	281
Walter et al., 1989	4-9	Throughout school year	Weekly	Teachers	Yes	1,105
Botvin et al., 1984	7	20	Weekly	Older peers and teachers	No	1,311
Botvin and Eng, 1982	7	12	Weekly	Older peers	No	426

techniques in eight 1-hour sessions during regular school hours with the teacher present. The intervention strategies of Jason et al. (1982) were delivered by graduate psychology students in six weekly sessions lasting about 30 minutes each. Spizzerei and Jason (1979) used clinical psychology graduate students, divided treatment classes into groups of 10, and engaged in role-playing scenes that lasted 5 to 10 minutes and were followed by 15 to 20 minutes of discussion.

A number of studies have used teachers to deliver the intervention program. Biglan et al. (1987a and 1987b) had science or health teachers present instruction sessions that ran for 3 or 4 consecutive days and were followed by a booster session, 2 weeks later, which emphasized refusal skills. Colquhoun and Cullen (1981) used a program of six 75-minute sessions conducted by teachers, with participation from local general practitioners. Colquhoun and Cullen reported smoking declines for 12-year-old boys from 11 percent to 4 percent 1 year later and, in 13- to 14-year-olds, declines from 20 percent to 14 percent in boys and 31 percent to 26 percent in girls.

Flay and coworkers (1987) delivered a 5-day classroom curriculum that was taught the same week that a local television station aired five 5-minute smoking prevention segments. There were an additional five 5-minute television segments on smoking cessation the following week. Pentz and colleagues (1989a and 1989b) had teachers deliver the intervention program in health, science, or social studies classes and reinforced classroom instruction with 10 homework sessions involving interviews and role-playing with parents and families.

A number of studies have combined staff or teacher delivery of program material with the assistance of a student peer. Arkin and colleagues (1981) involved all seventh grade classes of eight junior high schools (3,206 students at the program's start). Each seventh grade class nominated classmates who they believed would be effective leaders. The peer leaders directed discussions, provided feedback, and helped students to develop counterarguments. Ellickson and Bell (1990) used health educators to deliver the program to seventh graders in 10 schools, and teen leaders assisted adult teachers in 10 other schools. Perry and coworkers (1989), in a study of strategies to promote cardiovascular health, used same-age peer leaders in a smoking cessation program aimed at seventh graders. Murray and colleagues (1984, 1987, 1988, and 1989) employed a combination of teacher-led and peer-led intervention sessions and then tracked the participants for 6 years. They reported a significant reduction of smoking onset at 1 year, but the effect diminished with the passage of time.

Positive effects were reported also when the prevention program was delivered to elementary school students (Best et al., 1984; Dielman et al., 1985; Flay et al., 1983 and 1985). Best and colleagues (1984) included sixth graders from 22 schools in a social influences smoking prevention program. At the end of the eighth grade, 47 percent of never-smokers in the control group still had not tried smoking, and 60 percent of the treatment group never-smokers still had not smoked.

Johnson et al. (1986) delivered a social approach curriculum and a health approach curriculum aimed at Los Angeles area high school students. They concluded that social influence resistance training helps to reduce transitions to higher use by smoking experimenters. Health education was most valuable in preventing initial experimentation among those who were nonsmokers prior to the study.

Perry and coworkers (1980b), in the area of Stanford, California, examined a smoking prevention and cessation program delivered in regular 10th grade health education classes. On consecutive days during the fall semester, students received four 45-minute classes that covered handling social pressures to smoke, identifying and discussing the targets of cigarette advertisements, and brainstorming about how to help others remain nonsmokers or quit smoking. The students also measured their blood pressure, pulse rate, lung capacity, skin temperature, and carbon monoxide levels in breath. At the end of the semester, students in the program were more knowledgeable about the immediate physiological effects of smoking and about the best methods to quit and prevent others from smoking.

In a similar study, Perry and colleagues (1983) had 20 classes of 10th graders participate in a comparison of three treatment programs: the first was the social consequences of smoking; the second was the immediate and long-term physiological effects of smoking; and the third was the long-term health effects of smoking. The investigators cautioned that no single program appeared to be more effective than the other two, although the combined effect of all three programs was a 23 percent reduction of regular weekly smoking at 2-month followup.

Not all researchers have been able to replicate earlier reports (Best et al., 1988). Clarke and associates (1986) concluded that interventions led by program staff, which were "relatively light, short-term interventions," had little effect in an environment filled with powerful prosmoking messages by media, older peers, and adult role models.

Failure to achieve significant results in programs led by teachers have been reported by Lloyd et al. (1983), Clarke et al. (1986), and Burke et al. (1987). Lloyd and coworkers (1983)

surveyed teachers about their own smoking habits, attitudes toward smoking, and prior use of smoking prevention material. Teachers who rated lowest on this implementation scale had students whose test results for knowledge and behavior changes were similar to those for control students. Fisher et al. (1985), Clarke et al. (1986), and Burke et al. (1987) reported inconclusive results with programs that used a combination of teachers or program staff and peer leaders.

Several investigators have used mass media to supplement the more typical delivery approaches. Arkin et al. (1981) followed students who had received a social pressures curriculum and were nonsmokers at baseline. At followup, the percentages of students who were still nonsmokers for the adult-led sessions with media, peer-led with media, and peer-led without media were 82.1 percent, 81.0 percent, and 88.6 percent, respectively (students who received a standard curriculum were 69 percent nonsmokers). The addition of mass media did not provide a significant benefit in this study.

Murray et al. (1984, 1987, and 1988) reported similar results, in that adding videotape supplements to the social influences curriculum provided no additional benefits. Johnson et al. (1986) used a social influences curriculum to test the effect of recognizable compared with unfamiliar media models and reported no effects of the media models for any onset category or for quitting.

Complementary delivery channels. Biglan and associates (1987a) included a set of four messages mailed to the parents of seventh grade students. The object of the messages was to help reinforce refusal skills, health effects, and commitment to non-smoking. The messages also tried to encourage parents to discuss their views of smoking with their children and to set family rules about smoking. The first message was mailed at the end of the school intervention, and subsequent messages at 2, 4, and 6 weeks thereafter. The investigators concluded that messages to and through parents did not affect the outcome.

Positive effects have been reported, though, by some programs that included parent activities and mass media programming as complements to the school-based intervention (Flay et al., 1987; Pentz et al., 1989a and 1989b). Pentz and colleagues (1989a) included, as part of their intervention program, homework sessions that included interviewing parents and family members about family rules on drugs, techniques to avoid drug use, and how families can counteract media and peer influences.

In a related study, Pentz and associates (1989b) included a parent program that consisted of three to six organizational meetings per year, support activities for the school, and an

educational seminar for all parents. In addition, there was a 1-day workshop each year for school principals, parent group representatives, and student leaders. The training emphasized changing school policy toward prevention education, smoking in and around schools, and providing support skills for parent-child communication and prevention. Thirty-two parents were involved in delivering the parent components of this intervention program.

Complementary target outcomes. Reductions in tobacco use have been reported by social influences model programs aimed at general substance use (Ellickson and Bell, 1990; Hansen et al., 1988; Pentz et al., 1989a and 1989b). These studies aimed to reduce adolescents' use of drugs—tobacco, alcohol, and marijuana. In a study that focused on cardiovascular risk factors, Perry and colleagues (1989) reported that, after the fifth year of a school-based health education program, 13.1 percent of the educated group were current smokers, in contrast to 22.7 percent of controls.

In a study by Hansen and coworkers (1988), seventh grade students were provided with social pressure resistance training and were tested prior to training and at 12 and 24 months after training. The initiation of smoking was lower in trained students than among controls: 13.0 and 11.8 percent versus 18.2 and 17.8 percent at 12- and 24-month followup testing. The most significant effect was inhibition of the move to heavier smoking. At the level of five or more cigarettes in the preceding 30 days, the reduction was about two-thirds at 12 months (1.7 versus 5.3 percent for controls) and three-fourths at 24 months (1.4 versus 6.0 percent for controls).

Ellickson and Bell (1990) reported a reduction in the levels of cigarette use that signal heavier smoking. After eighth grade booster lessons, weekly smoking declined in one group by almost 50 percent. Ellickson and Bell suggest that booster lessons are important for maintaining and reinforcing earlier intervention efforts. However, they also suggest that early cigarette smokers "need a more aggressive program than that offered by the social influences model alone."

Long-term followup. The only long-term followup studies based on the social influences model reported no program effects enduring beyond high school (e.g., Murray et al., 1989), even if booster sessions were included (Flay et al., 1989). Observed effects were maintained, however, up to 4 years after the conclusion of a program with seventh graders (Murray et al., 1988).

Current activities. Researchers at the Oregon Research Institute are involved in a large-scale study of a variation on the social influences model that includes a much stronger

behavior-analytic focus than previous efforts. It differs from many previous efforts in that (1) it is a multiple grade-level intervention; (2) it relies heavily on videotaped material to present information and prompt discussion and training in pressure resistance skills; and (3) it addresses a wider range of risk-taking activities, including alcohol and marijuana use and behaviors such as shoplifting (Biglan et al., 1988). Results at 1 year were encouraging, at least among baseline ever-smokers (Ary et al., 1990).

At the Fred Hutchinson Cancer Research Center in Seattle, researchers are involved in a large-scale study of a social influences model variation. It is delivered annually in grades 3 through 10, is delivered by teachers, and includes a parent component; however, it remains focused solely on tobacco use (A. Peterson, telephone conversation).

Researchers at the New England Research Institute are testing another variation in a Hispanic population. Their intervention focuses on family and advertising issues and includes a video and discussion component designed to involve family members and neighbors in the school-based prevention program (S. McGraw, telephone conversation).

In Minnesota, researchers are testing the effectiveness of statewide legislation designed to encourage schools to adopt social-influences-based programs to prevent tobacco use. The state legislature is providing financial support to schools that adopt such programs, and the research will compare tobacco use by adolescents in Minnesota and in Wisconsin, to determine whether the smoking rate declines in Minnesota as a result of the legislation. The study also includes a randomized trial designed to evaluate the three programs that have been adopted most widely as a result of the 1985 legislation (Murray et al., 1988).

Researchers at the University of Southern California and the University of Chicago are testing a combination of television, family involvement, and school-based programming for their effect on tobacco use (Flay et al., 1988). Researchers in Vermont also are evaluating a school-based versus a school-plus-mass media program (Worden et al., 1988). Evans and colleagues at the University of Houston are attempting to construct a psychosocial profile of the quickly accelerated heavy smoker relative to the more slowly accelerated moderate or heavy smoker (Evans et al., 1991). They are applying the psychosocial model developed during their work on cigarette smoking to the problem of smokeless tobacco use (Evans and Raines, 1990), with Little League Baseball players as a study population. They are also evaluating the potential contributions to the psychosocial model of factors such as gender

(Evans et al., 1990), ethnicity (Getz and Evans, 1989), self-efficacy (Getz, 1988), and smoking by others, including parents, older siblings, and peers (Cardozo, 1989; Getz et al., 1990).

Evans and associates also have responded to feedback from teachers and administrators who suggest that many useful prevention programs demand more curriculum time and teacher training time than can be allotted. They are developing and testing a compact, 2-week program that requires minimal training and preparation time by classroom teachers. The "Little Red Notebook" program is based on the social influences model and includes exercises in decision-making, role-playing, and rehearsal; self-control methods; reinforcement of pressure resistance skills; and learning to use relevant community service agencies. Each section includes a step-by-step teacher's guide and copy masters for all materials used in the unit. Although more extensive evaluation is needed, there is some evidence of modest results related to decreased use of cigarettes, smokeless tobacco, and alcohol among seventh grade students (Cardozo, 1989; Evans, 1990; Evans et al., 1989).

Cognitive Behavioral Model

Program variations. Gilchrist and Schinke (1984), in a study with sixth grade students, used self-control skills for smoking prevention and reported that self-control students who reported ever smoking rose only 3.6 percent over baseline after 1 year; control condition students rose 39.3 percent in that same year. These students learned a problem-solving model called SODAS, which instructs students to do the following:

- Stop—think about what they are doing;
- Options—think about their choices;
- Decide—choose the best option;
- Act—make that option happen; and
- Self-praise—reward themselves for making the right decision.

Gilchrist and colleagues (1986) evaluated the self-control process with middle school subjects. At a 15-month followup survey, fewer self-control skills students than controls reported smoking one or more cigarettes for the previous week.

Glynn and coworkers (1985), working with sixth through eighth graders, described the stage model, which states that becoming a smoker is a lengthy, complex process with four stages. The first stage is the preparatory stage, in which adolescents first develop attitudes toward cigarettes and smoking. In the second stage of initiation, the adolescent smokes between one and three cigarettes. In the third stage, becoming a smoker, smoking is irregular and adolescents do not define themselves as smokers. The final stage is maintenance, when regular smoking has begun and the image of a smoker has been

Table 3
The stage model and smoking motives

Stages	Smoking Motives		
	Social Compliance	Affect Regulation	Self-Definition
Preparatory	Need for social approval	Use of foods, drinks, and over-the-counter medications to regulate emotional state	Need to rebel
Initiation	Peer pressure, social initiation, nonspecific curiosity	Curiosity about mood-altering properties of cigarettes	Need for impression management (i.e., how one appears to others)
Becoming	Continuing social influences	Positive evaluation of sensations produced by smoking	Is an instant adopter and skips this stage
Maintenance	Continuing social influences, positive evaluation of sensations produced by smoking	Establishment of a link between smoking and affective state of sensations produced by smoking	Satisfaction with projected image, positive evaluation

Adapted from Glynn et al. (1985).

adopted. Table 3 shows how the stage model depicts factors that influence adolescents at different smoking stages.

Schinke and associates (1985a) used graduate social workers to provide skills intervention and information intervention to sixth graders. At 6, 12, and 24 months after the intervention, the skills students had a lower percentage of smoking than did the information-only and the control students. A four-step chain in the skill-building interventions—stop, think, decide, and act—was used by Schinke and coworkers (1985b).

Schinke and Gilchrist (1984, 1985, and 1986) have conducted several studies that were led by project staff using the cognitive behavioral technique. In 1984, the investigators reported that students in the skills-building condition, when

compared with students in an attitude modification condition or with controls, had larger gains at followup testing for identifying healthy solutions, encouraging nonsmoking, and anticipating negative consequences of tobacco use. Pentz (1983) reported positive results with a combination of teacher and peer leader administration techniques.

Beneficial effects were reported when the program was delivered to elementary school students, rather than the usual delivery of psychosocial prevention programs to seventh or eighth grade students (Gilchrist and Schinke, 1984; Gilchrist et al., 1986; Schinke et al., 1985a, 1985b, 1986a, 1986b, and 1988a; Schinke and Gilchrist, 1984, 1985, and 1986). Schinke and colleagues (1986b), working with sixth graders, taught problem-solving, self-instruction, and communication skills. When compared with students in a health education program, students in this study had better knowledge scores and non-smoking intentions. Schinke and coworkers (1986a and 1988a) reported that, in a study that began with students in the fifth and sixth grades, students showed lower rates for both smoking and smokeless tobacco use.

Native American adolescents are a particularly vulnerable population for abuse of substances, including tobacco, according to results obtained by Schinke and colleagues (1988b). At 6-month followup, the treatment group reported less use of both smoked and smokeless tobacco during the previous 14 days. However, because of the small number of subjects ($n = 61$) and the short period of followup, the authors advise a cautious interpretation of their results.

Failures to duplicate results of earlier studies have been reported for studies with high-risk girls (Gilchrist et al., 1989). Gilchrist and associates reported the following data for high- and low-risk girls and boys at a 24-month followup survey. The percentage of weekly smokers in the high-risk girls category was 9.1 percent; for low-risk girls, weekly smokers were 3.6 percent; for high-risk boys, 7.3 percent; and for low-risk boys, 4.8 percent. The weekly smoking rate for high-risk girls was significantly higher than for any other intervention category and was similar to the high-risk girls in the control group (10.2 percent reporting weekly smoking).

Gilchrist and associates (1989) suggest that females begin and continue smoking for different reasons than do males. Young female smokers tend to be more socially competent and self-confident than their male counterparts and do not smoke for social coping purposes or to demonstrate assertiveness. Therefore, teaching refusal and social competence skills may be less useful and relevant for females than for males, and thus have less effect.

A more appropriate technique may require less attention to skills training and more to self-definition and self-expression. In addition, tension reduction and information on weight control methods, because smoking is perceived to be valuable for weight control, could prove to be more relevant to young female smokers (Gilchrist et al., 1989).

Complementary delivery channels. The programs based on the cognitive behavioral model have been exclusively school-based. Thus, there are no reports of investigation of complementary channels for program delivery.

Complementary target outcomes. Positive effects of reducing tobacco use have been reported by programs aimed at general substance use (Penitz, 1983; Schinke et al., 1988b). Such programs have not targeted other health outcomes, however.

Long-term followup. There have been no published reports from followup studies beyond 2 years for programs based on the cognitive behavioral model.

Current activities. Researchers at Columbia University are testing a variation of the cognitive behavioral model in a high-risk population (S. Schinke, telephone conversation). Adolescents at high risk for smoking often have been unaffected by intervention efforts in the past, and this remains an important area for research. The Columbia group employs the basic cognitive behavioral model but has modified the role models and scenarios to be more appropriate for high-risk youth. The investigators also have added a component to address values on deviance.

Life Skills Model

Program variations. Positive effects have been reported when the life skills program was delivered by the project staff (Tell et al., 1984), by teachers (Botvin et al., 1983, 1989a, and 1989b; Bush et al., 1989; Vartiainen et al., 1983, 1986, and 1990; Walter et al., 1986, 1988, and 1989), and by a combination of teachers or staff and peer leaders (Botvin et al., 1984; Tell et al., 1984; Vartiainen et al., 1983, 1986, and 1990). The smoking prevention curriculum for one cohort of the study by Tell and coworkers is shown in Table 4. Tell and associates provided this social skills training in a 10-session curriculum that began in September 1979 and ended in February 1981.

Botvin and colleagues (1989a) used a psychosocial approach with black junior high students. The study used 12 intervention sessions of 45 minutes each. In addition, an internal review committee of black researchers (a psychologist and two health educators) reviewed the material to make certain that the language, reading level, examples, and underlying concepts were appropriate for black youth. An external review group of black seventh grade students and outside

Table 4
A program variation of the life skills model

Session	Topics
September 1979	Personal commitment and discussion of social pressures.
September 1979	Pressure resistance training. Student-led role-playing.
November 1979	Social pressures and arguments against smoking.
March 1980	Coping with social anxiety.
May 1980	Pressure resistance training. Student-led talks about the harmful effects of smoking.
October 1980	Smoking: self-pollution and waste of resources. Smoking as a form of self-pollution and growing tobacco as a waste of agricultural resources were discussed.
November 1980	Passive smoking. Second-hand smoke, parental smoking, peer pressure at youth clubs were discussed.
December 1980	Long-term effects of smoking and marketing of tobacco. Cancer and cardiovascular diseases relating to smoking and comparison of selling tobacco in Third World countries versus selling it in Norway were discussed.
January 1981	Social and health aspects of smoking.
February 1981	It is your choice. A film on alcohol consumption was shown, and drinking and parallel smoking pressures were discussed.

Adapted from Tell et al. (1984). Sessions were 45 minutes in length.

experts with expertise with black youth was also formed. The main purpose of the study was to explore the feasibility of applying the life skills training model, previously used with middle-class white youth, to urban black youth. The overall rate of smoking during the most recent month of the study was down by 56 percent, although regular smoking did not appear to be affected.

Bush and coworkers (1989) identified problems that may affect most intervention studies for urban black youth: meeting the parental consent requirement, lack of true controls, variations in teacher effectiveness, frequent student transfers, isolation of the program within schools, data collection procedures, and lack of teacher support for the program. For example, at the seventh grade level, all of the health teachers were smokers, and their effectiveness therefore came into question. In addition, it was difficult for the research team to judge the effect of teachers as role models because of incomplete attendance at teacher training sessions and because there was some question about whether the teachers adhered to the curriculum.

Failures to duplicate results have been reported for studies with teacher-administered life skills programs (Botvin et al., 1984), particularly when the teachers received inadequate training (Botvin et al., 1989b; Tortu and Botvin, 1989). Tortu and Botvin (1989) cautioned that poor implementation can be misinterpreted as program failure. Therefore, to help ensure proper implementation of programs, effective teacher training must accompany teacher-administered programs. The training must include the theory underlying the program, demonstrations of skills needed to administer the program, practice of the new skills, and feedback and coaching from project staff. The social skills programs stress that students learn decision-making skills, assertiveness, and anxiety reduction. These skills require classroom techniques that differ from traditional teaching methods, for example, the practice of adolescent skills through role-playing (Tortu and Botvin, 1989).

Additional benefits have been reported when the initial intervention is followed by a booster program. Botvin et al. (1983), in an intervention program with seventh grade students, reported 60 percent fewer new regular smokers than when the same intervention program was used without booster sessions. Furthermore, the eight booster sessions, which took place in the second year of the program, resulted in 87 percent less regular new smoking than among controls.

Positive effects have been seen also when the intervention continues over several years (Bush et al., 1989; Tell et al. 1984; Walter et al., 1986, 1988, and 1989). Walter and associates began a study of coronary heart disease prevention with a baseline population of fourth graders. Each year from the fourth to the ninth grade, students received a teacher-delivered curriculum that included material designed to prevent cigarette smoking. After 6 years, the rate of initiation of cigarette smoking was significantly less (by 73 percent) than in the non-intervention schools.

By comparison, in a condensed timeframe, Botvin and colleagues (1983) conducted the life skills training program on consecutive days and completed the program in about 1 month, in addition to carrying out the usual practice of weekly sessions delivered over the course of a semester or a full school year. They reported that smoking initiation rates were significantly lower in the intensive program than among control students (who received no special prevention activities), according to monthly, weekly, and daily measures.

Complementary delivery channels. An intervention program that was delivered within a broad-based and communitywide heart disease prevention program produced positive results (Vartiainen et al., 1983, 1986, and 1990). The North Karelia Youth Project attempted to reduce the factors associated with cardiovascular disease risk, including smoking, serum cholesterol, dietary habits, and blood pressure. The program was begun with a group of students who were 13 years old. In two schools there was an intensive intervention program and in nine others, less intensive intervention; the balance of schools in the community served as controls. The intervention strategy was applied over a 2-year period.

In the first followup survey (Vartiainen et al., 1983), 21 percent of the students were smoking at least monthly in the intensive intervention schools, 19 percent in the less intensive intervention schools, and 29 percent in the control schools. At the second followup survey, these figures were 24, 22, and 34 percent, respectively. Four years after the program's start, the reported rates were 27 percent for the intensive intervention group, 26 percent for the less intensive intervention group, and 37 percent for the control group (Vartiainen et al., 1986). Eight-year followup results indicated that some of the intervention effect had been lost. Preventive effects seemed to have been beneficial only for those who were nonsmokers when the program began.

Complementary target outcomes. Effects that reflect reduced use of tobacco have been reported by programs based on the life skills model and directed to general substance use (Botvin et al., 1984) as well as those that aimed at cardiovascular risk factors (Tell et al., 1984; Vartiainen et al., 1983, 1986, and 1990; Walter et al., 1986, 1988, and 1989). Details of these studies are mentioned in previous sections.

Long-term followup. Two studies reported followup for more than 2 years beyond the initial life skills intervention. Walter and colleagues (1988 and 1989) reported positive effects at the end of the ninth grade, in a study that included interventions each year from grades 4 through 9. Vartiainen (1986 and 1990) reported positive effects 2 and 6 years after a 2-year intervention was delivered to students in grades 7 through 9.

Current activities. At the American Health Foundation, researchers are examining whether the comprehensive life skills model aimed broadly at cardiovascular risk reduction will be more effective for preventing tobacco use than will the targeted application of only those components aimed at substance use (M. Orlandi, telephone conversation). Researchers at Cornell University are exploring even broader applications of the life skills model that would seek to improve skills related to future employment or early sexual behavior (G. Botvin, telephone conversation).

CLINICAL APPROACH TO SMOKING CONTROL

Historical Trends

The major efforts in smoking control have been aimed at the individual smoker—trying to motivate smokers to quit and help them to do so. Such assistance has included formal cessation programs, usually delivered in small groups, and one-to-one direct advice or counseling from a health care provider. More recently, pharmacologic adjuncts (Grabowski and Hall, 1985) have been added to the treatment mix in both settings. This section briefly reviews the research on the effectiveness of clinical approaches and appraises their potential contribution to a comprehensive program to reduce tobacco use.

Research on smoking cessation was initially driven by a clinical perspective. The aim was to develop effective methods that cessation clinics could use with motivated smokers who referred themselves for "treatment," or that physicians and other health providers could use with their patients. Serious smoking cessation research and service programs have a rather short history, only about 30 years. Even early on there were proponents of both pharmacological approaches and educational-psychological approaches. The early pharmacological strategies were rather primitive by current standards. Although the role of nicotine in the maintenance and cessation of smoking was poorly understood, the notion of replacing or mimicking nicotine's action was seen as plausible. Much of the early pharmacological research focused on lobeline, presented in over-the-counter products like Bantron and occasionally by injection. Placebo studies yielded fairly convincing demonstrations of lobeline's lack of efficacy (Kozlowski, 1984).

Cigarette smoking quickly attracted the attention of workers in behavior therapy. Behavioral approaches to smoking cessation tended to reflect current practices or the zeitgeist in behavior therapy rather than deriving from an analysis or understanding of smoking behavior (Lichtenstein, 1982). Smoking was considered to be a learned habit; pharmacological and biobehavioral processes were neglected. Earlier behavioral approaches to smoking featured conditioning methods followed by self-control strategies and tactics that represented behavioral thinking in the 1960's and early 1970's. Behavioral approaches in the 1980's had major cognitive components,

reflecting the interest in cognitive behavioral strategies. Within this general trend, however, behavioral workers generally maintained an empirical attitude and became increasingly sensitive to the developing body of knowledge about both psychosocial and pharmacological processes in smoking behavior. For example, behavioral researchers evolved nicotine-fading (Foxx and Brown, 1979) or brand-switching strategies to deal with pharmacological processes and tended to be sympathetic to nicotine chewing gum as an adjunct to—or even a major component of—cessation programs (e.g., Goldstein et al., 1989).

Another trend in the late 1970's and 1980's was the shift in emphasis from smoking cessation to maintaining abstinence and preventing relapse. The change was sparked by repeated observations that most participants in cessation programs either quit or greatly reduce their smoking, but the majority subsequently relapse—most of them soon after the program ends. Although early programs tended to focus on smoking cessation by the end of the program, considerable program time is now devoted to relapse prevention. Marlatt and Gordon's (1985) book on relapse prevention epitomized this trend. Both behavioral and pharmacological strategies are employed to achieve maintenance and relapse prevention. Smoking cessation now is recognized as a process that encompasses several identifiable stages—from precontemplation to maintenance or relapse (Prochaska et al., 1988). The importance of tailoring cessation materials to the smoker's stage of readiness to change is increasingly recognized, although not yet empirically supported.

Two other noteworthy trends in clinical intervention are interrelated. One is the renewed and vigorous interest in pharmacologic intervention, especially nicotine replacement therapies (Grabowski and Hall, 1985). This thrust is fueled by advances in knowledge about the critical role of nicotine in maintaining smoking behavior and in the quitting or relapse process (US DHHS, 1988), which have paved the way to growing literature on the effectiveness of nicotine polacrilex—both when used with relatively minimal advice and support and when combined with behavioral counseling and group support. The final trend noted is toward briefer clinical interventions delivered in the context of usual medical care (Glynn, 1988; Ockene, 1987a; Russell et al., 1983). This strategy capitalizes on the credibility of physicians (American Cancer Society, 1977), the teachable moments in medical transactions (Vogt et al., 1989), and the possibility for physicians to use pharmacological adjuncts, a familiar treatment modality.

Effectiveness of Different Methods

There are different cessation methods, and it is possible to categorize them in different ways. Schwartz (1987) lists 21 different approaches in his summary table. With the exception of pharmacological strategies and physician advice or counseling approaches—where there has been much activity in the last 5 years—Schwartz's review of specific clinical cessation methods remains valid.

It is also possible to organize cessation methods into general strategies, for example, self-management strategies, aversive strategies, pharmacological strategies, relapse prevention strategies, combined behavioral-pharmacological approaches, and multicomponent strategies (Kamarck and Lichtenstein, 1988). In fact, nearly all clinical interventions are now multicomponent to a significant degree. Table 5, adapted from Lichtenstein and Mermelstein (1984), lists and briefly describes the typical elements in a multicomponent program, which are organized around three program phases: preparation for quitting, initial quitting, and the maintenance of quitting. No one program is likely to use all of these elements. Given the large number of different kinds of studies, the fact that some methods have been evaluated extensively and some very little, and the differences in evaluation criteria, it is difficult to identify the most effective interventions. However, the following conclusions seem defensible.

The research literature generally indicates that more intensive and extensive interventions are more effective than single-strategy or single-session methods. For example, single-strategy interventions have yielded weak results, whereas multicomponent programs (e.g., Lando, 1986; Ockene et al., 1982) have shown the highest quit rates. Good multicomponent programs can yield long-term (1-year) confirmed quit rates of 30 to 40 percent. The intensity of the intervention or number of contacts also seems important. For example, Lando's (1986) 15-session program is among the most effective intervention reported, and the high quit rates reported by Ockene et al. (1982) for the Multiple Risk Factor Intervention Trial are consistent with that conclusion. With respect to physician advice, a meta-analysis reveals that more frequent contacts are associated with higher quit rates (Kottke et al., 1988). Some research in the self-help or minimal assistance realm also indicates that additional prompts, for example, supportive phone calls, enhance effectiveness (Glynn et al., 1990; Orleans et al., 1988).

It is difficult to empirically determine and demonstrate the specific efficacious elements of multicomponent programs. There is undoubtedly a large nonspecific effect in smoking cessation programs. The commitment to attend regular sessions, expectations of help, group or counselor support, and engagement with therapeutic activities (e.g., homework assignments)

Table 5
Methods used by cessation programs

Program Phase	Typical Elements
Preparation	<p>Mobilizing client motivation and commitment</p> <ul style="list-style-type: none">• Deposits contingent on attendance• Review reasons for quitting and benefits of stopping <p>Self-monitoring; increase awareness of smoking patterns by keeping records*</p> <p>Setting target quit date 1 to 3 weeks ahead*</p> <p>Self-management training</p> <ul style="list-style-type: none">• Use self-monitoring to identify typical cues for smoking• Identifying substitutes for smoking and alternative nonsmoking behaviors*• Stress management training; relaxation or exercise
Quitting (usually one of typical elements listed)	<p>Aversive strategies</p> <ul style="list-style-type: none">• Pairing smoking with electric shock• Rapid smoking—inhaling every 6 to 8 seconds in the clinic until nausea is imminent or satiation—doubling or tripling at-home smoking <p>Nonaversive strategies</p> <ul style="list-style-type: none">• Nicotine fading (switching successively to brands with increasingly lower nicotine content)• Target date contract <p>Pharmacological—Using nicotine replacement methods (e.g., gum, patches) as a temporary substitute</p>
Maintenance	<p>Followup sessions or phone calls</p> <p>Coping skills training*</p> <ul style="list-style-type: none">• Transfer self-management skills to maintenance by avoiding cues to smoke and using substitutes (e.g., cinnamon sticks, water, deep breathing)• Cognitive behavioral coping: anticipating high-risk situations; planning coping strategies• Coping with slips or lapses; learning from mistakes <p>Social support</p> <ul style="list-style-type: none">• Buddy systems• Involving significant others (e.g., spouse) <p>Pharmacological—Continuing to use nicotine replacement to cope with withdrawal</p>

*Found in most programs

are known to have powerful effects on any behavior problem, including smoking. Attempts at component analysis—determining efficacious and nonefficacious elements—have generally failed (e.g., Lando, 1986); such studies are markedly lacking in statistical power (Glasgow and Lichtenstein, 1987). Similarly, attempts to identify the value of individual components by adding a single *behavioral* strategy such as spouse or partner support to a basic multicomponent program have also been unsuccessful (e.g., Lichtenstein et al., 1986).

The addition of pharmacological adjuncts, notably nicotine chewing gum, to multicomponent cessation programs yields a more consistent and positive picture. Combining nicotine gum and behavioral counseling tends to produce better results than either approach by itself (Goldstein et al., 1989; Hall et al., 1987; Killen et al., 1984).

Both clinical experience and research support the importance of focusing attention on the maintenance or relapse prevention phase of intervention (see Table 5). Although there are some notable examples of the effectiveness of relapse prevention components (Hall et al., 1984; Stevens and Hollis, 1989), there are as many failures (for a summary, see Glasgow and Lichtenstein, 1987). Nevertheless, there remains a consensus that attention to relapse prevention is important. It is plausible, however, that environmental factors, including other people's smoking, are critical to maintenance (Glasgow and Lichtenstein, 1987).

For the individual smoker, conscientious attendance at a multicomponent, small-group, cessation program (including nicotine replacement strategies) is the best possible move toward becoming an ex-smoker. Such a program is likely to produce a 30 percent quit rate at 1-year followup. Although far from the sure thing advertised by some proprietary programs and private practice providers, this is a good result compared with a single attempt at self-quitting (Cohen et al., 1989) or even quitting with the advice and assistance (e.g., prescription of a nicotine chewing gum) of a primary care physician (Glynn, 1988).

Cessation Clinics

Limitations of cessation clinics. Two extensively researched cessation programs illustrate the strengths and weaknesses of the cessation clinic approach. In the 1970's, many programs employed rapid smoking (Lichtenstein et al., 1973; Schmahl et al., 1972), typically accompanied by considerable behavioral counseling and support. Rapid smoking is an aversive procedure wherein the smoker puffs and inhales every 6 to 8 seconds until nausea begins. It is the most frequently studied clinical strategy, accounting for 49 of the 416 trials summarized in Schwartz's comprehensive summary (1987), and its close cousins—satiation

and regular-paced aversive smoking—account for another 39 trials. Quit rates, although quite variable, are often 30 percent or more at followup, which is considered good for cessation programs.

However, the procedure is used sparingly today for several reasons. The accelerated nicotine intake from rapid smoking requires screening and safeguards (Lichtenstein and Glasgow, 1977) and leads to the exclusion of many patients who need assistance. The method also requires close supervision either in one-to-one or in small group settings to monitor possible side effects. Concern about risks with the use of aversive methods makes many providers and consumers wary. Rapid smoking remains a reasonably powerful strategy, but it has a narrow range of application (Lichtenstein, 1982).

The second multicomponent program probably represents the best that formal cessation programs have to offer while again illustrating some inherent limitations. Over a span of 15 years, a multicomponent, nonaversive, 8-week, 15-session program was empirically developed and evaluated (Lando, 1986). (The program originally included satiation smoking—doubling or tripling at-home smoking for a specific period—a cousin of rapid smoking that provokes concerns about similar risk and screening; however, recent research indicates that nicotine fading effectively replaces satiation.) One-year abstinence rates were consistently 30 percent or better. Most importantly, the research team developed a partnership with the Iowa Lung Association, in which association volunteers were trained to deliver the program while the research team continued evaluation and monitoring. The Iowa Lung Association offered nearly 70 such clinics in 1 year (Lando et al., 1989). Thus, an empirically validated cessation clinic was given away to the public sector and disseminated at low cost statewide. However, the intensive nature of the program—15 sessions of 1 hour each—plus the need for trained volunteer leaders limit its applicability. Most smokers will not or cannot make such a behavioral commitment to any cessation clinic.

Acceptance of cessation clinics. Cessation clinics are often the initial strategy of antismoking efforts, and they are a tangible resource and an important component of any comprehensive program. It is worthwhile to encourage smokers to attend such clinics, and most cities have clinics that are underused (e.g., offered through local hospitals); however, cessation clinics are not accepted by and will not reach the great majority of smokers. There are several lines of evidence that support this assertion. (1) The great majority of ex-smokers quit or try to quit without the aid of formal programs (Fiore et al., 1990; US DHHS, 1982). (2) Data from surveys indicate that

most smokers prefer self-help or other assistance (e.g., from physicians) in preference to cessation clinics (Gallup Opinion Index, 1974; Owen and Davies, 1990; Schwartz and Dubitzky, 1967). (3) The demand for cessation clinics does not appear great, judging from anecdotal reports of various program recruitment efforts. According to one market research survey, about 1.7 million smokers, a little more than 3 percent of the smoking population, attended some kind of cessation clinic in 1988 (Pierce, 1990). Also, even if the demand increased, there would be many places, for example, rural areas and inner cities, where the supply of cessation clinics would always be inadequate. (4) Stop-smoking programs have not been nearly as successful commercially as their weight-loss counterparts. Schwartz (1987) notes that three national programs established between 1968 and 1971—Smoke Watchers, SmokEnders, and Schick—had reduced operations by 1985.

Health Care Provider Interventions

Clinical intervention through health providers offers greater potential to reach smokers. It is estimated that physicians have contact with at least 70 percent of all smokers each year (Ockene, 1987a) and that approximately 38 million of the 53 million adult smokers in the United States could be reached by physicians in the normal course of their medical care. Physicians are seen as a credible source of cessation advice (American Cancer Society, 1977). At the time of a consultation with a physician, patients are sensitized to their health and vulnerability, thus creating a teachable moment that could be used by health providers (Vogt et al., 1989). One NIH publication refers to these as "clinical opportunities" for smoking intervention and provides materials to promote physician involvement in smoking cessation (US DHHS, 1986).

These considerations have given rise to a sizeable body of literature on the effects of physician advice (see reviews by Glynn, 1988; Ockene, 1987b; Pederson, 1982). Compliance with physician advice to quit smoking has been addressed in more than 40 studies. Although the studies vary considerably in focus and methodological rigor, the evidence from randomized trials suggests that physicians who intervene with smokers have a small but measurable impact on public health. Studies of the effectiveness of physician smoking interventions indicate that advice or brief counseling alone can result in patient quit rates of 5 to 10 percent, an outcome of enormous public health significance (US DHHS, 1986). Furthermore, the data suggest that even higher cessation rates can be achieved when physician-patient contacts are more intensive and frequent and when nicotine gum is used also (Fagerstrom, 1984; Glynn, 1988; Wilson et al., 1987). As with most interventions, short-term (1- to 3-month) quit rates tend to be higher; by 1-year followup, significant relapse has occurred.

One cautionary note here is that most placebo-controlled trials indicate that nicotine gum is not effective when prescribed in routine outpatient settings (Hughes et al., 1989; Jamrozik et al., 1984; Lam et al., 1987). It is possible that instruction in the proper use of the gum (S.R. Cummings et al., 1988) has been insufficient. Nicotine gum is effective, however, if accompanied by counseling and support and if careful instructions for using the gum are given (Glynn, 1988). Nicotine replacement via transdermal patches is another promising strategy that both physicians and patients may find convenient. Preliminary data from patch trials are promising.

Surveys indicate that most physicians accept responsibility for dispensing cessation advice (Wechsler et al., 1983) and report that they do dispense such advice (Wechsler et al., 1983; Wells et al., 1986). Although some survey data reflect physicians' pessimism about their efficacy and indicate financial and organizational obstacles (Orleans et al., 1985), several studies have demonstrated that physicians can be motivated to deliver a cessation protocol, at least during the course of a study (e.g., Fagerstrom, 1984; Janz et al., 1987; Wilson et al., 1987). Whether the majority of physicians can be induced to advise or counsel smokers consistently when not motivated and monitored by a research staff remains to be demonstrated. Nevertheless, from a public health perspective, physician interventions have the potential to reach large numbers of smokers.

Importance of Clinical Interventions

Clinical cessation interventions have made substantial contributions to antismoking efforts. Although it is difficult to provide accurate quantitative estimates, cessation clinics have, over the past 25 years, helped several million smokers quit. The American Cancer Society has sponsored cessation clinics based on its own program and materials; the American Lung Association has also sponsored clinics on a more limited basis. Evaluation of these programs (Schwartz, 1987) indicates 1-year quit rates averaging about 20 to 25 percent.

Hospitals, health plans, and health departments are offering cessation programs in increasing numbers. Schwartz (1987) reported a major increase in these programs from 1980 to 1985, and the trend appears to continue. At least two standardized, commercial programs, SmokeLess and Smoke Stoppers, are now licensed to hospitals that offer the services to the community. An estimated 600,000 smokers have completed the SmokEnders program (US DHHS, 1989). Adding in the other major commercial programs, Schick and Smoke Watchers, along with the numerous private practitioners who work with smokers—psychologists, psychiatrists, and hypnotherapists—one can see the significant aggregate impact of such services. They continue to provide a resource for motivated smokers who are unable to quit without help.

Besides individual and group cessation services, clinical interventions in the context of medical care probably have a significant impact on smoking cessation. Many of the self-quitters noted in the 1982 Surgeon General's Report may have been prompted by a physician's advice or warning. National surveys indicate that most physicians accept responsibility for helping patients stop smoking and many provide advice (Ockene, 1987a), although far fewer provide tangible assistance. Survey data from both America (Ockene et al., 1990-1991) and Australia (Owen and Davies, 1990) indicate that smokers see physicians as a major resource.

Another indicator of medical provider impact on smoking cessation comes from prescription sales of nicotine-containing chewing gum. Since nicotine gum was introduced in 1984, an estimated 4 to 6 million smokers, according to one source, have received prescriptions for it (US DHHS, 1989). An industry spokesperson places the estimated number at 8 million and estimates that 95 percent of primary care physicians have prescribed nicotine polacrilex (Nicorette) (Rongey, 1990). Surveys indicate that about two-thirds of these prescriptions are patient initiated. These data also reflect the potential for health care providers to reach far more smokers than can cessation clinics. The availability of nicotine gum and other pharmacologic adjuncts that may be developed can prompt physicians and patients to engage in quitting attempts.

Because clinical interventions reach moderate numbers of smokers and because they are a resource and a source of hope for many dependent smokers, these interventions must be an integral part of any comprehensive plan. Policy and other environmental strategies may shift social norms and change attitudes toward smoking such that some people will quit (or not start) with their own resources; however, many people, especially heavy smokers, will need the assistance of some kind of clinical service. Most smokers will not require a full-service cessation clinic but could profit from advice and support (e.g., a prescription) from a health care provider, a worksite incentive program, or some measure of individual prompting and assistance.

Clinical interventions also have a subtle but important by-product. They help to develop and maintain experts on smoking behavior, who in turn may have influence on public opinion. This influence operates at both local and national levels. A comprehensive community program needs credible spokespersons, and a physician who actively advises and counsels smoking patients becomes such a resource. Similarly, leaders of cessation clinics also develop expertise and credibility as spokespersons.

There is a final contribution of the clinical approach that may be as important as the number of quitters produced. Clinical interventions have been the vehicle for developing knowledge about the process of quitting, understanding the nature of tobacco addiction, and developing useful quitting strategies. For example, cessation clinics have provided information about the effectiveness of nicotine chewing gum (e.g., Russell et al., 1983), the efficacy of combining behavioral and pharmacological strategies (Killen et al., 1990), and the usefulness of nicotine fading or brand switching (Foxx and Brown, 1979). Most of the strategies and tactics embodied in the self-help materials described below were developed in cessation clinics. As new knowledge about smoking develops and spawns new intervention technologies (e.g., nicotine patches), cessation clinics and health providers will provide settings within which they may be evaluated and refined.

SELF-HELP APPROACHES

Most of the estimated 37 million people who have stopped smoking since the Surgeon General's first report on smoking and health have done so without the aid of formal cessation programs (Fiore et al., 1990). Survey data indicate that about one-third of current smokers made a quit attempt within the last year (Harris, 1980), and they express a preference for quitting without the aid of formal cessation programs (Gallup Opinion Index, 1974; Owen and Davies, 1990; Schwartz and Dubitsky, 1967). In recent years, growing recognition of the importance of unaided quitting (US DHHS, 1982) and the relative limitations of clinic-based cessation programs in dealing with what is a public health problem (Epstein et al., 1989) have given rise to substantial literature on unaided or minimally assisted quitting.

Emerging studies suggest that unaided quitting is not a unitary concept, but rather one that requires definition (Lichtenstein and Cohen, 1990). There is no solid line separating clinical cessation from self-help efforts. It is probably more useful to construe a continuum ranging from an intensive, structured clinic to a smoker's making a New Year's resolution and quitting without any materials whatsoever. Self-help studies have reported on the effects of materials received through the mail (Jeffrey et al., 1982), community-wide quitting contests (Glasgow et al., 1985), New Year's resolution quitting (Gritz et al., 1988; Marlatt et al., 1988), persons requesting self-help manuals (K.M. Cummings et al., 1988; Davis et al., 1984), and computer-assisted self-quitting programs (Prue et al., 1990). Unaided quitting efforts have two major defining characteristics: first, the smoker initiates the self-quitting attempt on his or her own initiative or with minimal prompting from a health care provider or health educator; and second, the effort involves no face-to-face counseling or advice from a health professional.

Effectiveness of Self-Help Efforts

Not surprisingly, unaided quitting tends to result in somewhat lower quit rates than those achieved with clinical interventions, although the differences are not large. Point-prevalence quit rates at 1-year followup tend to be in the 10 to 20 percent range (Cohen et al., 1989; Davis et al., 1984; Schwartz, 1987). For continuous quitting, a less frequent but more conservative criterion is used; then, abstinence rates at 1-year followup tend to be in the range of 3 to 5 percent (Cohen et al., 1989; Davis et al., 1984). Cohen and colleagues (1989) included several samples from different areas of the United States and found no differences at 12-month followup between quitters receiving materials (self-help booklets) from the investigator and those who quit completely on their own. Although self-quitting rates are lower than those for more intensive interventions, their cost-effectiveness is probably higher since there is little or no professional time involved (Epstein et al., 1989).

Self-help materials are often used in concert with media or community programs. The media may be used to promote self-help products, as when a volunteer organization uses public service spots to encourage viewers to request a pamphlet or when proprietary companies use media to advertise products such as LifeSign or Cigarrest. The use of telephone cessation hotlines also can be increased through publicity (Ossip-Klein et al., 1984).

Community campaigns have typically made extensive use of self-help approaches. One particularly effective method is a mediated, community-wide, cessation program. Through publicity about a quitting program via television or newspapers, significant numbers of smokers can be induced to make serious quitting attempts (Cummings et al., 1987). Quitting strategies may be provided to participants also through written self-help materials, and prizes for selected quitters (via lottery) may be offered. Self-help materials can also be joined with nicotine polacrilex to increase quit rates (Fortmann et al., 1988; Killen et al., 1990). Finally, physicians prescribing nicotine gum (or pharmacists dispensing it) can provide written materials to help patients deal with the behavioral aspects of smoking.

Acceptability of Self-Quitting

Surveys have found that most smokers prefer indirect or self-help methods rather than formal cessation clinics (Gallup Opinion Index, 1974; Schwartz and Dubitsky, 1967). A recent probability sample from Australia (Owen and Davies, 1990) confirms the lack of interest in cessation groups (6.7 percent) but found considerable interest in "a program through your doctor" (23.7 percent) and "a program through [an]other health professional" (12.5 percent). Unpublished survey data from the Community Intervention Trial for Smoking Cessation

also suggest strong interest in assistance from physicians. This shift toward an interest in more direct or personalized cessation services may be an Australian phenomenon; however, it also may reflect historical changes in smokers. Today's smokers may better recognize their dependency and need for external assistance.

Nevertheless, there is a considerable consumer demand for take-home services or aids. Although no smoking cessation book has reached the nonfiction best seller lists—as is common for diet books—the public consumes millions of free brochures and pamphlets published by the Federal Government and the major voluntary organizations. One Government agency reported distributing over 2.5 million smoking-related items in 1989. It has been estimated that Government and voluntary agencies combined produce 100 *new* smoking and health items each year. The brisk market for commercial products such as Cigarrest and LifeSign also attests to the public's willingness to try promising methods in the privacy of their own homes and offices.

Importance of Self-Quitting

Several considerations make self-help materials a critical element in any comprehensive smoking intervention. Their acceptance by many smokers is a major factor; another factor is their availability, as Government agencies and major voluntary organizations have already created many useful products. For the voluntary organizations, both their mission and their self-interest dictate that they create, update, and disseminate good materials bearing their names; a shortage of good self-help materials is not likely. The great majority of these self-help materials either are free or cost very little. The problem is disseminating or deploying them effectively. A parallel motive drives the private sector; as long as there is the potential to make a profit, self-help products such as LifeSign and Cigarrest will be marketed.

Because self-help materials are acceptable to many smokers, are relatively inexpensive, and can be distributed in settings where smokers naturally are found (medical offices, worksites, stores), they have the potential to reach many more smokers than do clinical interventions. They also offer the opportunity to tailor messages to particular subgroups of smokers in a cost-effective way. Market segmentation can focus on smokers along the lifespan trajectory, such as written materials aimed specifically at adolescents, pregnant women, or mothers of newborns. Alternatively, self-help materials can be focused on various demographic groups or on smokers at different points on the readiness-to-change continuum (Prochaska et al., 1988).

Finally, the presence and publicizing of both nonprofit and proprietary self-help materials increase public awareness of the smoking problem. For example, media advertising and store displays of commercial materials (e.g., LifeSign, Cigarrest) contribute to an environment that reflects public concern about smoking and support for those trying to quit. In summary, specific self-help materials or methods are likely to have only weak effects by themselves, but in combination with media or community programs, they can reach various populations of smokers and are a critical part of any comprehensive smoking reduction program.

CONCLUSIONS

- Public information campaigns have been successful in increasing awareness of the disease risks associated with smoking and have motivated some smokers to quit; however, they do not create substantial change in the behavior of regular smokers when used as an isolated smoking control strategy.
- School-based education methods have been demonstrated to reduce the prevalence of smoking for several years among adolescents receiving the curricula. This benefit in reduced or delayed initiation of smoking has been demonstrated for programs that treat smoking in conjunction with other drug-use behavior as well as for curricula that deal with smoking alone.
- The best school-based curricula include skills training in dealing with the social environment, and programs that include parent and community involvement are more successful than those that do not.
- Formal cessation clinics have the highest rate of successful long-term cessation of any smoking control strategy, but only a limited number of smokers will participate in such programs.
- Formal cessation clinics, brief personalized interventions by health providers, and the gamut of self-help materials constitute a continuum of services aimed at the individual smoker. When properly integrated in community programs such as the Community Intervention Trial for Smoking Cessation (Pechacek, 1987), they complement one another and offer attractive options for smokers with varying needs and interests.

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Chapter 5

Approaches Directed to the Social Environment

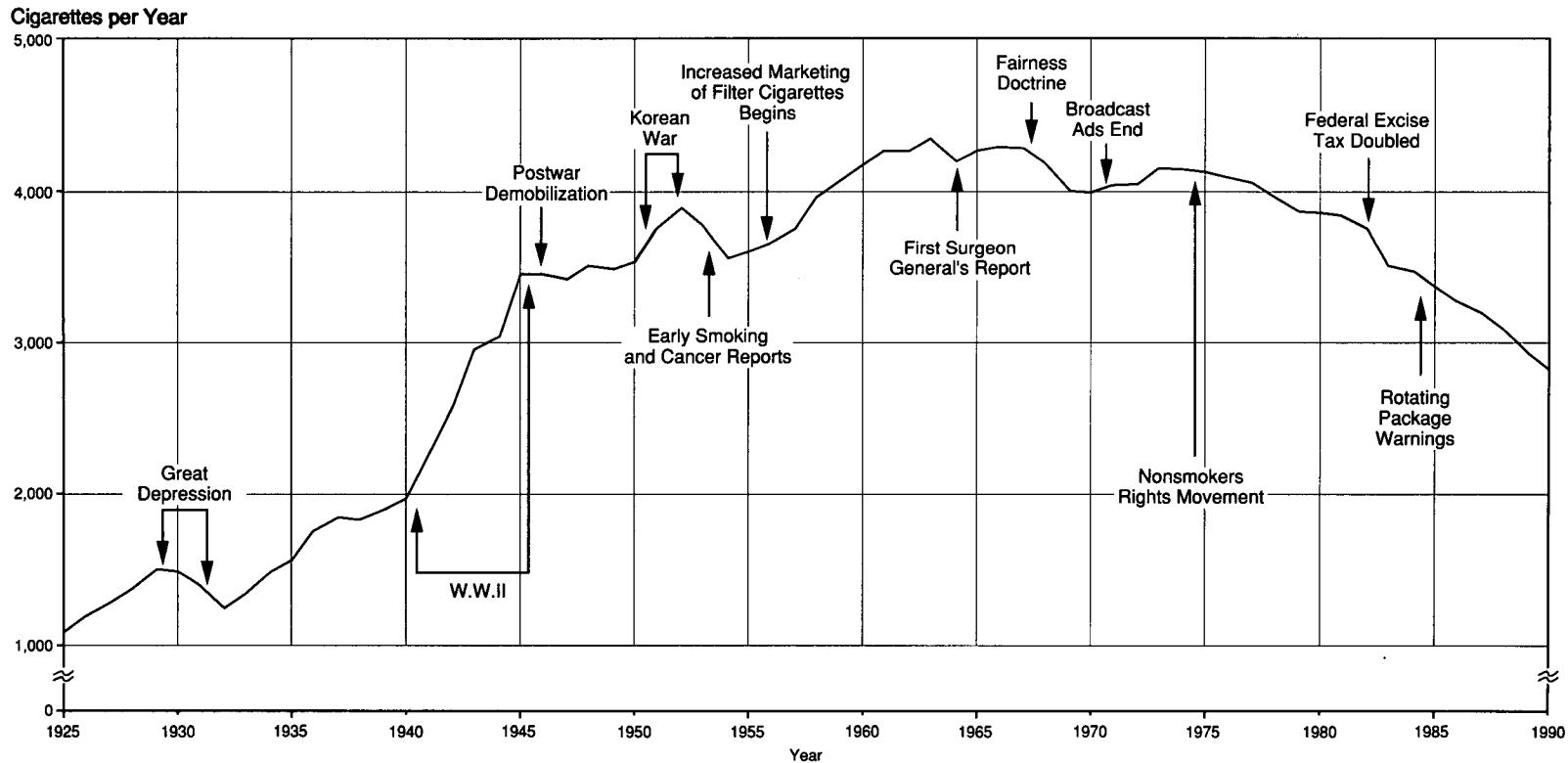
PUBLIC OPINION AND TOBACCO USE

The addictive nature of tobacco notwithstanding, tobacco use appears to be largely a socially mediated practice that is susceptible to change in the social environment. Changes in cigarette consumption in the United States seem to mirror shifts in public attitudes and opinions about smoking (Warner, 1986a). Figure 1 demonstrates a correspondence between the per capita cigarette consumption of adults and the timing of major public events related to smoking and health. Increasing consumption between 1900 and 1950 can be related to application of newly developed marketing and advertising techniques by the tobacco industry and the impact of World Wars I and II, when millions of men were introduced to cigarettes in the armed forces (Warner, 1986a; Whelan, 1984).

Most studies of seminal events that affected public awareness and knowledge about smoking, such as publication of the first Surgeon General's Report in 1964, have shown significant decreases in cigarette consumption in the year of the event (Hamilton, 1972; Warner, 1977 and 1989). Several studies have found the events to have a cumulative downward influence on demand for cigarettes. Warner, projecting from prevalence rates and trends of the mid-1960's, found that 1985 smoking rates for every age and sex cohort were significantly lower than expected, with the greatest decreases from the projected rates in the younger cohorts (Warner, 1989). He estimated that in 1985 there were 35 million fewer smokers than expected, a 38 percent decline in anticipated prevalence. Warner attributes this difference to changes in the social environment spawned by scientific and social interest in the hazards of smoking (Warner, 1986a and 1989).

As social beings, humans are subject to a desire to conform, to adopt the social conventions, customs, and norms of the majority (Wrightman, 1977). To the extent that individuals perceive their actions as deviant, there will be pressure to conform to the dominant public opinion. The history of tobacco use traced in Figure 1 can be seen in these terms, initially reflecting increasing social sanction of smoking (first by men and then by women), then growing disapproval of smoking as a practice dangerous to the smoker and, later, to others.

Figure 1
Per capita consumption of cigarettes (18 years and older), 1925 to 1990



Perception and internalization of social norms arise from a process in which the individual observes the distribution of opinion and behavior in the environment. The environment consists of both primary and secondary social networks (e.g., family, friends, and workplace) and impressions of society at large, derived largely from the mass media (Noelle-Neuman, 1974). In this light, an important function of tobacco advertising and promotion is to fill the environment with messages reinforcing the perception of smoking as a socially approved, accepted, and even desirable behavior (Davis, 1987; Tye et al., 1987; Warner, 1986a).

Efforts to control tobacco use, then, should focus on creating a social environment that provides persistent and inescapable cues to smokers to stop smoking and to nonsmokers not to start. Such an approach assumes that the best way to change individual behavior is to intervene through the social structures in a community that help shape an individual's opinions and attitudes (Warner et al., 1986).

INTERVENTION CHANNELS

The primary targets for tobacco control interventions are not individuals but the social networks that shape the attitudes of individuals (both smokers and nonsmokers) toward tobacco. For smoking control, the most relevant networks are the media, health care providers, worksites, and schools. Additional efforts to alter the environment in which the smoker smokes and the adolescent begins to smoke have been made through legislation, restriction on where smoking is allowed, restriction of access to cigarettes by adolescents, and increases in the economic costs of tobacco use. The following paragraphs review the nature of these intervention channels and provide suggestions about how each may be employed in a population-wide smoking control program.

Mass Media

The mass media play a critical role in influencing what society knows, believes, and does with respect to tobacco use (Tye et al., 1987; Warner, 1986a). In 1988, U.S. cigarette manufacturers spent \$3.27 billion on advertising and promotion (Centers for Disease Control, 1990a). Few popular models rival the "Marlboro man" for familiarity; this and other images from cigarette advertisements are seen daily by virtually every American. Moreover, the presence of tobacco advertisements reinforces the perception that "smoking must be acceptable, otherwise the Government would ban it" (Warner, 1986).

Although the tobacco industry has used them to encourage tobacco consumption, the mass media have played and will continue to play an important role in tobacco control efforts (Flay, 1987; US DHHS, 1989a; Warner, 1986a). Media coverage of the tobacco and health issue over the past quarter-century is credited with improving public awareness of

smoking's hazards, shifting attitudes about smoking, and lowering the percentage of smokers in the population (US DHHS, 1989a). However, the public's understanding of tobacco's hazards is still remarkably superficial, particularly among those segments of the population at greatest risk of smoking—the poorly educated, minorities, and teenagers (Warner, 1986a).

In a comprehensive tobacco control effort, the mass media serve a number of important functions, including (1) providing information to the public about facts and issues relating to tobacco use; (2) alerting citizens and policymakers to injurious public policies that promote tobacco use; (3) motivating people to stop or not start using tobacco; (4) recruiting smokers into treatment programs; and (5) conducting smoking cessation programs.

Those who control the media do not necessarily view any of these tasks as their responsibility. To the contrary, a substantial body of evidence indicates that, because they depend on tobacco advertising revenue, the media often evade the topic of tobacco and health (Dagnoli, 1990; Warner, 1985).

Tactics

Tobacco control activities directed at the media should seek to accomplish two goals: (1) increase the public's exposure to prohealth, antitobacco messages; and (2) limit the public's exposure to protobacco messages. The following sections briefly discuss tactics for accomplishing these goals.

Counteradvertising. Perhaps the most visible use of the mass media for tobacco control has been antitobacco campaigns sponsored by the major voluntary health organizations and Government agencies (Flay, 1987; US DHHS, 1989a; Warner, 1988 and 1989). For the most part, these campaigns have relied on donated air time and advertising space.

One of the most significant periods of antismoking advertising occurred between 1967 and 1970, when the Federal Trade Commission ruled that, under the Fairness Doctrine, television and radio broadcasters were required to donate air time to antismoking messages as a balance to cigarette commercials (O'Keefe, 1971; US DHHS, 1989b; Warner 1977, 1986a, and 1989). At their peak, antismoking messages were given about 1 minute of air time (much of it in prime time) for every 3 minutes of cigarette advertisements (Whiteside, 1971). Several studies support the conclusion that the antismoking messages aired during the Fairness Doctrine era markedly discouraged smoking (O'Keefe, 1971; Warner, 1989). Cigarette consumption declined each year during the campaign (Figure 1) and rose again after removal of cigarette advertising and the antismoking advertisements from the broadcast media in 1970.

This experience supports the idea that a public service announcement campaign can be effective in certain circumstances (Flay, 1987). After reviewing 56 evaluated antitobacco campaigns, Flay concluded that the key element in the success or failure of an antismoking campaign is its intensity. The more intensive the campaign—that is, the greater its reach, frequency, and duration—the greater the impact on behavior. The disappointing results of many health promotion campaigns delivered through the mass media can be traced directly to inadequate exposure of campaign messages (Bettinghaus, 1986; Flay, 1987; McGuire, 1984; Wallack, 1981).

Reliance on public service announcements most often results in campaign messages being seen infrequently (Flay, 1987; Wallack, 1981). In an evaluation of a 6-month anti-smoking television campaign conducted in media markets in New York and Pennsylvania, Cummings and colleagues reported that half of donated advertisements were aired between 12 midnight and 7 a.m. Airing of the same messages in purchased time significantly improved response, as measured in calls to a hotline (K.M. Cummings et al., 1989).

Several states, including Minnesota, Michigan, and California, have funded antitobacco media campaigns with revenue earmarked from cigarette excise taxes (Johnson, 1990; US DHHS, 1989a). In California, excise taxes are funding a \$28.6 million, 18-month advertisement campaign against smoking (Johnson, 1990). The campaign, launched in April 1990, includes paid advertisements in newspapers and magazines, on billboards, and in prime time on television and radio.

Public relations events. Creating events that will be of interest to large segments of the population is an effective and economical way to gain media coverage for tobacco control issues (US DHHS, 1989b). The best known national public relations event for smoking cessation is the American Cancer Society's Great American Smokeout, which has been held annually since 1977 (Flay, 1987; US DHHS, 1989a). The Smokeout is a multimedia event carried out each November throughout the United States. In most communities, it constitutes an 8-day media blitz leading up to Smokeout Day, when smokers are urged to give up cigarettes for at least 24 hours. Public awareness and participation in the Smokeout has been high for years (Flay, 1987; US DHHS, 1989a). A Gallup poll of adult smokers taken after the 1989 Smokeout showed that 85 percent of smokers were aware of the event and 10.5 percent abstained from smoking on Smokeout Day.

In 1987, the American Lung Association began sponsoring Non-Dependence Day, the 5th of July, as a way to bring attention to the problem of nicotine addiction and to offer assistance

to smokers trying to stop. National events such as the Smoke-out and Non-Dependence Day can be used to spin off media events such as television and radio cessation clinics (Flay, 1987), newspaper stories profiling former smokers (Cummings et al., 1987), and communitywide stop-smoking contests (Cummings et al., 1990; King et al., 1987; Pechacek et al., 1985).

Government agencies frequently designate specific times of the year to highlight specific prevention and disease control initiatives (e.g., high blood pressure control week). The State of New York designated the first week of January 1990 as "Tobacco Awareness Week" and granted \$5,000 to county health departments to create local tobacco control events. Those events varied across the state and included poster contests for schoolchildren, stop-smoking contests, smoking policy workshops for businesses, and training programs for health care providers. Local media coverage of events was heightened by the fact that local events were conducted as part of a statewide initiative.

Presentation of research findings is another way to gain access to the media (American Cancer Society, 1987; Davis, 1988a; US DHHS, 1989b). The media's desire for health stories is so strong that even familiar health information can be recycled or repackaged in such a way as to be of interest to media gatekeepers. The best example of such an event is the annual release of the U.S. Surgeon General's Reports on smoking and health. These reports usually contain little new scientific information, but their presentation by the Surgeon General in a high-profile news conference generates extensive media coverage (US DHHS, 1989a). Having a highly visible and credible spokesperson or group deliver the information will often generate media coverage, even when the message is familiar.

Tailoring information for local news media can be an effective way to extend the life of a national news story or create a new media event (American Cancer Society, 1987; US DHHS, 1989b). After a news release on the medical costs associated with treating smoking-related diseases in the United States, several state health departments issued cost information specific to their individual states, which resulted in a new wave of media coverage on the burden of smoking.

Advocacy. Media advocacy is the strategic use of the mass media to promote public policy initiatives (US DHHS, 1989b; Wallack, 1990). Media advocacy does not attempt to directly change individual smoking behavior but uses the media to promote public debate about the tobacco issue. It shifts attention from smoking as solely an individual problem to the role of public policy in shaping individual health choices. Media

advocacy stimulates community involvement in defining public policy initiatives that influence the social environment in which consumers make choices about tobacco use.

In contrast to a planned information campaign or public relations effort, a media advocacy campaign is more like a political campaign in which competing forces continually react to unexpected events, breaking news, and opportunities (US DHHS, 1989b; Wallack, 1990). When tons of imported Chilean fruit were banned after the discovery of a small amount of cyanide in two grapes, smoking control advocates alerted the media to the fact that there is more cyanide in one cigarette than was found in the grapes. The Chilean grapes incident was thus used as a vehicle to raise the issue of Government's failure to regulate the tobacco industry.

Specific kinds of knowledge are essential for effective media advocacy: knowing the media, knowing the relevant tobacco policy issues, and knowing how to frame an issue for public debate (US DHHS, 1989b). Tobacco control advocates need to understand how the different media work, that is, what types of stories are deemed newsworthy, how editors decide what stories get covered, and what deadlines and logistical issues might influence coverage. There are several excellent guides available that illustrate media advocacy skills specifically for tobacco control (American Cancer Society, 1987; US DHHS, 1989b).

Providing media advocacy training to interested persons is one way to encourage and enhance the use of news media for control of tobacco use. A communication network among advocates sharing information on local and national activities will promote media advocacy efforts. As noted earlier, local news coverage of smoking control issues is enhanced when local stories spin off from current issues in the national news media (American Cancer Society, 1987; US DHHS, 1989b). Newsletters and computer bulletin board systems provide ways to facilitate timely communications among national, state, and local advocates. The Smoking Control Advocacy Resource Center sponsors an electronic communications network (SCARCNET, 1990).

Regulations on Advertising

Because tobacco advertising is nearly ubiquitous, several medical and public health groups have argued that stronger regulatory actions are needed to curb the influence of pro-tobacco messages delivered through the media (American Medical Association Board of Trustees, 1986; Warner, 1986a). Currently, the Federal Government bans tobacco advertising in the broadcast media and regulates the content of tobacco advertisements by Federal Trade Commission action (US DHHS, 1989a).

A number of proposals to further restrict tobacco advertising and promotion are now under consideration by public health groups, state and local governments, and Congress (Colford, 1990; Myers et al., 1989). One such proposal would limit the imagery and graphics of tobacco advertisements to permit only "tombstone ads," with no models, slogans, scenes, or colors. Other proposals that would restrict tobacco advertising and promotion range from a total ban on all tobacco advertising, to limited restrictions, such as disallowing certain types of promotion (e.g., tobacco company sponsorship of sporting and cultural events, brand advertising in movies, and distribution of free samples).

Most of the proposed legislation to regulate tobacco advertising is designated for action at the Federal level because of laws that preempt states and localities from regulating cigarette advertising (Myers et al., 1989; US DHHS, 1989a). However, state and local communities do have jurisdiction in regulating the location of tobacco advertising when the medium is not national in scope. For example, several metropolitan areas (Denver, San Francisco Bay Area, and Amherst, Massachusetts) have prohibited tobacco advertisements on their mass transit systems (US DHHS, 1989a). In Minnesota, the state's Sports Commission banned tobacco advertising in the Hubert H. Humphrey Metrodome (US DHHS, 1989a). The City of Detroit banned tobacco advertisements on billboards (McMahon and Taylor, 1990). The City of New York passed an ordinance prohibiting tobacco advertisements on city-owned property. Numerous cities and two states (Minnesota and Utah) have passed laws prohibiting the distribution of free tobacco product samples (US DHHS, 1989a).

Health Care Providers

Tobacco control efforts directed at the health care sector should seek to accomplish the following goals: (1) establish routine counseling on tobacco as a minimum standard of practice for all health care settings (i.e., physicians' offices, hospitals, public health clinics); (2) make all health care facilities smoke-free; (3) increase the number of pharmacies and other health care facilities that will not sell tobacco products; (4) increase the number of health insurance companies that offer financial incentives that discourage tobacco use (e.g., lower premiums for nonsmokers, payment for cessation services); and (5) increase the number of health care providers actively involved in promoting tobacco control initiatives in other sectors of the community, such as in schools, through the media, and in worksites. Intervention activities to achieve these goals fall into three categories: education, economic incentives, and regulation.

Education

Antitobacco counseling efforts by health professionals appear to have great potential in encouraging patients to stop or reduce their tobacco use (Glynn et al., 1990). The strength of this approach lies in the large number of smokers who can be reached by credible sources in environments where health is a salient topic. Estimates show that if "stop smoking" messages were routinely delivered to patients by physicians, 38 million smokers could be reached and the number who stop smoking each year could be doubled. Despite the fact that most physicians believe it is their responsibility to encourage their patients to abstain from using tobacco, many fail to do so routinely with all patients (Anda et al., 1987).

A number of barriers to more active involvement in tobacco cessation counseling have been cited. Among them are insufficient time, training, and backup materials to provide effective help (Orlandi, 1987; Orleans et al., 1985). In an effort to address these barriers, several health provider groups have developed training materials and programs to assist health care providers in becoming more proficient in providing tobacco cessation assistance (Davis, 1988b). In 1989, the National Cancer Institute and the American Cancer Society initiated a national program to recruit and train physicians from around the United States who will in turn provide training in tobacco counseling to health providers on a statewide or regional basis. The establishment of a core group of health care providers who are capable of training other providers will in time result in more training opportunities and, presumably, more effective tobacco counseling by all health care providers.

Insufficient time is an important barrier that affects attendance at training programs. Too often those who voluntarily attend training programs are already predisposed and knowledgeable about counseling their patients to abstain from tobacco. To recruit other providers, some groups have advocated visiting health care offices to provide on-site training, much like the pharmacy company sales representatives who make regular visits to health care providers (Kottke et al., 1988). Such an approach has the advantage of involving the provider's office staff in training and provides the opportunity to disseminate relevant tobacco control materials (e.g., self-help guides, labels for patients' charts, list of community cessation services).

Because influential health care providers in a community are often asked to comment on the tobacco issue, providing them with training on effective use of the media is important to ensure that the prohealth message is heard (American Cancer Society, 1987; US DHHS, 1989b). The tobacco control movement has demonstrated that concerned community

leaders, in spite of limited media experience, can be effective media advocates. Experience has also demonstrated that such community-based advocacy can be greatly enhanced if tobacco control advocates are introduced to some basic lessons of media advocacy (US DHHS, 1989b). In the United States, Doctors Ought to Care, a concerned group of physicians and other health professionals, has created satirical media events to publicize the problem of tobacco use and promotion, a prominent example being its sponsorship of the Emphysema Slims tennis tournament as a counterpoint to the Philip Morris-sponsored Virginia Slims tournament (Doctors Ought to Care, 1989).

Economic Incentives

Convincing pharmacists to stop selling a profitable product like cigarettes is not easy (Richards and Blum, 1985). However, the number of tobacco-free pharmacies is increasing, and the American Pharmaceutical Association has endorsed the position that pharmacists should not sell tobacco products (US DHHS, 1989a). In Nevada, a local pharmacist made national news when he built a tobacco "bonfire" to publicize the fact that his store would no longer sell tobacco products. In Erie County, New York, the American Cancer Society urged community pharmacies to stop selling tobacco during the Great American Smokeout. In New Jersey, one advocacy group compiles and publicizes a list of tobacco-free pharmacies (New Jersey Group Against Smoking Pollution, 1988). Pharmacists have been encouraged also to be more involved in counseling their clients on ways to stop using tobacco. In 1982, the National Cancer Institute in collaboration with the American Pharmaceutical Association produced and distributed over 25,000 copies of the "Pharmacist's Helping Smokers Quit Kit" (NCI, 1982).

Regulation

Two-thirds of the states now require hospitals to restrict smoking to designated areas (Pertschuk and Shopland, 1989; US DHHS, 1989a). Minnesota was the first state to pass a law that requires all hospitals to be smoke-free.

There are many compelling reasons for health care facilities, especially hospitals, to adopt strong smoking restrictions (Knapp et al., 1986). Permitting smoking in the facility may undermine physicians' advice to stop smoking. Nonsmoking patients in the facility may be adversely affected by exposure to environmental tobacco smoke. The majority of hospital fires are caused by smoking in bed. Finally, other sectors of the community look to actions in the health care sector to model their response to the tobacco issue.

One strategy that has been used effectively to help promote the establishment of stronger smoking policies is to survey patients and staff about their attitudes about restricting

smoking (Kottke et al., 1988). Population surveys have demonstrated strong public support for tough smoking restrictions in health care facilities (US DHHS, 1989a). Getting local medical and public health organizations to endorse smoking restrictions can pressure administrators to institute stronger smoking restrictions (American Cancer Society, 1988; Knapp et al., 1986). Finally, publicly acknowledging health care facilities that have strong antismoking policies may help pressure others to adopt similar restrictions (Kottke et al., 1985). There are several comprehensive guides available that describe strategies for implementing voluntary no-smoking policies (American Hospital Association, 1988; Burtaine and Slade, 1988; Hurt et al., 1989; Knapp et al., 1986).

Licensure requirements for health care facilities could be changed to mandate that tobacco prevention and cessation services be offered. The New York State Health Department is currently considering a regulation that would require hospitals to include plans for cardiovascular disease prevention programs (including prevention of tobacco use) in their application for a "certificate of need" to build a coronary care unit. Similarly, funding for state and local health departments could be made contingent on their providing certain types of tobacco control services.

Worksites

Worksites are an important channel for tobacco control because they constitute a setting in which large numbers of smokers can be reached with programs to encourage and support cessation efforts (Fielding, 1984; US DHHS, 1985). Worksites are also an important channel for involving nonsmokers in tobacco control efforts, particularly through the promotion of no-smoking policies (American Cancer Society, 1988).

Tobacco control activities for worksites should seek to accomplish the following goals: (1) increase the number of worksites that provide tobacco control programs for their employees and (2) increase the number of worksites that adopt policies that discourage tobacco use (e.g., no smoking indoors, lower health insurance premiums for nonsmokers, hiring of nonsmokers only). Intervention activities to accomplish these goals fall into the same above-mentioned categories: education, economic incentives, and regulation.

Stimulated by both public and private initiatives, an increasing number of businesses are adopting policies that limit smoking at work. A 1987 national survey conducted by the Bureau of National Affairs found that 54 percent of the businesses responding to the survey had policies limiting smoking at work (Bureau of National Affairs, 1987). The 1986 Adult Use

of Tobacco Survey showed that 45 percent of employed adults in the survey reported having some smoking restrictions at their workplace (Centers for Disease Control, 1988).

Education

Policies limiting smoking at work have resulted in an increased demand for worksite tobacco education and cessation programs (Martin et al., 1986; Newsweek, 1988). Community organizations such as the American Lung Association, the American Heart Association, and the American Cancer Society have all developed educational programs and materials to assist worksites in providing tobacco education for their employees (LaRosa and Haines, 1986). A number of commercial stop-smoking programs have created programs and marketing strategies specifically for worksites (Newsweek, 1988; US DHHS, 1989a).

In addition to offering educational programs, some businesses offer their smoking employees incentives to stop smoking (Schwartz, 1987; US DHHS, 1985). A common type of incentive is the offer to pay part or all of the cost to attend a cessation program. General Motors absorbs 75 percent of the fee for a smoking cessation program offered to its employees (Schwartz, 1987). Some employers have offered a cash bonus to employees who abstain from smoking (Rosen and Lichtenstein, 1977). Recently, a company in Houston began charging smokers an extra \$10 a month to pay for higher health care benefit costs associated with smoking (Winslow, 1990).

A strong policy against smoking is the cornerstone of a successful workplace tobacco control effort (Emont and Cummings, in press; Fielding, 1986). The most common barrier to adopting a restrictive smoking policy is a perceived absence of employee demand (Bureau of National Affairs, 1987; Emont and Cummings, 1989). In a 1987 survey, two-thirds of companies without policies cited insufficient employee demand as the reason for not adopting a policy (Bureau of National Affairs, 1987). In addition, many employers fear a negative reaction from smoking employees, including possible legal action and grievances (Bureau of National Affairs, 1987). However, surveys of smokers and nonsmokers consistently show support for smoking restrictions at work (US DHHS, 1986 and 1989a).

Conducting workshops to educate employers about the rationale and tactics for implementing smoking restrictions is one approach to encouraging worksites to implement no-smoking policies. Publicizing surveys that demonstrate support for worksite smoking restrictions can be an effective way to make employers aware of employee demand for such policies. In the same vein, actively marketing tobacco control services to worksites, rather than just reacting to requests for such assistance, can substantially increase the number of worksites

voluntarily implementing tobacco control policies and programs for their employees.

Economic Incentives

A growing body of evidence shows that health care costs are greater for smokers than for nonsmokers (Kristein, 1983; Winslow, 1990). This information is particularly relevant to employers, because a large share of health insurance is purchased by employers as a benefit for employees. The issues related to insurance as an economic incentive are covered later in this chapter.

The courts have established that it is the employer's common law duty to provide a safe workplace. In several cases employers have been held legally and financially responsible for smoking-related illnesses and disability caused by exposure to environmental tobacco smoke at work (Myers and Arnold, 1987). As evidence about the health hazards posed by environmental tobacco smoke continues to mount, the concern about liability for allowing unrestricted smoking at work will probably stimulate more employers to institute restrictive smoking policies (US DHHS, 1986).

Regulation

Government efforts to regulate smoking restrictions for private and public worksites have increased markedly in the past decade (Pertschuk and Shopland, 1989; US DHHS, 1986 and 1989a). As of 1990, 14 states and nearly 300 cities and counties had mandated the adoption of workplace smoking policies (Pertschuk and Shopland, 1989). There has been little evaluation of the adequacy of implementation or level of compliance with smoking laws. The available evidence does not support the tobacco industry claim that smoking laws in workplaces are expensive and unenforceable (US DHHS, 1989a).

Schools

Most smokers begin using tobacco before the age of 18; only a small percentage take up smoking after age 21 (US DHHS, 1989a). Most health professionals agree that the reduction of tobacco-caused disease can best be achieved through preventing children from initiating tobacco use (American Academy of Pediatrics, 1987; American Medical Association, 1987; Blum, 1986; Colorado Department of Health, 1986; Coyle, 1988; Maine Department of Human Services, 1983; Minnesota Department of Health, 1984; Pennsylvania Plan for Tobacco or Health, 1986; Warner et al., 1986). Schools are important for tobacco control efforts also because they are significant community institutions.

School activities to control tobacco use should seek to accomplish the following two goals: (1) increase the number of schools that implement state-of-the-art tobacco prevention curricula and (2) increase the number of schools that are tobacco-free. Intervention activities to accomplish these goals

Information Dissemination

fall into two broad categories: information dissemination, which includes activities to encourage voluntary actions by schools, and regulation, which mandates that schools take specific actions. Examples of each of these intervention strategies are given below.

Since the mid-1960's, tobacco education has been a common element of school health programs. However, the nature of tobacco education efforts and their designated targets have changed over time (US DHHS, 1989a). There has been a shift away from information-oriented programs to psychosocial curricula designed not only to address youth's motivations to smoke but also to impart skills for resisting influences to smoke (Flay, 1985; US DHHS, 1989a). There has also been a shift in the target group from high school and college students to middle school and elementary schoolchildren (US DHHS, 1989a). Although evaluations of school-based tobacco prevention programs indicate that no single program can be relied on to deter adolescents' tobacco use across the board, evidence does point to certain key features of school-based programs that have been consistently associated with positive preventive effects. These include multiple sessions over many grades; information about the social consequences and short-term physiological effects of tobacco use; information about social influences on tobacco use, especially peer, parent, and media influences; and training in refusal skills (Glynn, 1989).

The extent to which state-of-the-art curricula for prevention of tobacco use have been adopted and are used by schools has not been systematically documented, although anecdotal evidence suggests that few school systems provide truly substantial curricula (Best et al., 1988; Cleary et al., 1988; US DHHS, 1989a). Barriers to widespread adoption of tobacco prevention programs within schools include demands on teacher time, cost of materials for specific programs and teacher training, and competing educational and health priorities (Best et al., 1988; Cleary et al., 1988). Packaging program materials so that they are easy for teachers to use will facilitate their adoption. Recruiting and training influential representatives from school systems to serve as local smoking control resources will help ensure that teachers stay current with program materials and will develop advocates for tobacco prevention within school systems (Glynn, 1989).

School-based no-smoking policies are important because the school environment should be free of tobacco smoke, and teachers and school staff are influential role models for children. Evidence suggests that the rules about smoking at school influence the efficacy of tobacco prevention programs. Tobacco education programs implemented in schools that

prohibit smoking appear to be more effective than identical programs in schools with less restrictive policies (Best et al., 1988).

Conducting workshops to educate school administrators and board members about the rationale and tactics for implementing no-smoking policies is one approach to encourage schools to implement such policies. Conducting and publicizing surveys that demonstrate support for tobacco-free schools can be used to pressure school boards to consider implementing stronger tobacco use policies (National School Boards Association, 1987).

Regulation

School education about the health consequences of tobacco use is mandated by law in 20 states (US DHHS, 1989a). Several states also require teacher training about the effects of tobacco use. In Connecticut, to be certified to teach in public school, a person must pass an exam on the effects of nicotine and tobacco use (US DHHS, 1989a).

Little is known about the level of compliance with state regulations. As noted previously, the nature and scope of tobacco education efforts appear to vary widely across school districts. Regulatory actions that fail to stipulate the nature and scope of tobacco curricula will likely be ineffective. Moreover, standards should be established to guide implementation and evaluation of curricula. Standards should address the curricula that should be used, teacher training, and minimum number of hours devoted to tobacco education at each grade level.

By 1990, 15 states had prohibited smoking by secondary school students, and another 17 states had laws that restrict students' smoking to designated areas (US DHHS, 1989a). Most secondary schools have written policies that prohibit or restrict smoking by students (National School Boards Association, 1987; US DHHS, 1989a). Smoking by school faculty and staff members is generally permitted, but only in areas away from students. Three states, New Jersey, Wisconsin, and Utah, have passed laws that prohibit smoking by anyone on school property. Although most schools have policies regulating smoking, fewer than 5 percent are totally smoke-free (National School Boards Association, 1987). An important barrier to adoption of a tobacco-free policy is concern about opposition from the teacher's union. Union contracts often negotiate smoking areas for teachers, even though the vast majority of teachers do not smoke. Thus, legislation that mandates schools to be tobacco-free is probably necessary. In general, public support is greater for laws restricting smoking in schools than for other locations such as private worksites and restaurants (US DHHS, 1989a). If additional evidence can be produced to demonstrate

a link between school smoking policies and smoking initiation, it is probable that measures to prohibit tobacco use on school grounds will become more common.

Table 1 summarizes the tobacco control activities discussed in this section and identifies groups and organizations that may assume responsibility for each. These interventions may have a greater synergistic effect when combined, compared to the sum of individual effects. The key to a community-based approach lies in assuring that the intervention is broad-based and permeates the social networks.

COMMUNITY MOBILIZATION

Although national and statewide initiatives are critical components of a comprehensive smoking control plan, many of the most effective interventions will be individually applied in thousands of cities and towns across the United States. To achieve behavior change in a community, the target population must be involved in identifying the problem, planning and undertaking steps to correct the problem, and creating structures in the community that assure the change is maintained. An underlying assumption is that the community must be empowered to control the intervention and must accept "ownership" of it. This approach has been tested in several community health promotion initiatives, including the Stanford Five-City Project (Farquhar, 1978; Farquhar et al., 1985), the Minnesota Heart Health Program (Blackburn and Pechacek, 1984), and COMMIT—the Community Intervention Trial for Smoking Cessation (Pechacek, 1987). There are two practical ways to implement tobacco control interventions that provide community ownership. These may be described as "social action" and "locality development" (Rothman, 1979).

Social action implies grassroots organizing of disadvantaged and disaffected groups who demand change in the social structure. An excellent example of social action in the tobacco control field is in the formation of local groups (e.g., Group Against Smoking Pollution) to lobby for restrictions on public smoking. Such groups often can be strong advocates for rapid change. The strength of the social action approach is also its weakness: because they are confrontational, grassroots groups provoke conflict and may sometimes inhibit the adoption of consensus.

Locality development maximizes local participation in the intervention by including more than only the most committed groups in the change process. Essentially everyone is invited to join in identifying and solving the problem. An important advantage of this approach is that it expedites participation by established community organizations and increases participation by community leaders.

**Table 1
Examples of tobacco control activities, by channel and group responsible for performance**

Channel	Tobacco Control Activities	Groups Responsible*
Media	<ul style="list-style-type: none">• Sponsor antitobacco informational campaigns• Sponsor smokeout days and/or communitywide cessation events (e.g., TV clinics, contests)• Advertise cessation services• Hold press conferences to release relevant tobacco research findings to the media• Create events to dramatize the problem of tobacco use in the community (e.g., satirize tobacco promotions)• Conduct and publicize surveys to document support for tobacco control policies• Conduct advocacy training for community leaders• Establish a communications network among tobacco control advocates• Lobby politicians to earmark government funds for counter-advertising and to regulate tobacco ads and promotions	A, B, C, D A, B, D, G A, B, C, D A, B, C, D, E, H B, C, G, H A, B, C, D, E, G, H B, H A, B, H All groups
Health Care Sector	<ul style="list-style-type: none">• Disseminate materials to assist health care providers in counseling patients who smoke• Sponsor seminars to train health care providers on ways to counsel patients to stop smoking• Recruit and train influential health care providers in media advocacy• Sponsor a program to encourage community pharmacies to become tobacco-free• Conduct surveys of patients, staff, and visitors to document support for tobacco-free health care facilities• Sponsor seminars to promote tobacco-free health care facilities• Include tobacco education in medical/health professional school curricula• Reimburse providers for treating tobacco addiction• Gather data to support health insurance premium discounts for nonsmokers• Lobby politicians to mandate smoke-free health care facilities; mandate insurance coverage for cessation services, and premium discounts for nonsmokers; and mandate performance of tobacco control services by health departments, hospitals, and other health care facilities	A, B, C, D A, B, C, D, E B, C, H B, C, E, H A, B, C, D, E, H B, C, D, E C, E I A, C, E, I All groups

Table 1 (*continued*)

Channel	Tobacco Control Activities	Groups Responsible*
Worksite	<ul style="list-style-type: none"> • Disseminate information to support establishment of smoke-free workplace • Sponsor seminars to promote no-smoking policies in the workplace • Conduct surveys of employees to document support for no-smoking policies and cessation services • Gather data to support health insurance coverage of tobacco cessation services • Gather data to support health insurance premium discounts for nonsmokers • Lobby politicians to mandate smoking restrictions in worksites • Lobby politicians to mandate insurance coverage for cessation services and premium discounts for nonsmokers and to provide tax incentives to worksites that offer cessation assistance to their employees • Support employee litigation against employers who fail to implement meaningful smoking policies 	A, B, C, H, I, J A, B, C, H, I, J A, B, E, H, I, J A, E, I, J A, E, I, J All groups All groups B, C, H, I
Schools	<ul style="list-style-type: none"> • Disseminate state-of-the-art curricula to schools • Sponsor workshops to train teachers to implement tobacco education curricula • Make presentations on tobacco-free schools to school boards, PTAs • Conduct student surveys to document the need for tobacco education • Conduct surveys of students, faculty, and school staff to document support for tobacco-free schools • Mandate that all teachers receive tobacco education training • Lobby politicians to mandate tobacco-free schools 	A, B, E A, B, E, F B, C, H A, B, F A, B, F A, B, E All groups

* Key

- A Government health agencies
- B Health voluntaries
- C Health professional associations (e.g., medical societies)
- D Hospitals and other health care facilities
- E Universities, including medical schools
- F Elementary/secondary schools
- G Community organizations (e.g., youth groups, service clubs)
- H Activist groups (e.g., Group Against Smoking Pollution, Doctors Ought to Care)
- I Insurance industry
- J Business organizations (e.g., Chamber of Commerce)

Coalition building is a form of locality development. Coalitions encourage local organizations and groups to adopt tobacco control as their own project. Networking among coalition members fosters sharing of resources and reduces conflict. It lends instant credibility to the program because it involves recognized community leaders and tends to isolate opponents.

Involving organizations encourages them to divert their resources to tobacco control, in itself a change in norms. Because community organizations network with each other, this change diffuses throughout the community and affects the membership of every organization. Seen from a systems perspective, change in organizations leads to change in the entire community.

The role of the tobacco control interventionist in a locality development approach is to catalyze and coordinate action by the wide cross-section of organizations and individuals recruited to the effort. Under a broad, communitywide strategy, small task-oriented groups within the coalition pursue specific, manageable goals. Maintaining communication among organizations and promptly resolving disputes is an important function of leadership, and a democratic structure of coalition governance is critical to building a true sense of ownership by all the members.

There are four major steps in the coalition-building process: community analysis, planning, implementation, and maintenance. Each is critical to the development of a lasting tobacco control intervention that will permanently change community structures and norms.

Community Analysis

Community analysis provides an accurate, in-depth understanding of the community's needs, resources, social structures, and values. At the same time, it provides an opportunity to begin involving the community in the problem-solving process.

The first task is to define the community geographically. A community may be as small as a neighborhood or as large as a major metropolitan area. The important factors in defining a community are interdependence among important social groups and a sense of shared values and norms that lead to individual identification with the community. Because of the importance of major media in determining such identity and in changing norms, consideration should be given to defining the scope of the community as widely as the area of dominant influence of the local broadcast and daily print media. In any case, such a definition should be undertaken in consultation with the leadership of important community sectors, including health, education, business, labor, and government.

Once the community is defined, the next step is to identify the community resources and structures that are potentially available to focus on the tobacco control effort. A large body of quantitative and interpretive data is collected from both secondary sources (e.g., census data, economic reports, histories) and primary sources (leaders and members of the various community sectors). Information should be gathered on the demographic makeup of the population, smoking patterns, and the levels of illness and disability in the community. It should assess the economic structure and well-being of the community, identify business leaders, and tabulate major employers. Political activity and the level of citizen participation should be appraised.

The analysts should carefully assess the level of health promotion and treatment programs available. What resources and skills already exist, and what is the level of service being provided? How ready are providers to join in a tobacco control effort?

The important public and private educational systems should be identified, and the content of the health curriculum appraised. In addition, an effort should be made to identify important social, fraternal, and community improvement organizations and to characterize their memberships. Important religious denominations and major and minor media outlets also must be identified and analyzed. A calendar of major community events should be compiled.

The community leadership structure, because it is likely to affect the intervention, is as important as a list of community resources. What organizations and groups are currently involved in tobacco control? Who are the groups and individuals likely to help or hinder the project? Who are the important leaders who could make a significant contribution? What are competing community priorities, and who are their advocates? How do people want to participate?

This information should be gathered in interviews with community leaders, beginning with those most likely to be interested in the intervention, such as the leadership of major volunteer health organizations and those in charge of health promotion at the local health department and hospitals. From these interviews, influential community leaders will be identified. These leaders in turn should be interviewed to identify additional community leaders and important organizations. This process should be pursued as long as profitable.

The point of the analytic exercise is to determine how the community makes decisions and to begin involving the community in the task of solving the tobacco problem. At the end of the process, the analysts should be able to determine the

community's readiness for change. Are the various elements of the community able to work together to identify and solve common problems? Can they achieve consensus on goals and priorities? Who are the key players who must be part of that consensus? Is there a history of collaboration to build on or must trust-building and conflict resolution be an early component of the tobacco control intervention? To what extent is tobacco control a community priority?

Planning

At this point the process of planning the intervention begins. A small group of influential individuals willing to commit the time and energy needed to plan and begin implementing the project should be selected. An important consideration in choosing members for this initial group is that major stakeholders be included, that is, those with a preexisting commitment to tobacco control. In many communities this will include representatives of the major voluntary health agencies and other health promotion organizations. Other important community sectors, such as education and business, should be represented if possible.

This planning group will determine the structure and initial membership of the coalition and will begin recruiting members. It will set overall goals for the program and will determine staffing structure, office location, and similar needs. If resources are available to pay a staff, the program director should be hired at this point, and the planning group should have a significant role in writing the job description and screening candidates. Staff support is vital to the success of the intervention. If funds are not available to pay for a staff, individuals employed by health agencies may be reassigned from current activities. In either case, clear role definitions are important.

Implementation

The program director should be someone familiar with the target community (preferably a member of it) and should be acquainted with local resources, values, and decision-making processes. The most important skill is the ability to "network," preferably on a communitywide level.

The coalition should be as broad as possible and divided into task forces according to members' interests. Obvious choices for task forces would be media, public policy, health care, worksites, youth and education, and cessation services, though there may be others. A scheme for coalition governance should be devised early. Some type of board or executive group is needed to make important management decisions, but care should be taken to ensure that interventions are planned and implemented by the task forces. An important board function may be allocating resources among the task forces, so it is important that the board be responsive to the coalition's membership, possibly through election to fixed terms.

Training and education of board and task force members are important and continuing aspects of the community mobilization process. Most members will not be experts in tobacco control and may approach the problem with strategies that are ineffective or incomplete. They will benefit from further education on the smoking problem, nationally and as it exists in their community, and they should be exposed to strategies established as effective in previous interventions. Many will bring important skills to the program that can be enhanced by training in other areas, but some will benefit from learning new skills. For example, physicians trained in media advocacy can be a powerful addition to the project's efforts.

A strategic tobacco control plan presents the coalition's overall goals and a series of specific objectives toward meeting those goals. It is important both in guiding rational, sequential implementation of the intervention and as a tool for mobilizing the community to recognize tobacco use as an important public health problem. The plan should be a product of the task forces, which will set priorities, identify resources, and plan activities. In developing the plan, the community begins to assume ownership of the project.

Above all, the tobacco control plan should represent a comprehensive, communitywide approach employing multiple, integrated interventions. Coordination among task forces and intervention activities is vital and is the primary responsibility of the program staff. Rather than providing interventions themselves, the staff will identify others in the community to undertake the intervention activities and to coordinate those efforts. A number of state and local tobacco control plans have been produced and are available for guidance (Colorado Department of Health 1986; Coye, 1988; Minnesota Department of Health, 1984).

Maintenance

Maintenance of the intervention is necessary to its success. Smoking will not disappear from a community in months or in a few years, and changes in community norms will probably occur over the course of a generation. Any outside financial support for a community intervention will be restricted in amount and duration. More fundamentally, ownership of the intervention will not be complete until the community redirects its resources to smoking control. This action will, in itself, constitute a significant normative change.

Planning for transfer to the community should be an integral part of the intervention. Activities should be structured to elicit the greatest possible participation from community organizations and structures. The strategic use of seed money grants and contracts can build a constituency for tobacco control within organizations and ensure a continuing interest in addressing the problem.

In addition to broadening the group of stakeholders who believe in the importance of tobacco control and have actively worked at it, this approach gives individuals and organizations the experience of successfully implementing programs they might otherwise not have attempted. Selecting low-cost activities, or at least demonstrably cost-effective activities, will increase the sense of self-sufficiency.

Only by letting the members of the community implement the tobacco control program can it continue after outside funding is exhausted. Staff members must not become service providers. Rather, they are facilitators, coordinators, and trainers. It is recognized that the community will make mistakes, but it will learn from these mistakes and, given time, will institutionalize an effective tobacco control program.

RESTRICTIVE LEGISLATION

Restrictions on smoking for fire and safety reasons have existed for much of this century, but restrictions based on health and annoyance have been implemented largely over the last two decades (US DHHS, 1986). The major motivations for this new wave of restrictions have been the irritation and annoyance of the nonsmoker caused by environmental tobacco smoke and the evolving understanding of the disease risks associated with exposure to environmental tobacco smoke. Now these motivations are blending to produce a social climate in which cigarette smoking is increasingly unacceptable.

Much of the credit for changes in the social acceptability of smoking has focused on recent events such as the call for a smoke-free society by the year 2000 as well as reports on the scientific evidence by the Surgeon General (US DHHS, 1986), the National Academy of Sciences (1986), and most recently the U.S. Environmental Protection Agency (in press). However, this kind of social shift occurs slowly, gathering momentum with time. The understanding of the risks associated with environmental tobacco smoke began in 1970 when the Surgeon General at that time, Jesse L. Steinfeld, M.D., recognized the clear biological plausibility of a significant public health risk from environmental tobacco smoke. Addressing the National Interagency Council on Smoking and Health, he stated, "Evidence is accumulating that the nonsmoker may have untoward effects from the pollution his smoking neighbor forces upon him." Dr. Steinfeld called for a bill of rights for the nonsmoker (Steinfeld, 1972), and he directed the National Clearinghouse for Smoking and Health to conduct a complete assessment of scientific evidence on the topic for inclusion in the next Surgeon General's Report (US DHEW, 1972).

Those documented concerns, coupled with nonsmokers' annoyance at being exposed to tobacco smoke, ignited the nonsmokers' rights movement. By the mid-1970's, the change in social acceptability of smoking was well under way and has been credited with the downturn in per capita cigarette consumption that began in 1974 (Warner, 1981).

Federal Actions

Federal Government efforts to restrict smoking have not been as extensive as those of state and local governments. Outside the tobacco belt, state and local governments are less subject to lobbying efforts by the tobacco industry and therefore have passed more laws restricting smoking.

The only area in which Congress has acted to restrict smoking has been aboard commercial airline flights. Until recently, most of the regulation of smoking on airlines was the responsibility of the Civil Aeronautics Board (CAB). In 1971, the CAB mandated that all commercial airline flights provide nonsmoking sections large enough to accommodate every passenger who desired to sit in them, and in 1983 it issued new regulations that banned smoking on flights of 2 hours or less. However, within hours of its announcement, the ban was reversed at the insistence of lobbyists and powerful members of Congress (Walsh and Gordon, 1986).

Nevertheless, public pressure for a smoking ban continued to mount, and as a result, Congress passed legislation in 1987 doing exactly what the CAB had tried to do in 1983—ban smoking on all commercial airline flights of 2 hours or less. This included about 80 percent of all flights within the continental United States (US DHHS, 1989a). In spite of concerns to the contrary, the airlines have found the law to be an easy one to enforce. Flight crews found it necessary to initiate enforcement actions against only 1 out of approximately every 4 million airline passengers in 1988 (Hensley, 1989).

In 1989, Congress again considered the issue of smoking on commercial air flights because the law dictating the 2-hour smoking ban was about to expire. The Senate wanted a total ban on all flights, whereas the House voted only to continue the 2-hour ban. A compromise was reached, whereby the ban on smoking was increased to 6 hours, effectively eliminating smoking on all flights except those to Alaska, Hawaii, and foreign locales, as well as on charter flights (Phillips, 1990).

Most other Federal action regulating smoking has been by agencies restricting smoking at Government worksites. The General Services Administration, which is responsible for one-third of all Federal buildings, prohibits smoking except in designated areas. The Department of Health and Human Services completely bans all smoking in its buildings. In 1986,

the Department of Defense established a new policy to curtail smoking among Armed Forces personnel. As part of the policy, smoking is permitted only in designated areas (US DHHS, 1989a).

State Legislation

In 1973, Arizona became the first state to restrict smoking in a number of public places because environmental tobacco smoke is a public health hazard. This was done in response to the 1972 Surgeon General's Report, which for the first time identified involuntary smoking as a health risk. The passage of the Arizona law marked a shift in the content of laws regulating smoking. Instead of restricting smoking because it is a fire hazard, likely to contaminate food, or morally wrong, legislatures started restricting smoking because it endangers the health of nonsmokers (US DHHS, 1989a).

Throughout the 1970's, the regulation of smoking in public places became a major issue for state legislatures. In 1974, Connecticut became the first state to pass a law restricting smoking in restaurants, and in 1975, Minnesota passed its Clean Indoor Air Act. This was the first law to use the approach that smoking would be prohibited everywhere except where specifically permitted, thereby making nonsmoking the norm. It was also the first law to extend smoking restrictions to worksites, both public and private. Continuing until today, this law has served as a model for other state legislatures seeking to pass comprehensive smoking legislation (US DHHS, 1989a; Kahn, 1983).

The growth of state smoking legislation was rapid throughout the 1970's and 1980's. Two years that particularly stand out are 1975, in which 13 states enacted smoking laws, and 1987, in which a record 20 states passed such laws. The flurry of activity in 1987 reflected the 1986 publication of reports from the Surgeon General and the National Academy of Sciences, both of which documented the health risks of involuntary smoking (Rigotti, 1989; US DHHS, 1989a). As of August 1, 1990, 45 states and the District of Columbia had passed laws restricting smoking in public places in some manner (Tobacco-Free America, 1990).

The laws that were passed were also more restrictive. Previously, laws restricted smoking only in public places such as elevators or buses, but the new laws began increasingly to regulate smoking in restaurants and private worksites (Rigotti, 1989; US DHHS, 1989a; Warner, 1981). As of August 1, 1990, 27 states regulated smoking in restaurants and 18 states restricted smoking at private worksites (Tobacco-Free America, 1990).

The restrictiveness of state smoking laws varies in different regions of the country. In particular, southern states have fewer smoking laws, and they are less comprehensive. Of the five states that have no laws whatsoever to restrict smoking in public places, two—Tennessee and North Carolina—are major tobacco producers (Rigotti, 1989; Tobacco-Free America, 1990; US DHHS, 1989a).

No-smoking laws passed by the states are generally implemented by the state health departments with minimal burden (US DHHS, 1989a). For example, for the 3 years after the passage of the Minnesota Clean Indoor Air Act, the cost to the Minnesota Department of Health was only about \$4,600 per year (Kahn, 1983).

Local Legislation

During the 1980's, efforts to control cigarette use spread to the local level—towns, cities, and counties (US DHHS, 1989a). During the period between 1986 and 1990, a more than fourfold increase occurred in the number of communities with smoking ordinances, from 89 in 1986 (US DHHS, 1989a) to 468 in 1990 (Tobacco-Free America, 1990).

Although state smoking laws are generally called clean indoor air acts, smoking laws at the local level are usually referred to as smoking ordinances (Pertschuk and Shopland, 1989). With few exceptions, these local ordinances are stronger and more comprehensive than corresponding state laws and are often enacted because of difficulties in passing stronger state laws (Rigotti, 1989). A legislative response by the tobacco industry has been to promote state legislation that preempts the right of local communities to pass laws restricting tobacco use. As a result, seven states have passed laws preventing the passage of more stringent ordinances at the local level. In Florida, the law not only prevents the passage of future local smoking ordinances but also preempts all existing ones (Tobacco-Free America, 1990).

The most complete records on local smoking ordinances have been kept for California, which has been a leader in the passage of these laws. The first were passed in 1979, and in 1982, San Diego became the first large California city to enact an ordinance regulating smoking in the workplace (US DHHS, 1989a). In 1983, the San Francisco Board of Supervisors passed an ordinance regulating smoking in private worksites, which later was brought before the voters in the form of a proposition. In spite of heavy opposition from tobacco interests, it passed, and the publicity generated by the campaign stimulated other communities around the country to pass similar ordinances (Martin and Silverman, 1986).

Laws restricting smoking are often called "self-enforcing" because few complaints of violations are filed, and so it is

assumed that most people are obeying the law (Rigotti, 1989). In San Francisco, only 1 out of approximately 60 Department of Public Health inspectors was assigned to enforce that city's Smoking Pollution Control Ordinance. The percentage of time he spent doing that job declined during the first year until, during the last 4 months, only 21 percent of his time was spent on the program. No additional funds were needed to enforce the law (Martin and Silverman, 1986). Similarly, New York's Health Department reported receiving only a few complaints after that the city's no-smoking law restricted smoking in restaurants (US DHHS, 1989a).

An effort to actively measure compliance with laws restricting smoking, rather than just counting the number of complaints received by a health department, was made in Cambridge, Massachusetts. Researchers asked city residents whether they had recently noticed smoking in places where it was not permitted 3 months after the passage of a city smoking ordinance. One-third, it turned out, had noticed illegal smoking. Asked what their response was, most people said that they had ignored the violation (US DHHS, 1989a).

Public Opinion

Rigotti (1989) makes the point that public support for smoking restrictions was present long before either the passage of no-smoking laws or the publication of most of the evidence that passive smoke could be damaging to one's health. As early as 1964, most nonsmokers felt that smoking should be allowed in fewer places, and by 1975, a majority of both nonsmokers and smokers felt that way. In 1987, a Gallup poll found, for the first time, that a majority of all adults (55 percent) favored a complete ban on smoking in all public places (US DHHS, 1989a).

Effects of Restrictions On Smoking Prevalence

In 1982, the government of Hong Kong began making a concerted effort to reduce smoking in that city. Smoking was restricted in public places, a fourfold increase in the duty paid on tobacco was instituted, public health education was increased, and an antismoking publicity campaign launched. As a result, 16 percent of the population quit smoking between 1982 and 1984, and the number of regular smokers between the ages of 15 and 19 was cut in half. When ex-smokers were asked in surveys which factors were influential in causing them to quit, respondents identified two main ones—cost and health concerns (Mackay and Barnes, 1986).

A similar effort to decrease smoking was instituted by the U.S. Department of Defense starting in 1986. Between 1985 and 1987, smoking prevalence decreased in all branches of the Armed Forces, particularly in the Army, which was the branch most active in getting its personnel to eliminate smoking (Hagey, 1989; Rigotti, 1989; US DHHS, 1989a).

Data collected by the Wisconsin Department of Health and Social Services show the effects of the antismoking campaign in that state. Per capita sales of cigarettes in Wisconsin started dropping off sharply from a peak in 1981. Coincident with this dropoff were two cigarette tax increases, one state and one Federal, and the 1983 passage of Wisconsin's Clean Indoor Air Act (Centers for Disease Control, 1989).

Employee Attitudes

Worksite smoking restrictions are gaining acceptance among workers, including smokers (Becker et al., 1989; Biener et al., 1989a; Sorensen and Pechacek, 1989). Sorensen and Pechacek found support for no-smoking policies among smokers who were interested in quitting, those who were concerned about the health effects of smoking, those who indicated a high level of support from coworkers for previous quit attempts, and those who had a high number of nonsmoking coworkers. This may help to allay the fears of employers who believe that smoking restrictions will lead to dissension or low morale among employees. In most situations, smoking restrictions can be implemented without significant conflict.

A study that included a survey of smokers outside office buildings in Pasadena showed similar support from smokers for smoking restrictions. Pasadena citywide smoking regulations require restrictions in all indoor places, including worksites. In the study by Sussman et al. (in press), a majority of smokers interviewed thought it was important to stop smoking and had positive feelings about the nonsmokers' rights movement. In addition, about three-quarters of the smokers had made at least one quit attempt, with those subject to no-smoking policy reportedly putting more effort into quitting smoking. The researchers caution that "little is known about attitude-behavior relationships and smoking policy effects" (Sussman et al., in press).

Impact of Worksite Restrictions

Millar (1988), in a government work setting, found a continuous quit rate of 3.5 percent at 1 year after smoking restrictions went into effect. Two hundred registrants for a smoking cessation course were surveyed at 6 weeks, 6 months, and 1 year after smoking restrictions began. The overall smoking prevalence in the year after restrictions declined from 29 to 24 percent.

A recent study analyzed the impact of a strict smoking policy at the Texas Department of Human Services (Gottlieb et al., 1990). The policy limited smoking to break rooms or lounges and cafeteria smoking sections. Regional administrators were given the authority to declare a worksite smoke-free if no appropriate room was available, and smoking was banned outright in 4 of the 12 regions. Again, most of the departments studied had some restrictive policy in effect prior to implementation of the new policy and before the study began.

The Texas study showed that the reduction in smoking prevalence at 6 months after policy implementation was greater in the work areas with smoking bans than in those with smoking restrictions. Consumption of cigarettes at work decreased in work areas with both types of policies. However, the authors concluded that although daily consumption of cigarettes at work decreased significantly, "no significant change was detected in smoking prevalence."

The authors of the Texas study summed up in this way: the "failure to find changes in smoking rates may also have been due to an insufficient follow-up period. Quitting smoking has been conceptualized as a process of change, with smokers moving through the stages of precontemplation, contemplation, action, and maintenance. It is possible that the smokers had increased their readiness to quit but not yet taken action" (Gottlieb et al., 1990).

Impact of Smoking Bans

The Australian Public Service used a sample of 2,113 employees who were surveyed 2 to 4 weeks before a complete workplace smoking ban was implemented and again 5 to 6 months later (Borland et al., 1990). Fifty-seven employees who were smoking at the time of the initial survey were not smoking at the time of the followup surveys. However, 36 previous nonsmokers reported starting smoking; it was not noted whether the 36 were relapsing ex-smokers or new smokers. Including the 36 employees who took up smoking brought the reduction findings to a 1 percent reduction in prevalence over the 6-month period, which was not considered significant by the study authors. However, because it is unlikely that these employees took up smoking as a result of the workplace smoking ban, including them in the equation reduced the drop of prevalence that might have been found.

An additional indicator that the reported drop in prevalence might be low is that the work settings in which this study was conducted had various levels of restrictions on smoking prior to the mandated ban. It is therefore possible that some smokers had already quit as a result of a smoking control policy prior to the ban and that this reduction in prevalence was not captured in the study.

The study reached its conclusions on smoking prevalence by conducting pre- and postpolicy surveys on workplace smoking consumption. The smokers were asked to estimate the number of cigarettes they usually smoked on both workdays and nonworkdays and to recall the number of cigarettes they smoked in the previous 24 hours, divided into seven time periods. The study showed that moderate and heavy smokers

had fewer cigarettes during the day, with the greatest change among heavy smokers. Small increases in smoking rates outside the work environment did not compensate for the enforced reduction at work.

In a more recent study at the Johns Hopkins University, however, a significant reduction in smoking prevalence was found to result from implementation of a total ban on smoking (Stillman et al., 1990). As of July 1, 1988, smoking was banned in all areas of the Johns Hopkins Hospital complex involving 24 buildings in an area covering 12 square blocks. The previous policy had allowed smoking in designated areas of cafeterias, waiting areas, and lounges. The new policy was announced on January 1, 1988, and the announcement was followed by an extensive internal media campaign. A health-oriented campaign that emphasized the effects of passive smoking and included free screening for exhaled carbon monoxide was launched. Educational programs to ensure policy enforcement were offered to the staff, and four smoking cessation options were offered free to all employees. In addition to these efforts, discreet observations of visitor and employee smoking were performed monthly beginning 8 months prior to the ban and at 1 month and 6 months after the ban started.

The initial survey of 8,742 full- and part-time employees was distributed 6 months prior to the ban, thereby allowing for inclusion of smokers who ceased in anticipation of the ban. One year after the initial survey and 6 months after the ban, respondents who were still actively employed (4,480) were mailed a followup survey. A significant decrease in employee smoking prevalence was found (21.7 percent before the ban to 16.2 percent after the ban).

Effect on Continuing Smokers

There is no consensus whether smoking restrictions encourage smokers to quit or the extent to which restrictions alter behavior. Some researchers have suggested that, over time, smokers may adapt smoking behavior to smoking restrictions, rather than using the restrictions as an incentive to quit (Biener et al., 1989b). Others suggest that worksite no-smoking policies encourage smokers to put more effort into quitting (Sussman et al., in press). Although restricting the areas in which smoking may occur might reduce the cues that encourage smoking, it is also suggested that the smoking area itself could become a cue to smoke (Glasgow, 1989). Additional research may provide more insight about this area.

Elements Needed For Worksite Restrictions

A number of investigators have made suggestions for the important elements to successfully introduce worksite smoking restrictions and make them as effective as possible. Announcing the restriction or ban well in advance is essential. This will

allow time for smokers to prepare for quitting or to make adjustments. Rosenstock and colleagues (1986) recommended introducing new policies gradually, offering smokers an opportunity to express their dissatisfaction, and making clear the limitations of employee influence over the new policy. Millar (1988) suggested that, in designated smoking areas, smokers be separated from nonsmokers and that smoke be vented to the outside and not through the building's ventilation system. Finally, smokers' efforts to quit should be aided by available cessation classes, coworker support, publicity regarding adverse health effects, and ex-smoker support groups.

In conclusion, there is some evidence that worksites that eliminate smoking completely, offer cessation clinics and other incentives to encourage smoke-free lifestyles, and implement comprehensive health promotion measures will experience a measurable drop in smoking prevalence.

PREVENTING TOBACCO SALES TO MINORS

In the United States today, more than 3 million children under the age of 18 regularly smoke cigarettes or use smokeless tobacco. More than 2 million others are actively experimenting with tobacco use and are at high risk for becoming regular users. Tobacco companies collect more than \$1.25 billion annually from the sale of their products to minors (DiFranza, 1989).

More than half of all smokers begin before the age of 14, and 90 percent begin by the age of 19. Tobacco use by young people is a problem easily understandable in terms of economic demand and supply. A major factor in creating demand for tobacco within young age groups is tobacco industry advertising and promotion. Inadequate and unenforced laws assure that this demand is met with a readily available supply. In the 6 years following the introduction of Virginia Slims and other "feminine" cigarettes in 1968, the number of teenage girls who regularly smoke more than doubled. During the late 1970's, the rate of smoking among teenage boys decreased, whereas female smoking remained high.

Although 45 states and the District of Columbia prohibit the sale of tobacco to minors, most often defined as anyone under the age of 18, youngsters who want to obtain cigarettes find it easy to do so. An estimated 1 billion packs of cigarettes are sold to minors under the age of 18 every year, usually in violation of the law (DiFranza and Tye, 1990). The National Adolescent Student Health Survey of 12,000 students found that 86 percent of respondents believed it would be easy for them to obtain cigarettes (American School Health Association, 1989).

There are many reasons to prevent minors from obtaining tobacco products. First, easy availability conveys a message that the substance is not really very harmful. Second, illegal tobacco sales to minors foster disrespect for the law and may help young people toward illegal purchases of alcohol or use of illicit drugs. Third and most obvious, the harder it is for young people to obtain tobacco, the fewer will use the substance.

Minors' Access To Tobacco

By 1990, 45 states had some legislation preventing minors' access to tobacco products. Only three, however (Indiana, Utah, and Idaho), are considered to meet the standards for even "basic" coverage, based on criteria established by the U.S. Office on Smoking and Health, meaning that in addition to establishing a minimum age for sale, there are penalties for merchants selling tobacco to minors and some restrictions on the placement of cigarette vending machines. Six states have no minimum age law whatsoever (Montana, Wyoming, New Mexico, Missouri, Louisiana, and Kentucky). No state law is considered to be "comprehensive," which in addition to the basic category's requirements would include a requirement for warning signs at the point of purchase, provision to revoke merchant licenses for violation, and a ban on the distribution of free tobacco products (Centers for Disease Control, 1990b).

A DHHS study of enforcement of laws prohibiting the sale of tobacco to minors was able to document only 32 instances of those laws having been enforced outside of Utah, which has a relatively good record (Office of the Inspector General, 1990). In his 1989 report, the Surgeon General stated:

In marked contrast to the trends in virtually all other areas of smoking control policy, the number of legal restrictions on children's access to tobacco products has decreased over the past quarter-century. Studies indicate that compliance with minimum-age-of-purchase laws is the exception rather than the rule (US DHHS, 1989a).

Sales by Retail Stores

In studies across the country, it has been shown that, on average, 75 percent of retail stores sell tobacco to minors as young as age 12. In one Massachusetts community, an 11-year-old girl was successful in purchasing cigarettes at 75 out of 100 attempts (DiFranza et al., 1987). In the largest trial of this type, in Santa Clara County, California, 18 minors aged 14 to 16 visited 412 stores and 30 vending machines with the intent of purchasing cigarettes. They were successful at 74 percent of the stores and 100 percent of the vending machines (Altman et al., 1989). In Erie County, New York, minors purchased cigarettes in 77 percent of stores that had received a special mailing about the law prohibiting tobacco sales to minors, and in 88 percent of stores that did not receive the mailing (Skrerney et al., 1990).

Table 2
Survey of Minnesota 10th graders

Location	Percentage of Yes Responses*
Drug Store	42
Grocery Store	53
Convenience Store	68
Vending Machine	71
Gas Station	80

*Question: *Have you purchased tobacco at these places?*

Attempts to purchase tobacco products in at least 18 different communities have yielded similar results: On average, three of four retail stores will sell tobacco to minors, in violation of the laws of their state (Tobacco and Youth Reporter, 1989a).

Researchers asked 10th graders in two Minnesota communities "Have you ever purchased cigarettes from any of these places?", with the results shown in Table 2. Most teens thought it would be "very easy" (55 percent) or "fairly easy" (31 percent) to obtain cigarettes. Among teenage smokers, 90 percent thought it was "very easy" to obtain cigarettes (Forster et al., 1989).

Vending Machine Sales

As mentioned above, when minors aged 14 to 16 attempted to purchase cigarettes from 30 vending machines in Santa Clara County, California, they were successful in all 30 attempts. Even after a massive community education program had reduced illegal over-the-counter cigarette sales to minors by 50 percent, followup tests showed vending machine sales allowed minors to purchase cigarettes 100 percent of the time.

In a major study covering the three-state area surrounding Washington, D.C., Davis and colleagues escorted minors to 120 cigarette vending machines (twice each, for a total of 240 attempts). The children were successful in 100 percent of attempts to buy cigarettes (Davis et al., 1989). Davis concluded that "teenagers have easy access to cigarette vending machines in three different jurisdictions in the Washington, D.C., area. There is every reason to believe that this reflects the situation across the country" (Tobacco and Youth Reporter, 1989b). Identical results were obtained when minors were escorted to cigarette vending machines in New York, Colorado, and New Jersey.

A study by the National Automatic Merchandising Association, the trade association for the cigarette vending machine business, confirms the impression that vending machines are the source of cigarette supply for many very young teenagers when they first begin to experiment with smoking. The study found that, while only 16 percent of teens regularly obtained their cigarettes from vending machines (which still represents more than half a million teenagers), vending machines are a key source of supply for young teens. Among the study's conclusions were:

- Thirteen-year-olds are 11 times as likely as 17-year-olds to buy cigarettes from vending machines (22 percent vs. 2 percent).
- Most teens (56 percent) say they use vending machines "because no one will stop me from buying cigarettes this way."
- Whereas virtually all teenage smokers (96 percent) had been stopped from buying cigarettes over the counter, only about 1 in 10 had ever been stopped from buying cigarettes from a vending machine.
- A growing trend is to sell cigarettes and candy from the same vending machines, which is likely to further encourage and facilitate cigarette sales to minors.

Free Cigarette Samples

Tobacco companies spent \$265 million giving away cigarette samples through direct distribution or coupons during 1988, the most recent year for which data are available (Centers for Disease Control, 1990). One of the key functions of tobacco company giveaways is to provide young people with their first experimental packs of cigarettes or smokeless tobacco products at no cost and little risk of being caught. That young people are the target for many free cigarette distribution campaigns was made clear by a recent Camel advertisement that included a coupon with the encouragement to get a friend or a "kind-looking stranger" to redeem the pack for you if you are uncomfortable, an obvious come-on to underage youth.

Sean Marsee, the Oklahoma youth who died at age 18 of mouth cancer caused by using smokeless tobacco, got started when a tobacco company representative gave him a free pack of snuff at a rodeo. Indeed, giving free samples to young nonusers has been a foundation of the growth strategy of the U.S. Tobacco Company (makers of Skoal, Copenhagen, Happy Days, and other smokeless tobacco products). The company has run advertisements in youth-oriented magazines offering free samples, complete with instructions for use, and gives free samples to young people at music, sports, and other events.

Davis and colleagues asked a large number of young people if they had personally been given free tobacco samples;

14 percent of the total and 20 percent of the high school students responded in the affirmative. Approximately half reported having seen other teenagers being given free cigarette samples (Davis and Jason, 1988).

DiFranza organized a group of young people to send coupons in response to tobacco company solicitations for free tobacco samples being sent through the mail. Fifteen of twenty were mailed free tobacco samples at home, in violation of Massachusetts state law (DiFranza, 1989).

Action at the Community Level

Over the past several years, there has been a flurry of activity to prevent the sale of tobacco to minors. Much of this action has been at the community level. For example, in Santa Clara County, California, a major communitywide education campaign resulted in a 50 percent reduction in the number of stores selling tobacco to minors (from 74 percent to 38 percent), although there was no impact on the rate of sale by vending machines, which remained at 100 percent (US DHHS, 1989a).

In Woodridge, Illinois, police officer Bruce Talbott successfully pushed for enactment of a local ordinance requiring tobacco merchants to obtain a license and providing for fines and licensure revocation for violation of the law prohibiting sale of tobacco to minors under age 18. Compliance is monitored by means of "sting" operations in which a minor is escorted to stores. If cigarettes are sold to the minor, the store owner must pay a fine. Since enactment and enforcement of the law, the proportion of stores in Woodridge selling tobacco to minors has declined from 92 percent to 0.

In Minnesota, the town of White Bear Lake outlawed cigarette vending machines in 1989. Since that time, 8 other communities have followed suit, 11 have imposed more limited restrictions, and 10 others are considering restrictions. A tobacco company effort to enact state legislation that would preempt these local ordinances failed (Jean Forster, Ph.D., personal correspondence). The State of Utah, using evidence that lockout devices on cigarette vending machines in that state failed to prevent access by minors, outlawed cigarette vending machines from all areas accessible to minors. The law was upheld by the Supreme Judicial Court of Utah against a challenge from the vending machine industry.

A number of jurisdictions have outlawed the distribution of free tobacco samples. They are totally prohibited in Minnesota and Utah; it is illegal to distribute smokeless tobacco samples in Nebraska. Eight communities in Massachusetts prohibit giveaways of tobacco samples.

Another step that is being taken by an increasing number of jurisdictions is to post signs that warn against tobacco sales to minors. This may be effective not only at warning would-be underage tobacco purchasers but also at reminding store personnel of the law.

A growing number of activists, impatient with the sometimes slow progress of enacting controls over the sale of tobacco to minors—often in the face of determined tobacco industry resistance—have taken to direct action against cigarette vending machines. For example, one antismoking organization published instructions for disabling cigarette vending machines, including the use of bent paperclips and coins dipped in Superglue. Another produces “out of order” stickers that can be placed over the coin slot of cigarette vending machines.

Stop Teenage Addiction to Tobacco (STAT) is a nonprofit educational organization that was founded in 1985 to eliminate tobacco addiction of adolescents by raising public awareness of how tobacco companies use sophisticated marketing campaigns to attract young people and how ready access increases tobacco consumption among young people. STAT has prepared model legislation that has served as the basis for legislative efforts in a number of communities around the country. Its “Position Paper on Tobacco-Free Schools” has helped many jurisdictions eliminate school smoking. STAT is forming a national network of community organizers to implement strategies that will reduce the sale of tobacco to minors.

A Public Policy Agenda

Eliminating the sale of tobacco to minors is an essential step if we are to achieve the national public health goal of a smoke-free society. Based on research and review of what has been effective at the state and community levels, the following steps are probably necessary.

- All free distribution, “sampling” in tobacco industry parlance, must be outlawed. The offer of free cigarettes and smokeless tobacco products is reminiscent of the drug pusher who gives the first sample free to get his customer hooked.
- Legislation at either the state or local level should establish that any merchant must obtain a license prior to selling tobacco products. There must be a provision that repeated violation of the law prohibiting tobacco sales to minors will result in meaningful monetary fines and/or extended revocation of that license. There should be provision that enforcement will be ensured by means of sting operations conducted by either the police or health department of the jurisdiction (the Tennessee

state law explicitly provides that it is not entrapment for a youth under official supervision to attempt to purchase cigarettes to monitor compliance with the law).

- In light of their potential to start young people on the course of tobacco addiction, cigarette vending machines must be outlawed. The Nation's 374,000 cigarette vending machines are an open invitation to addiction for the Nation's young people. A vast majority are located in areas where they cannot be effectively supervised. With the proliferation of 24-hour convenience stores over the past several decades, cigarette vending machines can no longer be justified.
- Signs should be required providing notice of the minimum-age-of-purchase law and of the store's intent to abide by the law.
- The legal age for sale of tobacco should be raised to 21, making it consistent with the age for legal sale of alcohol. This will send an important message that tobacco is just as hazardous as alcohol. It will also make it simpler for merchants to monitor identification for sale of products that are legal for adults but not for minors by establishing a consistent age for both tobacco and alcohol. Perhaps most important, because relatively few high school students are friendly with 21-year-olds (though many know 18-year-olds), this would reduce access to tobacco products for high school students.
- Smoking by students should be prohibited in schools. In addition, smoking by adults should be prohibited on school campuses, establishing teachers as appropriate role models.
- Tobacco prices should be increased by means of taxation because young people are price sensitive in their demand for tobacco products. Ideally, revenue generated by increased taxes should be used for health education, as has been done with Proposition 99 tax revenues in California.

ECONOMIC INCENTIVES

This section describes environmental manipulations based on the application of economic incentives. Economic incentives serve to reduce consumption of tobacco products by increasing, either directly or indirectly, the costs of using these products. In this section, three economic incentive policies are examined: (1) higher excise taxes on cigarettes, (2) preferential hiring and promotion of nonsmokers, and (3) insurance premium differentials for smokers and nonsmokers. An attempt is made here to present some of the conceptual linkages between economic incentives and smoking and to describe the development and current status of each of the three strategies.

Excise Taxes on Tobacco Products Past and Current Status

The excise tax is an administratively simple mechanism through which public policy can influence the price of tobacco products. The chief purpose of excise taxes has always been generation of revenues, although recently these taxes are receiving increased interest and support as a public health measure.

A Federal excise tax on cigarettes has existed since 1864 and was an especially important source of Federal revenues before the enactment of the Federal income tax in 1913. Since 1951, the tax rate has been raised twice. In 1982, it was doubled from 8 cents to 16 cents per pack; and in 1990, it was raised 8 cents to be implemented in two stages.

In 1921, Iowa became the first state to implement an excise tax on cigarettes. By 1960, all but four states had enacted cigarette excise tax policies, and in 1969 North Carolina was the last state in the Nation to do so. Currently, 396 city and county governments also impose an excise tax on cigarettes. These local governments are largely concentrated in just a few states, and in 1988 they were responsible for 2 percent of all excise taxes collected on cigarettes (Tobacco Institute, 1990).

One of the largest single-year increases ever in a state excise tax on cigarettes occurred recently in California. In January 1989, Proposition 99 raised the tax from 10 to 35 cents per pack, boosting the California tax to one of the highest in the Nation. There is now substantial variability in the excise tax rate among states.

An important historical perspective on cigarette excise taxes is gained by considering the relative contribution of the tax to the overall price of cigarettes. Table 3 shows the percentage of the average price of cigarettes accounted for by Federal and state taxes from 1954 to 1988. This table shows that the Federal tax is declining as a proportion of the total cost of cigarettes. Even with the 8-cent increase in 1983, the relative impact is quickly being eroded by inflation toward the pre-1983 level. The overall relative decline in Federal revenues also holds when compared with either the consumer price index or gross national product. As a percentage of the total Federal tax base, revenues from cigarette excise taxes have declined from 3 percent in 1950 to 0.5 percent in 1987. Since the early 1970's, state revenues as a percentage of the total price of cigarettes have also declined appreciably. Without constant re-adjustment of the rate, real revenues from excise taxes will continue to decline as long as a unit rate is used. Annual adjustments to the Federal tax based on a cost-of-living index have been proposed. Alternatively, an *ad valorem* tax would index the tax rate to the price of cigarettes. As of 1988, Hawaii was the only state to use this method.

Table 3
Excise taxes as percentage of cigarettes' total cost to consumers

	Federal and State Taxes ^a	Federal Taxes	State Taxes
Year ^b			
1955	48.7%	36.7%	12.0%
1956	47.4	34.9	12.5
1957	48.8	35.4	13.4
1958	48.0	36.1	11.9
1959	46.6	32.9	13.7
1960	48.9	32.2	16.7
1961	48.6	31.6	17.0
1962	48.3	30.6	17.7
1963	49.4	31.1	18.3
1964	49.3	30.1	19.2
1965	49.8	29.9	19.9
1966	51.4	28.4	23.0
1967	50.8	27.7	23.1
1968	49.2	25.2	24.0
1969	48.9	24.0	24.9
1970	47.7	21.7	26.0
1971	46.8	20.9	25.9
1972	47.7	20.0	27.7
1973	48.4	19.9	28.5
1974	47.6	19.9	27.7
1975	44.5	17.9	26.6
1976	41.4	16.9	24.5
1977	40.5	15.8	24.7
1978	37.1	14.4	22.7
1979	35.5	13.8	21.7
1980	34.5	14.0	20.5
1981	33.1	12.8	20.3
1982	29.9	11.4	18.5
1983	26.8	12.0	14.8
1984	33.2	17.3	15.9
1985	32.3	16.2	16.1
1986	30.8	15.2	15.6
1987	29.9	15.1	14.8
1988	28.8	13.7	15.1
1989	26.5	12.0	14.5
1990	26.4	11.2	15.2

^aSource: *Tobacco Institute (1990)*.

^bFiscal year ending June 30.

Anticipated Effects Of a Tax Increase

How much reduction in smoking might we expect in response to increasing the price of cigarettes? The quantitative relationship between price and demand is described by economists as price elasticity, which is defined as the change in demand for a product relative to the change in price. For example, a price elasticity of -0.5 implies that a 10 percent increase in the price of a product will result in a 5 percent decrease in the quantity demanded. Note that a given tax increase must first be translated into the percentage increase in the retail price before its effect can be estimated.

Studies on the price elasticity for cigarettes in the United States were summarized in the 1989 Surgeon General's Report (US DHHS, 1989a). Thirteen studies conducted since 1980 were identified. Overall price elasticity estimates varied from -0.14 to -1.23. However, there was a clustering of short-term elasticity estimates in the -0.4 to -0.5 range, and the mean estimate was -0.43. These estimates are similar to those obtained in European studies, as summarized by Pekurinen and Valtonen (1987) and Godfrey and Maynard (1988). Considering the differences in cultural attitudes toward smoking, varying levels of government involvement in antismoking health education, and substantial variations in the real price of cigarettes, the overall level of agreement between the American and European studies adds a degree of confidence to the general findings of these studies.

Overall price elasticities convey no information regarding which groups and types of smokers are more sensitive to price changes. However, by analyzing survey-based data rather than aggregate consumption data, Lewit and colleagues have attempted to answer several critical questions about differential impacts. Using a sample of nearly 20,000 adults surveyed in the 1976 National Health Interview Survey, Lewit and Coate (1982) found that the consumption response to a price increase occurs primarily through reduction of smoking prevalence, rather than reduction of the average number of cigarettes smoked per smoker. The elasticity for participation, that is, the number of smokers, was found to be -0.26. The elasticity for the number of cigarettes per smoker was only -0.10. Thus, it would appear that the primary impact of an increase in the cigarette excise tax would be to encourage some smokers to quit, but the majority of smokers would continue to smoke about the same amount.

Studies that have examined age-specific responses to the price of cigarettes are of particular interest to public health professionals because they assess the potential impact of price policy on teenage smoking. It is well known that most adult smokers started before the age of 20, and thus a high priority for smoking control efforts is the reduction of teenage smoking.

Table 4
Age-specific estimates of the price elasticity of demand
for cigarettes

	Elasticities		
	Overall	Participation	Quantity per Smoker
Age Group			
12-17 yr	-1.40	-1.20	-0.25
25	-0.89	-0.74	-0.20
26-35	-0.47	-0.44	-0.04
36-74	-0.45	-0.15	-0.15
All adults	-0.42	-0.26	-0.10
All ages	-0.47	-0.31	-0.11

Adapted from US DHHS (1989a, p. 537), and US GAO (1989, p.30).

rates (DiFranza et al., 1987). The first study (Lewit et al., 1981) found the price elasticity for youths aged 12 to 17 to be -1.40, a substantially higher figure than for adults. Similar to adults, adolescents also respond to price primarily through participation, rather than the quantity smoked per smoker. The price elasticity estimates for participation and quantity smoked were -1.20 and -0.25, respectively. A second study, by Grossman and colleagues (1983), used data from four smaller, more recent samples provided by the National Surveys on Drug Abuse. The estimated price elasticities for participation were all less than the figure obtained in the earlier study. To obtain their summary estimate of -0.76 for these studies, the authors excluded the highest and lowest figures and averaged the remaining two. The authors of a General Accounting Office report on teenage smoking suggest relying on this lower elasticity estimate, rather than the -1.20 figure, because of the recency of the data used in the second study (US GAO, 1989). A summary of the elasticity estimates provided by these studies is shown in Table 4.

The participation elasticity estimates provided in Table 4 may be used to project the decrease in smoking prevalence related to a given tax rate change. The current price of cigarettes is needed to convert the tax increase into the percentage change in the retail price of cigarettes. Also necessary are estimates of current prevalence of smoking. For example, Warner (1986b) projected the reduction in prevalence in adult cigarette smoking for three specific values of possible tax rate changes. In 1986, a 16-cent-per-pack increase in the excise tax would have raised prices 15.1 percent. Based on 1982 prevalence data, this would be expected to reduce the number of adult smokers by over 2.5 million (3.9 percent). More recently,

Cummings and Sciandra (1989) have used similar methods to estimate the response in overall smoking prevalence in New York State to a scheduled 12-cent increase in the state excise tax.

The US GAO report (1989) employed analogous procedures to estimate the effect of a tax increase on teenage smoking. Using the more conservative estimate for participation elasticity of -0.76 and the most recently available prevalence estimates, the GAO predicted that a 21-cent tax increase would result in a reduction of more than one-half million teenage smokers. Because deterrence in the teen years may result in lifelong abstinence from smoking, the health impact on this group is especially significant.

Projected responses to excise tax increases are subject to a number of potentially distorting influences, and estimates should be interpreted with caution. The level of uncertainty increases as we seek to generalize the results of previous studies to changing social and normative environments, varying levels of tax increases, and long-term impact on smoking. Recent empirical data on cigarette consumption trends may be helpful in validating short-term price response estimates. Several conceptual issues regarding the use of results from elasticity studies in forecasting price response are also summarized below.

Significant increases in the cigarette excise tax have occurred recently in the United States, Canada, and the State of California. From 1981 through 1984, the real price of cigarettes in the United States increased 27 percent, while per capita consumption declined 10 percent (Harris, 1987). In Canada, the real price of cigarettes rose 66 percent from 1982 to 1988, with an attendant 24 percent drop in per capita consumption (Canadian Council on Smoking and Health, 1990). Finally, preliminary data from California suggest that overall sales in California in the third quarter of 1989 dropped 10.5 percent from that in the third quarter of 1988 (James Howard, personal communication, 1990). The 25-cent-per-pack state tax increase implemented in January 1989 raised the price of cigarettes in California about 20 percent.

These declines in cigarette consumption reflect a substantially accelerated decline over the rate for previous years and are consistent with a price elasticity in the range of -0.36 to -0.50. However, the extent to which the declines may be attributed purely to the price increases cannot be precisely determined. The Canadian Council on Smoking and Health attributes only about half of the decline in consumption to the effect of the increase in cigarette prices.

Recent consumption trends, and how they have been interpreted, point to several of the difficulties involved in accurately measuring and predicting responses to price increases. There are many influences on smoking behavior that operate concurrently with changing levels of price, making it difficult to isolate specific effects. It is possible that more of the recent decline in smoking than is generally recognized is due to general societal trends. On the other hand, Harris (1987) suggests that the decline in smoking prevalence, particularly among lower income groups, might have been substantially greater if the real price of cigarettes had not declined during the 1970's.

Recent experience suggests that tax increases are not simply passed directly to consumers but may be accompanied by an additional percentage increase by the manufacturers, thus "multiplying" the impact of the tax increase (Harris, 1987). There has also been increased marketing and sales of low-cost generic and discount brand cigarettes (Adler and Freedman, 1990), a trend that may serve to partially offset the influence of a tax increase. The long-term impact of tax increases on consumption is less clear than the short-term response. It is also uncertain whether large increases in price have the proportionately equivalent effect of small increases.

Preferential Hiring And Promotion

Relationship to
Other Policies

A range of worksite policies and programs may potentially influence smoking behaviors. Rigotti (1989) outlines a continuum of worksite smoking policies that includes (1) no explicit policy, (2) environmental alterations, (3) designated smoking and nonsmoking areas, (4) total smoking bans, and (5) preferential or exclusive hiring of nonsmokers. This section considers only the fifth and most restrictive category. This does not imply that less restrictive policies do not also generate economic incentives for reducing cigarette consumption. Job opportunities may be constrained for those who resist applying for positions where restrictions are imposed. Among the costs of noncompliance with established worksite smoking policies is the threat of losing one's job—certainly an economic incentive. Some worksites have also developed financial incentive programs as part of their overall effort to facilitate smoking cessation among employees. These incentives typically involve small monetary rewards to employees who successfully maintain abstinence from smoking (Orleans and Shipley, 1982). Variations of this approach include the use of contests, prizes, and lotteries to increase the program's visibility and appeal. A number of programmatic approaches to worksite incentives are described in a workbook published by the National Cancer Institute (US DHHS, 1989c).

Walsh and McDougall (1988) identify several motivational concerns that underlie company smoking policies. The reasons for preferential hiring and promotion of nonsmokers appear somewhat different and more situation-specific than those given for on-site restrictions. Protection of the health and rights of nonsmokers in the workplace is a key component of worksite restrictions (Rigotti, 1989). However, the extension of policies to personal behaviors away from the worksite may be motivated more by economic considerations (Walsh and McDougall, 1988). Employers defend the practice of preferentially hiring nonsmokers because smokers incur higher costs to both the business and society (Action on Smoking and Health, 1989). Some occupations involve environmental exposures where employees who smoke are at a much greater health risk and thus not hired for this reason. Hiring restrictions have been imposed also for jobs that require high levels of physical fitness, such as for firefighters and police officers. Additionally, for occupations where respiratory functional decline caused by tobacco use can be confused with compensable occupational injury, employers have hired only nonsmokers to limit disability costs.

Prevalence and Current Trends

Recent surveys of employers suggest that the practice of hiring only nonsmokers is uncommon, occurring in only 1 to 2 percent of the businesses surveyed (Bureau of National Affairs, 1987; Peterson and Massengill, 1986; Swart, 1988). The Bureau of National Affairs report found little evidence that exclusive hiring practices are becoming more prevalent, despite growing implementation and acceptance of worksite restrictions. However, a more recent report (Action on Smoking and Health, 1989) cited evidence to suggest that the frequency of these practices is increasing. Hiring preferences, as opposed to absolute hiring restrictions, are more common. The Bureau of National Affairs survey found that 5 percent of the organizations surveyed gave companywide preference to nonsmoking applicants, and another 10 percent allowed individual supervisors to preferentially hire nonsmokers. It is possible that informal preferential hiring practices are substantially more widespread than the policy survey suggests. A poll by a New York recruiting firm found that 46 percent of the executives of large firms would choose a nonsmoker over an equally qualified smoker (Bureau of National Affairs, 1987).

Such informal preferences may also apply to promotion and firing decisions. Although Peterson and Massengill (1986) found that none of the companies surveyed indicated that they preferentially promoted nonsmokers, anecdotal evidence suggests such practices exist, although discreetly (Freedman, 1987). A similar situation may exist with regard to demoting or firing employees who smoke, even though companies that

hire only nonsmokers do not as a rule dismiss smokers employed prior to implementation of the hiring policy (Action on Smoking and Health, 1989).

Any increase in the prevalence of nonsmoker hiring policies is expected to be gradual. When businesses were asked to project whether they would have such a policy in place in the future, 3.8 percent predicted they would by 1990, and 6.6 percent by 1995 (Swart, 1988). There are several reasons for reluctance on the part of employers to implement preferential hiring policies. There is a perception that less restrictive measures are working well and that hiring restrictions are intrusive and go beyond normal employment practices. Businesses may not want to restrict their pool of available employees. Also, verification of smoking status of current and potential employees and decisions on how to respond to infractions are problematic and potentially costly. Guidelines by Action on Smoking and Health (1989) suggest that employers clearly state their policy to all applicants and that consequences of infractions be stipulated. Some employers have implemented biochemical or physiological testing to verify smoking status.

Influence of Hiring And Promotion Preferences

Although several formal evaluations of the effect of worksite smoking policies on smoking have been conducted, none have specifically examined the impact of preferential or exclusive hiring practices. Clearly, one potentially important contribution that such policies make is the message they convey about the changing social acceptability of smoking. Formal policies against hiring smokers are still relatively uncommon but may be highly visible and attract considerable media attention. The more direct impact of such policies is expected to occur through the economic incentive to quit smoking provided by the policy. If employment is contingent on quitting smoking, some potential applicants might be motivated to quit smoking rather than settle for some other job. Whether or not this happens depends on a number of considerations, including the availability of other employment opportunities and the strength of the individual's propensity to smoke.

Legal Issues

The legal right of employers to preferentially or exclusively hire nonsmokers is generally recognized. Federal and state statutes prohibit discrimination on the basis of race, religion, national origin, and, in most circumstances, age and sex. In some situations, it is also unlawful to discriminate on the basis of sexual orientation, political affiliation, marital status, citizenship, and physical or mental handicap (Myers, 1990). Aside from these attributes, employers in most situations have the right to make hiring decisions on whatever basis they choose, including smoking status.

On the forefront of occupations experiencing establishment of nonsmoker hiring policies are emergency services. A firefighter in Oklahoma who was dismissed from his job when observed smoking off duty challenged his dismissal, but the employment policy of the fire department was upheld in Federal court in 1987. Another challenge to a nonsmokers-only hiring policy occurred when the application of a New York woman for employment in a jewelry store was rejected. In this case, the applicant claimed that she was discriminated against on the basis of a handicap, namely an addiction to smoking. Although New York state law classifies addicts of certain drugs as handicapped, no mention is made of tobacco. Even so, the case is proceeding after it was determined by a state board that there was probable cause to suspect that unlawful discrimination had occurred.

Additional legal challenges to preferential hiring policies are probable. The American Civil Liberties Union opposes such practices except where the smoking status of applicants or employees can be shown on a case-by-case basis to interfere with job performance. However, no actions by the American Civil Liberties Union to date have been initiated against employers who refuse to hire smokers. Additional challenges to non-smoker hiring practices may be brought on the basis that they are discriminatory to blacks, because of a higher smoking prevalence among blacks. One other potential focus of legal debate on preferential hiring practices is the invasion of privacy issue, although this aspect of such policies has so far gone unchallenged.

Two additional caveats may apply to employment policies that favor nonsmokers. The first applies to any workplaces that are covered by collective bargaining agreements with labor unions. Most cases in which unions have confronted management on smoking policies have focused on workplace restrictions. However, collective bargaining agreements may also pertain to restrictions on eligibility for employment. Efforts by the Manville Corporation, a Texas asbestos manufacturer, to hire only nonsmokers and ban workplace smoking have been stymied by litigation instigated by the International Machinists Union. Although in some cases management has successfully defended its nonsmoker-hiring policies, the general recommendation for employers is to develop and impose hiring policies and smoking restrictions in consultation with the unions involved and in accordance with current collective bargaining agreements (Action on Smoking and Health, 1989).

The second situational limitation on the legal right of employers to hire only nonsmokers occurs when state or local laws prohibit such practices. In 1989 legislation was passed in Virginia that prohibits state agencies from requiring employees

**Differential
Insurance
Premiums**
Current Status

to be nonsmokers. Private employers are not affected by the legislation, nor are agencies prevented from implementing workplace smoking restrictions. A similar bill in the State of Maryland, applicable to both public and private employers, was defeated in 1989.

Substantial evidence that smoking is firmly associated with reduced longevity, health care costs, and damage to property has accumulated over the past 45 years. This evidence has elicited varying degrees of response from the corresponding major components of the insurance industry—life, health, and property. Before the release of the 1964 Surgeon General's Report, no major insurer of any type offered premium reductions to nonsmokers. Now almost all life insurance companies provide nonsmoker discounts, whereas only a small but growing number of health and property insurers do so. This section examines the development and current status of differential premium rates for smokers and nonsmokers for each of the three major arms of the insurance industry. To the extent that these differentials are visibly passed on to individual consumers, they may provide an economic incentive not to smoke. Premium differentials could be labeled as either nonsmoker discounts or smoker surcharges; the net premium costs to smokers and nonsmokers would be the same. However, for both historical reasons and marketing purposes, the term "nonsmoker discount" is generally used.

Although life insurance companies began to introduce nonsmoker discounts as early as 1965, adoption proceeded slowly until 1979. In that year, a definitive actuarial study by State Mutual Life Assurance revealed a substantial and statistically significant mortality difference between smokers and nonsmokers. Collaborative evidence provided by other companies soon followed. By 1984, the National Association of Insurance Commissioners had developed formal guidelines for setting differential premium rates for smokers and nonsmokers, which were subsequently incorporated into practice in most states. Currently, the vast majority of companies provide nonsmoker discounts on individual policies. The size of the discounts varies across ages and gender; average discounts are in the range of 12 to 22 percent (US DHHS, 1989a).

The situation for health insurance, where providers have been slower to adopt nonsmoker discounts, is considerably more complicated. Most health insurance is purchased as group coverage, where the health status and risk factors of individuals typically are not considered. Furthermore, actuarial data on the health care cost differentials of smokers and nonsmokers have not been as complete and readily available as for mortality differentials (US DHHS, 1989a). Administrative costs and the problem of verifying the smoking status of individuals covered

by group policies may also contribute to the reluctance of the industry to provide discounts. Despite a National Association of Insurance Commissioners resolution (1985) supporting premium differentials in both group and individual policies and an Action on Smoking and Health (1987) special report that questioned the legality of not differentiating, only about 15 percent of individual policies offer nonsmoker discounts. Even fewer group plans do. Individual policies carry discounts that range from 3 to 15 percent. Group plan differentials are usually provided on the basis of the percentage of nonsmokers in the group and offer discounts of a few percentage points to groups below a specified smoking prevalence level.

Nonsmoker discounts in property and casualty insurance are also relatively uncommon. This situation exists despite solid evidence that smoking materials are responsible for a significant percentage of house fire property damage and fire-related deaths and that smokers have more vehicular accidents than nonsmokers (US DHHS, 1989a). The Farmer's Insurance Group was the first company to offer nonsmoker discounts and as of 1987 was still the only major insurer to offer them on both homeowner and automobile policies. Discounts on homeowner policies range from 3 to 7 percent and on automobile policies from 10 to 25 percent. Recently the Hanover Insurance Company increased its nonsmoker discount for automobile policies from 5 to 10 percent. The difficulty of verifying smoking status, as well as prohibitory regulations in certain states, have deterred more companies from adopting discount policies.

State insurance commissions and legislatures have prohibited certain practices that offer premium differentials because they were deemed discriminatory. However, the National Association of Insurance Commissioners has actively sought to encourage state governments to remove legal barriers to nonsmoker discounts and has facilitated the collection of actuarial data to help justify the practice. In the future, a willingness on the part of state legislatures and insurance commissions to require the availability of differentially priced policies may result from these efforts.

One additional insurance industry practice that indirectly offers a financial incentive to quit smoking is the coverage of costs for smoking cessation programs. This coverage is currently uncommon, and the future growth of such policies is uncertain. Only 11 percent of carriers surveyed in 1985 provided benefits for smoking cessation programs (US DHHS, 1989a). Employers have absorbed some of the burden for providing cessation resources, and more may be expected to do so if discounts for group health insurance policies continue to become more widely available.

Effects of Premium Differentials

Similar to the situation regarding preferential hiring, no empirical studies have assessed the impact of differential insurance premiums on smoking. Until such studies are conducted, expectations must remain speculative. Premium differentials may reduce smoking by providing both economic incentives and social or educational influences. For several reasons, premium differentials will probably provide less economic incentive for not smoking than direct increases in the price of cigarettes. Their impact is acute only at the time the policies are paid, and even then it may not be made clear to consumers that smokers are paying more. In many circumstances, smokers will have the option of simply switching to another policy or provider that does not differentiate. Health insurance premiums are often paid entirely by employers, although increasing efforts by employers to reduce their health insurance costs may result in more smokers having to pay extra for health insurance.

The role of the insurance industry in providing additional awareness and support for the declining social acceptability of smoking may be just as powerful as any economic incentives it provides. Being asked about one's smoking status when completing insurance forms is yet another reminder of the potential personal health and economic consequences of smoking. Health maintenance organizations may be especially inclined to provide educational reminders and resources for smoking cessation, although adoption of such efforts is also advocated for the larger community of health care providers (S.R. Cummings et al., 1989).

An Overview Of Economic Incentives

There are several aspects of the use of economic incentives to discourage smoking that have raised ethical concerns about their fairness and appropriateness. The regressivity issue concerning excise taxes has surfaced repeatedly and is a basis for opposition to proposals to increase taxes on cigarettes. A regressive tax is defined as one where the proportion of individual's income consumed by the tax is inversely related to income level (Fusfeld, 1982). Cigarette taxes appear to be highly regressive (Citizens for Tax Justice, 1988; Toder, 1985), although Harris (1985) suggests that the regressivity issue has been exaggerated. Proponents of increasing excise tax rates, although aware of the regressivity issue, weigh this concern against the expected improvements in health status and longevity resulting from the reduced prevalence of smoking. They also note that the lower income groups, where the burden of smoking-related disease is greatest, are also expected to show the greatest response to a price increase (Townsend, 1987).

Many other elements have been introduced into the debate over the fairness of economic incentives. Among these are ethical concerns about paternalism, victim blaming, and fair distribution of costs. The current racial and socioeconomic disparities between smokers and nonsmokers has elicited charges that economic incentive policies are racist and elitist. The accuracy of projected effects of a tax increase has been questioned, and little empirical evidence is available on the effects of the other economic incentive strategies. Potential consequences include a lack of employment opportunities and affordable insurance for those who are unwilling or unable to stop smoking.

Despite the numerous arguments raised in opposition to economic incentive policies, there is broad support for these approaches. Increases in the cigarette excise tax are advocated by numerous health organizations, including the American Heart Association, American Lung Association, American Cancer Society, American Public Health Association, and American and Canadian Medical Associations. Several proposals have been offered to mitigate at least some of the previously raised ethical concerns. These suggestions merit serious consideration and further reflect the importance of a coordinated, multifaceted approach to smoking and tobacco control. For example, Toder (1985) and Warner (1986b) argue that potentially negative effects of excise tax regressivity could be offset by making other aspects of the tax structure more progressive. Earmarking of tobacco tax revenues for health care and tobacco cessation and education programs may reduce the perception that smokers are being victimized or exploited. A 1987 American Medical Association poll (Harvey and Shubat, 1987) showed that a majority of smokers support an increase in the cigarette excise tax if the revenues are earmarked for Medicare costs. In California, 75 percent of the estimated \$600 million generated in the first year of the Proposition 99 tax increase is designated for health care, drug education, and research. Increased affordability and availability of smoking cessation resources and programs help remove economic and logistical barriers to quitting and also contribute to an atmosphere of positive support and reinforcement for those trying to quit.

The economic incentive strategies examined here focus on methods that increase the cost of smoking for consumers. Another approach is to apply economic inducements and policies to the supply side of the smoking problem, which includes agricultural practices and policies, cigarette manufacturing and distribution, and advertising (Walsh and Gordon, 1986). Initiatives that may reduce smoking by affecting this side of the smoking equation include (1) elimination of the tobacco support program (Warner, 1988), (2) agricultural

policies that promote and subsidize alternative crops (Milio, 1985), (3) elimination of tax deductions for tobacco advertising (US DHHS, 1989a), (4) further restrictions on advertising (Warner et al., 1986), and (5) tighter controls on the distribution and sale of tobacco products (DiFranza et al., 1987). The political influence of the tobacco industry has undoubtedly impeded the implementation of these initiatives, but the increasing political influence of the antismoking movement enhances the opportunity for a broad spectrum of antismoking legislation. The potential impact of policies to restrict advertising and actively support the agricultural transition to other crops extends beyond their direct impact by complementing and reinforcing other antismoking efforts. For example, economic inducements and educational efforts might be even more effective when seen as part of a broader and more congruous Federal policy to reduce smoking and improve health.

CONCLUSIONS

- The targets of recent interventions to control tobacco use are social networks that shape the attitudes of individual smokers and nonsmokers, including media, health care providers, worksites, and schools.
- The use of media in tobacco control includes providing information on the risks of tobacco use and dangers of policies that promote tobacco use, motivating smokers to stop and others to not start, and conducting cessation programs or recruiting smokers into treatment programs.
- Health care providers should not only intervene with their smoking patients but also be agents for social change.
- Restrictions on smoking in the worksite and other locations change the social acceptability of smoking and may increase the number of individuals who try to quit and who have long-term success after cessation.
- Comprehensive smoking control strategies are best implemented at the local level and can be implemented through formation of coalitions of established community groups.
- Most adolescent smokers have little difficulty in purchasing cigarettes, even when these purchases violate local laws. Increasing the barriers to cigarette purchases by minors is important in strategies to prevent the initiation of regular tobacco use.
- Economic incentives that may reduce the consumption of cigarettes include increasing the excise tax on tobacco products; preferential hiring and promotion of nonsmokers; and increasing the cost of life, health, and other forms of insurance for smokers.

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Interdependence and Synergy Among Smoking Control Activities

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Chapter 6

Interdependence and Synergy Among Smoking Control Activities

INTRODUCTION

Efforts to control tobacco use have employed a wide range of tactics and techniques to reduce the prevalence of smoking. Traditional approaches to smoking control have focused on the individual, with less attention to the broad social context within which the individual acts.

More recently, a number of researchers have recognized that local values, norms, and behavior patterns are significant in shaping an individual's attitudes and behaviors (Abrams et al., 1986; Farquhar et al., 1977; McAlister et al., 1982; Puska et al., 1985). Rather than emphasizing changes by individuals, the newer approach argues that permanent, large-scale behavioral change is best achieved through changing standards of acceptable behavior; that is, through adoption of different norms for health-related behavior (Abrams et al., 1986; Farquhar, 1978; Farquhar et al., 1985a; Syme and Alcalay, 1982; Van Parijs and Eckhardt, 1984).

In the past 15 years, a number of major health-promotion initiatives have used a community approach to change behavior (Abrams et al., 1986; Elder et al., 1986; Farquhar et al., 1985b; McAlister et al., 1982; Mittelmark et al., 1986; Puska et al., 1985; Tarlov et al., 1987). Most of these efforts addressed multiple risk factors in cardiovascular disease, with goals of changing individual subjects' behavior with regard to smoking, diet, and screening for health problems. The majority of such projects reflected the need to change the social context of their communities, recognizing that the environment has a significant role in facilitating or inhibiting the adoption of new behaviors (Farquhar et al., 1977; Farquhar et al., 1985b; McAlister et al., 1982; Puska et al., 1985). Some researchers also have discussed the importance of changing community norms. Planning interventions that capitalize on the inherent interdependence and synergy of a system is likely to yield a maximum effect.

In this chapter, (1) a conceptual framework for a comprehensive, synergistic approach to smoking control is presented; (2) pertinent data in support of such an approach are reviewed; (3) examples are presented to illustrate how interventions have built and can build on the interdependence and synergy

CONCEPTUAL FRAMEWORK

among them; and (4) synergistic approaches for three specific target populations—women, black Americans, and Hispanic Americans—are reviewed.

Individuals do not act in a vacuum; rather, they are greatly influenced by the social environment in which they act. A smoker often responds to environmental cues when deciding to smoke or not smoke. For instance, a work break, the end of a meal, and exiting from a no-smoking facility are situations that provide the smoker with cues to smoke; while attending a religious service and working in designated no-smoking areas are examples of cues that inhibit the smoker's behavior. Many cues have their origins in rules about acceptable behaviors—norms (Robertson, 1977). Changing the environment that surrounds the smoker involves changing the prevailing norms.

In concept, the social environment may be considered a system with related and interdependent parts that serve to maintain the whole. The system includes many components, or subsystems, that carry out the activities required to keep the system viable; among these subsystems are the political, economic, and educational institutions that ensure governance of, resources for, and socialization into the system. The system is not a simple aggregation of its component parts; rather, it is a unique structure that includes all the parts and the interdependencies that connect the parts (Von Bertalanffy, 1962). The system also provides the context for all activities, including making choices about behaviors. The social environment system is based on some degree of cooperation and consensus on social norms (Ashby, 1958; Boulding, 1978), and individuals generally act within the parameters of the system.

Social norms change along with the system to provide new rules of conduct to help maintain the reformed system (Robertson, 1977). An example of this can be seen in the emerging norms related to tobacco use. Technical changes—recognition of the dangers of smoking cigarettes and of inhaling secondhand smoke—have led to restrictions on public smoking, and as this secular trend accelerates, smokers find it is no longer appropriate to light up in all settings.

Factors that promote continued tobacco use are still found at many levels in the system, though. The political subsystem provides price supports for tobacco growers and thus affects the economic subsystem. Together, the political and economic subsystems contribute to the development of public and private resources that expand the tobacco industry's capability to further promote its products. In addition, tobacco industry representatives are adept at using the communication subsystem to relay messages that promote acceptability for tobacco use (Leventhal et al., 1987; Tye et al., 1987; Warner, 1986a;

White, 1988). An important factor is the addictive nature of tobacco (US DHHS, 1988), which helps to maintain a high level of demand for the product.

Conversely, there are system factors that inhibit the use of tobacco. The political sector has publicly endorsed and supported some restrictions on certain tobacco industry activities, most notably in the area of distribution and promotion of products to minors (DiFranza et al., 1987; Tobacco-Free America Project, 1988; US DHHS, 1989). Excise taxes on tobacco products have some effect in the economic sector. When cigarette taxes are portrayed as "sin" taxes (Harris, 1982; Tobacco Institute, 1988), a message about smoking behavior is disseminated through the system. The economics of such taxation also may affect the prevalence of smoking: estimates indicate a drop of about 2 percentage points in the prevalence of adult smoking for every 8-cent increase per package of cigarettes (Harris, 1982; Lewit and Coate, 1982; Warner, 1986b). Another subsystem, the scientific sector, has published thousands of studies linking ill effects to tobacco use, thereby providing yet another force against smoking.

The net environmental effect of the forces influencing tobacco use has been a gradual move away from the free use of tobacco and toward restrictions on its use. In the past 20 years, tobacco advertising has been restricted to media other than radio and television (Whiteside, 1971); 41 states have implemented restrictions on smoking in public places (US DHHS, 1986); all states have enacted cigarette taxes (US DHHS, 1989); and many other restrictions on tobacco sales and use have been legislated (Pertschuk and Shopland, 1989).

There is little doubt that environmental changes have an effect on the smoking habits of individuals. The 1964 Surgeon General's Report, for example, led to a significant change in smoking prevalence (US DHEW, 1964; Warner, 1985). A similar effect was seen when the Federal Communications Commission required "equal time" for antismoking messages on radio and TV to match the time allotted for cigarette commercials (Warner, 1985). "Clean air" laws, enacted recently around the country, also may have had an effect on prevalence as smokers find it more difficult to smoke in public places.

As the forces working toward restrictions on tobacco use multiply, a type of synergy—beneficial cooperation among various sectors of the system—develops. To the extent that relations among the sectors are harmonious and oriented toward a common goal, the synergy that develops produces a net effect of the combined forces that is greater than the sum

STUDIES OF ENVIRONMENTAL CHANGE

of their separate effects. Ultimately, the synergy of multiple forces supporting tobacco restrictions should lead to a societal norm in which tobacco use is not acceptable.

Empirical research addressing how various changes in tobacco control relate to the social environment and to the prevalence of tobacco use has been largely retrospective and observational. Few experiments have been conducted in which the multiple social forces that promote tobacco restrictions have been manipulated.

The Stanford Three-Community Study (Farquhar et al., 1977) used the communication sector (media) to deliver messages about smoking cessation. Although success was limited, there appeared to be some synergy between the media messages and intensive assistance with smoking cessation provided to individuals at high risk for cardiovascular disease (Meyer et al., 1980). In another community, media messages alone were used, and the observed effect was not significantly greater than the change seen in a control community that received neither media messages nor face-to-face intervention (Farquhar et al., 1981).

Investigators of the Australian North Coast study found significant smoking reduction among all smokers through a combination of media programs with community programs (Egger et al., 1983); again, that effect was not seen in a community that received only media interventions. Similarly, the Finnish North Karelia Project showed a significantly greater decrease in smoking in a community that received multichannel stop-smoking activities than in a control community that received no intervention (Puska et al., 1983). A Swiss national study used media, public policy changes, and a community organization approach to achieve significantly higher rates of smoking cessation in intervention communities than in the control communities (Gutzwiller and Schweizer, 1983). Three ongoing community studies—the Minnesota Heart Health Project (Jacobs et al., 1986), the Pawtucket Heart Health Program (Elder et al., 1986), and the Stanford Five-City Project (Farquhar et al., 1985)—are projects similar to those above; however, their results have not yet been reported.

SYNERGISTIC EFFECTS AMONG SELECTED INTERVENTIONS

Additional examples of the effectiveness of multiple intervention subsystems and the effects of synergy can be seen in at least three specific areas: media coverage of antitobacco events, policy changes at worksites, and antismoking messages conveyed by physicians. The following paragraphs briefly describe the interactions and interdependencies that lead to a presumably synergistic result.

Media Coverage Of Antitobacco Activities

Several advocacy techniques have been used in efforts to obtain media coverage of antitobacco events in two major areas: promotional activities and cessation activities. A small but influential group of advocates has developed simple techniques to attempt to gain media attention. A common tactic is to borrow some aspect of a prosmoking promotion and endow it with an antismoking message; for example, the "Emphysema Slims" tennis tournament was hosted to counter a "Virginia Slims" tournament (US DHHS, 1988). Similarly, the media are attracted to conflicts. In a "monster truck" rally, one of the drivers chose to decorate her truck with no-smoking symbols; she was prevented from driving her decorated truck because the event was sponsored by a tobacco company (Doctors Ought to Care, 1990).

The media also respond to the positioning of an issue around another extant issue. Several recent news events, for example, were amenable to reframing in terms of tobacco information. When cyanide was found in Chilean grapes in March 1989, news releases related the fact that cyanide is present in tobacco smoke (DeNelsky, 1989). Advocates of smoking control also noted the apparent contradiction in a tobacco company's support of a dance troupe (Smoking Control Advocacy Resource Center, 1989). Similarly, a number of editorials pointed out that the amount of benzene in Perrier water taken off the market was only a fraction of the amount of benzene in tobacco (Smoking Control Advocacy Resource Center, 1990).

It is difficult to determine whether such media coverage has any effect on smokers. It is likely, however, that such coverage reinforces and helps to solidify a nonsmoking norm that already has substantial support.

It is easier to draw conclusions from media coverage of cessation activities. Some investigators (Bettinghaus, 1988; Flay, 1987) have examined the efficacy of media promotions for use of a smoking cessation hotline (Anderson et al., 1989), use of self-help cessation materials (Jason et al., 1988), and participation in other smoking cessation programs (Cummings, 1987; Danaher et al., 1984). Although the results vary, there is a strong trend for increased participation in smoking cessation activities when media messages are available; similarly, evidence suggests that smokers are more likely to stop smoking when the two activities are combined than when each activity is presented alone (Flay, 1987).

Media control and smoking control activities are interdependent in that media cannot operate without activities and events to cover, and cessation activities and motivation messages to stop smoking make significant news only rarely (e.g.,

when new research findings are released). When tobacco-related issues are framed in a newsworthy manner, both media and smoking control groups benefit. Furthermore, smokers benefit because they are made aware not only of their habit and the opportunity for changing that habit but also of the ways in which they are manipulated into tobacco use. Such insights may motivate them to look more carefully at their smoking.

Over time, the antismoking messages may be adopted into the normative structure of society, and notions about the impropriety of tobacco vendors' promoting cultural, political, sporting, and other events will become norms.

Worksite Policies For Smoking Control

Restrictive smoking policies are being implemented increasingly in both public and private workplaces. All Federal workplaces are now subject to policies that restrict smoking to designated areas (US DHHS, 1989). In addition, 31 states have laws restricting smoking in public workplaces, and many other states have similar restrictions through executive actions (US DHHS, 1989). The numbers are equally impressive for private workplaces: almost 300 cities and counties have mandated formal policies about smoking in public and private workplaces. Surveys reported in 1986 (Bureau of National Affairs) and 1987 (US DHHS) placed the prevalence of restrictive smoking policies in private workplaces at 30 percent and rising rapidly, since the majority of workplaces surveyed that did not have a policy had at least a plan to institute one in the near future (US DHHS, 1986 and 1989).

The effect of worksite smoking policies on the attitudes of smoking employees provides important information on the acceptance or nonacceptance of this normative change. Results from a number of studies (Brown et al., 1988; Thompson et al., 1987; US DHHS, 1987) showed that smokers as well as nonsmokers responded well to smoking restrictions at work. Both groups reacted more favorably to the policy after it was implemented than before (Petersen et al., 1988; Rigotti et al., 1986; Rosenstock et al., 1986), suggesting that conversion to the new norm was accomplished easily.

Although data are somewhat equivocal, experts are becoming more convinced that worksite smoking policies have some effects on employees' smoking (Petersen et al., 1988; Rosenstock et al., 1986). Studies of employee participation in workplace smoking cessation programs that are offered along with implementation of a smoking control policy indicate that, for at least some workplaces, policy implementation increases enrollment in cessation activities (Martin, 1982; Walsh and McDougall, 1988).

The interdependence of worksite policies and smoking cessation activities is clear: when workplace policies restrict smoking, smokers will reduce the amount they smoke during the workday. Employers benefit in the long run by increased productivity and decreased costs for cleaning and insurance. Nonsmoking employees benefit by reduced exposure to environmental tobacco smoke, whereas smokers benefit in terms of health (if they achieve cessation) and support in stopping their habit. Where restricted smoking policies are implemented, worksite norms are likely to change to advocate nonsmoking, thus offering smokers an ongoing incentive to quit and to stay abstinent.

The synergistic effect between worksite policies and the smoker is that the employer action may propel the smoker toward cessation. Nonsmoking employees are also likely to support nonsmoking and may provide repeated and continuing impetus for smokers to quit. Smokers may benefit because some of the cues for smoking are controlled, making it easier for them to avoid the practice. Over time, the new nonsmoking norm may become entrenched in the workplace, providing smokers with yet another prompt to stop smoking.

Physician Actions For Tobacco Control

Physicians have regular, recurring opportunities to offer smoking cessation messages to their patients, because most smokers (70 percent) visit a physician annually (Ockene, 1987). Smokers listen to their physicians, and a sizeable number of smokers report that their physicians have advised them to stop smoking (Ockene et al., 1987).

The advice of a physician is particularly effective when it is part of a general office system that provides regular messages about quitting smoking and offers assistance with cessation efforts (Ockene, 1987; Wilson et al., 1987). Chart identification, use of an office coordinator who asks about smoking status, and a regular plan for advising the patient on the specifics of smoking cessation are more effective in helping patients achieve cessation than simply asking about smoking. The regular physician messages may be enhanced also by the environment of health care offices: a no-smoking office policy, amplified by posters, cessation information, and other cues for nonsmoking, provide strong normative support for cessation.

In addition to physicians' having an ability to affect individual smokers, they are powerful lobbyists for smoking control activities. Through their professional associations (American Medical Association, American Academy of Family Physicians, and others), physicians present a formidable lobby to persuade policymakers to control the use of tobacco. Historically, the professional associations have worked toward tobacco

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control in a number of areas, especially in smoke-free environments and control of advertising directed to youth. Physician organizations such as Doctors Ought to Care provide regular lobbying at the national, state, and local levels to restrict tobacco use.

As with the other examples, the synergistic effect of physicians' messages and other smoking control activities is found in the repeated and pervasive messages to smokers to modify their behavior. In addition, the health care environment for the smoker promotes nonsmoking as the acceptable behavior.

In each of the three examples above, there appears to be an interdependence and synergy between the sector employed for control of tobacco use and the other societal subsystems. In addition, each sector seems to be contributing toward the development of increasingly stronger nonsmoking norms. Although empirical substantiation for such assertions is weak, a number of current research efforts in smoking control (for example, the Community Intervention Trial for Smoking Cessation [COMMIT] and the American Stop Smoking Intervention Study for Cancer Prevention [ASSIST]) are expecting synergy in planning interventions, and they may provide more information on the empirical validity of this approach.

While the overall prevalence of smoking has gone down significantly over the past 20 years, the prevalence is still high among those in our society who are most disadvantaged—women of all races, black people, and Hispanics who have the lowest education level and incomes. This is not accidental. The cigarette industry spends \$2.5 billion per year to convince minority groups, women, and young people that nicotine—an addictive drug—is their ticket to "elegance, power, confidence, maturity, and desirability" (Tuckson, 1989). Tobacco companies spend \$1.4 million per year on advertising in Hispanic communities, and in black communities they spend \$5 million per year on billboards alone (Davis, 1987). Surveys in low-income communities have shown that they are saturated with billboards promoting cigarettes (Tuckson, 1989).

The presence of the tobacco industry in the lives of minorities and women of all races goes well beyond advertising. The industry is an important funder of minority organizations, publications, and events, and it has even managed to ally itself with civil rights issues by equating freedom to smoke with the civil freedoms guaranteed by the Bill of Rights. The National Cancer Institute has funded projects that aim directly at these groups, and communities are beginning to build coalitions to combat the cigarette companies when their targeting of particular populations becomes apparent.

Following are discussions of the magnitude of the problem for each of three groups (women, blacks, and Hispanics), as well as a consideration of barriers that racial minority groups and women must confront in smoking cessation.

Smoking Among Women

Magnitude of the Problem

Before World War II, smoking was primarily a male behavior. In the late 1930's and 1940's, women began to take up cigarette use until the prevalence of smoking among women peaked at 32 percent from the mid-sixties to the mid-seventies (US DHHS, 1989). Since that time, smoking rates have declined for both sexes, but the rate of decline among women has been slower than that among men. In 1986, 28 percent of adult women smoked compared with 33 percent of adult men (Morbidity and Mortality Weekly Report, 1987). If the differential rate of decline among men and women continues, by the end of the century more women than men may be smokers.

While fewer males have taken up smoking in recent years, the rate of initiation has remained fairly constant among females (Fiore et al., 1989). The situation among disadvantaged women, however, is even worse. From 1979 to 1985, the smoking prevalence among women who were less educated and had lower socioeconomic status (SES) actually increased from 40 percent to 44 percent.

Barriers to Smoking Cessation

Women tend to underestimate the health risks that they incur because of cigarette smoking (Sorenson and Pechacek, 1987). It has been speculated that the more rapid decline in smoking among men relative to women in the 1960's was due to the Surgeon General's Report linking smoking with lung cancer and heart disease. At the time, these diseases were seen as more relevant for men than for women. Since that time, the disease rates for women have increased markedly. While mortality from breast cancer has not changed in recent years, mortality from lung cancer among women has risen dramatically. Lung cancer now exceeds breast cancer as the largest cause of cancer deaths among women (American Cancer Society, 1990).

Concern about physical appearance may be another barrier to smoking cessation by women. Quitting smoking is often accompanied by significant weight gain (Rodin and Wack, 1984), and women are more likely than men to report that fear of weight gain keeps them from giving up cigarettes (US DHHS, 1980; Waldron, 1988).

Female adolescents who smoke have been shown to be more self-confident, socially skilled, and outgoing than those who do not. Girls seem to adopt smoking not because they are pressured to, but because they seek to identify themselves as independent, successful, and glamorous—precisely the image

Channels for Reaching Women

projected by cigarette advertisers. Finally, smoking is one of the significant ways that women cope with stress, particularly the stress of being a mother of small children (Biener, 1987).

The health care system is a good channel for smoking cessation efforts, as women tend to be high utilizers of health services. The fact that many women quit smoking during pregnancy suggests that the prenatal period provides a good opportunity for intervention. Public health clinics and neighborhood health centers that serve disadvantaged groups should make a special effort to convey the importance of quitting to their clients.

There are many magazines directed to women specifically. Counteradvertising (i.e., advertising designed to undermine the goals of tobacco advertising) in such magazines and/or convincing them to refuse to advertise cigarettes would reduce the association between attractiveness and smoking that is so prevalent in the media. At least two magazines, *Ms.* and *Good Housekeeping*, refuse to take cigarette advertisements. When tobacco companies are found to be targeting women, as in the recently revealed campaign to market Dakota cigarettes to a specific subgroup of women, influential groups such as the National Organization of Women may be willing to mobilize to counter the tobacco industry's promotional activity.

Many supermarkets and food stores have become involved in efforts to promote healthy choices by labeling foods that are low in cholesterol and/or high in fiber. These stores are often willing to disseminate information about the health risks of smoking (Hunkeler, et al., 1990). Efforts could be made by community organizers to discourage sales of cigarettes by food stores and sales of cigarettes to minors.

Content of Messages

Three messages about smoking may be particularly relevant in campaigns directed to women: (1) smoking is as much of a health risk for women as it is for men; (2) quitting smoking promotes the health of children; and (3) the possibility of being slimmer is not important enough to risk the health dangers of smoking. Messages about how to acquire social support from family members, friends, and coworkers may also help women to quit smoking.

Smoking Among Blacks Magnitude of the Problem

Black Americans have the highest smoking prevalence rates: 35.4 percent of black adults smoke—40.6 percent of black men and 31.5 percent of black women (Fiore et al., 1989; US DHHS, 1988). Blacks suffer the Nation's highest rates of morbidity and mortality from smoking-related diseases, including cardiovascular disease and lung cancer (Cooper and Simmons, 1985; US DHHS, 1985 and 1988). Cigarette smoking is a major contributor to the short life expectancy of inner-city black men (McCord and Freeman, 1990; Rivo et al., 1989).

Sociodemographic factors associated with smoking among black people are similar to those for the U.S. population as a whole. They include lower income, less education, blue-collar occupations, unemployment, male gender, and unmarried status (Orleans et al., 1989b; US DHHS, 1988; Warnecke et al., 1978.)

Although the rate of smoking initiation is decreasing, and the ratio of quitting is increasing at similar rates for blacks and whites, blacks currently have a lower quit ratio (defined as the proportion of smokers who have quit). Quit ratio estimates range from 32.9 percent to 38.8 percent for blacks and from 47.1 percent to 49.3 percent for whites (Fiore et al., 1989; US DHHS, 1990). Past survey data suggest that black smokers may try to quit as often as whites, but they succeed less often (US DHHS, 1985).

Among blacks, several high-risk groups deserve special attention: (1) black women, because of the unique risks associated with smoking during childbearing years, and because their smoking rate is declining more slowly than that of black men (Fiore et al., 1989; Marcus and Crane, 1987); (2) smokers with less than a high school education because they are quitting at the slowest rates (Pierce et al., 1989); and (3) black men in blue-collar and service occupations because their smoking rates may exceed 50 percent (US DHHS, 1985). Special efforts are needed also to reach the chronically unemployed, who have high rates of smoking and may not be active in church and community groups (Lemann, 1986).

Barriers to Smoking Cessation

For black people, barriers to quitting smoking include reliance on cigarettes as a way of coping with the life stress and social disadvantage related to low SES and pervasive discrimination, limited access to health care in general and to smoking-related services and resources in particular, and limited confidence in their ability to quit (Hunkeler et al., 1990). A study of smoking among black people in Richmond, California, showed that more than 90 percent knew that smoking was harmful to health, but only 27 percent thought they could quit within the year (Hunkeler et al., 1990). Norms in black communities may actually encourage smoking. Many blacks regard other problems such as drugs, unemployment, and crime as having a higher priority than smoking. Powerful advertising tailored to black consumers not only glamorizes and legitimizes smoking but also downplays the health risks (Blum, 1989).

Fewer blacks (54 percent) than whites (70 percent) report a physician's office as their usual source of care. Twice as many blacks as whites say they receive their regular medical care from hospitals, public health clinics, and emergency rooms. Fewer

blacks than whites receive medical advice to stop smoking (Marcus and Crane, 1987; US DHHS, 1985).

Stronger smoking norms and tobacco advertising influences in black communities help to sustain a high smoking rate. Black-targeted tobacco advertising has become increasingly predatory and pervasive. The tactics include extensive cigarette advertising in black print media; increased billboard and point-of-purchase cigarette advertising in inner-city neighborhoods; tobacco company sponsorship of sports, civic events, and entertainment and cultural events important to the black community; and well-publicized philanthropic support of black causes and organizations (Blum, 1989; Cummings et al., 1987; Tuckson, 1989).

Channels for Reaching Black Smokers

Lasting change in individual smoking behavior requires changing the social and cultural context in which smoking occurs by integrating program components into many existing communication channels (Hunkeler et al., 1990). These communication channels include the health care system, black-focused mass media, churches, voluntary health organizations, fraternal and mutual aid organizations, workplaces, unemployment offices, job training programs, retail establishments, families, and neighborhood and tenants' organizations (Orleans et al., 1989b).

These channels include two types of organizations that might be mobilized to reduce black smoking—those that reach black populations easily, such as black churches, black fraternal and mutual aid organizations, and neighborhood and tenants' organizations; and those that have health and smoking on their agendas already, but are not focused on the black population, such as voluntary health organizations (e.g., American Cancer Society, American Heart Association, American Lung Association). To involve both types of organizations in the reduction of smoking among black people requires convincing black organizations to take up smoking as an issue (despite their other pressing priorities) and convincing the voluntary health organizations to produce materials that focus on blacks. Any successful effort to reduce smoking among blacks requires strong black leadership. Unfortunately, at this time many of the organizations in black communities do not have the resources to add smoking to their list of priorities. Enlisting the aid of those organizations requires time. Many of the organizations that deal with smoking, such as the lung association and the cancer society, are just beginning to focus more heavily on low-income and minority smokers.

If quitting smoking can be linked to other difficult problems faced by black communities, such as unemployment, quitting smoking might be more of a priority. For example, if

it could be shown that nonsmokers are more attractive job candidates, people might be more motivated to quit. If job training programs and unemployment offices distributed self-help materials and/or offered a smoking cessation component to their training, unemployed black smokers might be more interested in quitting.

Health professionals can play a key role in educating individual smokers and community groups about the hazards of smoking (Ockene, 1987), but they should be practitioners in emergency rooms and public health clinics as well as regular physicians so that the low-SES groups with the highest proportion of smokers are reached. Medical-based programs should be offered in the hospital and public health clinics and emergency rooms where black smokers receive a disproportionate amount of their medical care (Orleans et al., 1989b). The National Medical Association could play a critical role by training its members to offer brief counseling and self-help materials as part of routine medical care (e.g., Glynn and Manley, 1989).

Influential members of important nonmedical organizations also should be involved to raise consciousness about smoking as a health and social issue in black communities. The key spokespersons in Philadelphia's successful campaign against Uptown cigarettes included health professionals, public health officials, political leaders, and clergy from the black community (Robinson et al., 1990).

Communications aimed at black children and adolescents should include peer education. Recent focus groups indicate that information about smoking risks for blacks may be more credible coming from black than from white sources, and that information about other quitting benefits may be most convincing when the sources are "everyday" people instead of celebrities (James et al., 1990). Communications aimed at families and social networks have the potential to increase social support for quitting smoking and to mobilize efforts to curtail cigarette use among black children and adolescents. Widespread community concern to protect black children from a lifetime of nicotine addiction was a major tactic in the successful grassroots campaign against Uptown cigarettes in Philadelphia (Robinson et al., 1990). Interventions that target youth may reach both young people and their families; for instance, the making of a rap video, "Stop Before You Drop," by the Richmond Quits Smoking Project in Richmond, California, was a mobilization tactic that reached families as well as over 300 young people involved in the production at various levels.

Many effective health education campaigns combine formal and informal interpersonal communications, such as personal medical advice and social support from one's primary social group (McDill, 1975; Warnecke et al., 1978). This may be especially true within the black community because of its strong self-help tradition. Recruiting and training volunteers from churches, neighborhood councils, and community organizations to talk with family members, friends, coworkers, and neighbors about smoking was one strategy used by the Richmond project to extend formal programming to informal social networks (Hunkeler et al., 1990).

Community-based motivation or education campaigns should employ black-focused media (e.g., newspapers, magazines, and radio) to the greatest extent possible. The need to reach blacks with the lowest SES and educational levels requires that print materials be suitable for low-literacy populations (Doak et al., 1987) and that alternative audiovisual media also be available.

Videotaped or televised quit-smoking programs are useful complements to print materials, especially to reach low-literacy groups. Minimal counseling might be provided to smokers using self-help materials by means of toll-free telephone quitlines, like the nationwide Cancer Information Service (1-800-4-CANCER), although few black smokers may avail themselves of this service.

Briefly trained lay leaders (Lando et al., 1990) can provide quit-smoking assistance through organizations and institutions already established in the black community. The project in Richmond, California, recruited volunteers through churches, neighborhood councils, and community organizations to encourage, support, and assist quitters. Schoenbach and colleagues (1988) trained life insurance agents to deliver self-help quitting guides to interested policyholders nationwide.

Interventions aimed at groups and organizations, not just individuals, are needed. Self-help programs, workshops, and clinics can be offered in churches, medical settings, schools, workplaces, and community organizations. The Richmond project distributed stop-smoking materials in more than 100 community sites, including restaurants, barber shops, youth organizations, recreational centers, senior centers, grocery stores, churches, the public library, and unemployment offices (Hunkeler et al., 1990).

Voluntary health organizations, particularly the American Cancer Society and the American Lung Association, are the major providers of self-help materials and quit-smoking clinics in the United States (US DHHS, 1989). Their multiracial quitting guides are designed for wide appeal to blacks and other

minorities and are written at reading levels suitable for low-literacy smokers (American Cancer Society, 1988; Strecher and Rimer, 1987). The community and worksite-based clinics of both organizations achieved similar, relatively modest outcomes (Lando et al., 1990). Both programs can be led by facilitators recruited and trained from the target community.

An issue at present is the role of generic stop-smoking materials versus black-focused materials. Both have their place. The experience of the Richmond project was that blacks were very receptive to both black-focused motivational materials and black-focused quit-smoking guides. Examples of black-focused stop-smoking literature include *A Guide to Quitting Smoking*, created by the Richmond project, and North Carolina Mutual Insurance Company's *Quit for Life* guide, designed as a companion to the multiracial guide, *Freedom from Smoking for You and Your Family*, from the American Lung Association (Strecher and Rimer, 1987).

It is noteworthy that offers of standard counseling, groups, and self-help materials will reach only a small group of black smokers. However, the experience of the Richmond project was that, while the program had to offer these services to gain credibility and to accommodate the few who used them, most black smokers who were interested in cessation needed more innovative approaches to quitting.

Content of Messages

Messages about smoking for black Americans should contain clear information about the health consequences of smoking, the health benefits and other potential gains from quitting smoking, suggestions for how to quit smoking, and information to combat the cigarette companies' message that smoking is glamorous. Information about the health risks of secondhand smoke exposure should be included to exploit the altruistic quitting motives commonly cited by black ex-smokers (Orleans et al., 1989a).

Because health is the primary motivation for quitting among black smokers, as among all U.S. smokers (Orleans et al., 1989a) and because blacks do not receive messages about the health risks of smoking as often as do whites (US DHHS, 1987), black-focused antismoking campaigns should clearly state the health risks and the benefits of not smoking. Messages should emphasize the fact that while quitting smoking is not easy, it can be done, and that there are individuals interested in helping others quit. Other benefits, not strictly health-related, such as freedom from addiction and inconvenience, saving money, greater self-esteem, and more social acceptability, should be stressed. Reassurance about overcoming common quitting barriers, for example, concerns about weight gain and the loss of smoking as an all-purpose coping tactic, also is important.

The smoking issue should be framed in ways relevant to the concerns of blacks, particularly with regard to family life, for instance, emphasizing the economic burden of smoking-related illness for black families and the hazardous effects of secondhand smoke on children (Hunkeler et al., 1990; James et al., 1990). Family themes like these are emphasized in the American Lung Association's new motivational brochure (1990) developed specifically for black smokers. These messages are similar to those meant for all other racial or ethnic groups, but there is a difference in tone and emphasis. Many blacks are already well aware of the problems they face (unemployment, higher mortality rates, drug abuse, etc.), including smoking. What is needed is more information on how blacks can combat smoking personally, in their families, and in the wider community by organizing to decrease the advertising of cigarettes (Hunkeler et al., 1990).

Counteradvertising has become an essential antismoking strategy in minority communities. Its goals are to expose the tactics used by the tobacco industry to recruit new smokers, especially minority women, children, and adolescents. Counteradvertising can deglamorize smoking through images and slogans that mock the themes of power, attractiveness, escape, popularity, and pleasure that are used now to promote cigarettes (Blum, 1989; Tuckson, 1989). One of the successful tactics in the campaign against the new Uptown cigarettes was to expose the tobacco industry strategy of marketing more highly addictive, high-nicotine and high-menthol cigarettes to black smokers (Robinson et al., 1990).

Counteradvertising strategies can involve everyone, non-smokers and smokers alike. Recently, the City Council of the predominantly black city of Richmond, California, in a preliminary vote, passed an ordinance that prohibits billboard advertising of alcohol and cigarettes within 500 feet of each school. Thus, whole communities can be mobilized against smoking.

The community-based project in Richmond portrayed smoking as "unhip," "uncool," and socially undesirable behavior (Hunkeler et al., 1990). Counteradvertising can also include (1) political action and legislation to regulate the billboard cigarette advertising that is two to three times more prevalent in black than in white communities; (2) strategies to reduce point-of-purchase advertising and curtail minors' access to tobacco products in community retail establishments and to prohibit the distribution of free samples of cigarettes; (3) stopping patronage of events sponsored by tobacco companies; and (4) the refusal of philanthropy from tobacco companies (Tuckson, 1989).

Smoking Among Hispanics

Magnitude of the Problem

The proportion of current smokers among Hispanic men varies from 31 percent to 41 percent, and among Hispanic women from 21 percent to 33 percent, in national and regional surveys (Escobedo and Remington, 1989; Escobedo et al., 1990; Marcus and Crane, 1985). Rates for Hispanic men are similar to or greater than those for white men, but a substantially lower proportion of Hispanic women than white women are smokers. Smoking rates for the three major Hispanic subgroups, Mexican Americans, Cuban Americans, and Puerto Ricans, were compared in the Hispanic Health and Nutrition Examination Survey (HHANES) conducted between 1982 and 1984 (Escobedo and Remington, 1989). Similar gender differences were observed among Mexican Americans and Cuban Americans, but the gap was much less striking among Puerto Ricans. Puerto Rican women report smoking at a much higher rate than either of the other Hispanic subgroups examined as part of HHANES. In addition, birth cohort analyses based on HHANES data estimated that, although the prevalence of smoking appears to be decreasing among Hispanic men, smoking rates actually increased among successive cohorts of Hispanic women (Escobedo and Remington, 1989).

Barriers to Smoking Cessation

Acculturation to the U.S. mainstream is a complex, multi-dimensional phenomenon that has an important but poorly understood role in many health-related behaviors. In a telephone survey of smoking behavior, completed with 1,669 Hispanic residents of San Francisco in 1986-1987 (Marín et al., 1989b), smoking rates were higher for the more acculturated Hispanic women but lower for the more acculturated men. These data suggest that smoking behavior among Hispanics becomes more like that of whites with increasing levels of acculturation and, as a consequence, smoking may become an increasingly serious problem for Hispanics as they merge with mainstream U.S. society.

A consistent finding in surveys (Marcus and Crane, 1985; Marín et al., 1989b) has been that Mexican-American smokers report smoking fewer cigarettes per day than the average reported by white or black smokers. Although a lower proportion of highly acculturated men smoke, they report a greater number of cigarettes per day than less acculturated men. Among women, a high proportion smoke and report smoking more cigarettes as acculturation increases. Among a sample of 547 Mexican-American smokers participating in HHANES, comparison of self-reported smoking behavior with levels of serum cotinine (a specific metabolite of nicotine) showed that approximately 20 percent of men and 24 percent of women reported smoking fewer than 10 cigarettes per day, and that estimated underreporting of cigarette consumption ranged from 2 to 17 cigarettes per day (Pérez-Stable et al., 1990). These

observations have important implications for cessation strategies, because light smokers are much more likely to successfully quit smoking on their own with appropriate motivational messages and self-help methods.

Unemployment, little education, and little or no awareness of cessation services also contribute to the barriers that Hispanics face in attempting to quit smoking. Less educated persons are more likely to smoke and less likely to quit, and Hispanics have the fewest average years of education of any ethnic group in the United States. Up to 50 percent of adolescents from all subgroups do not graduate from high school. In addition, many Hispanic immigrants have little formal education and at least 25 percent speak little or no English; thus, smoking prevention and cessation services are less accessible to them.

With regard to barriers at the individual level, cigarette smoking remains a socially acceptable behavior among Hispanics. Few Hispanics question whether it is permissible to smoke at a private home and many consider offering a cigarette a polite gesture (Marín et al., 1989a). Smokers attempting to quit may confront situations in which they must politely refuse a cigarette in a culturally appropriate manner. Smoking among Hispanic men is perceived also as part of the machismo culture. The tobacco industry has exploited these cultural traits in advertising campaigns aimed at Spanish-speaking people.

Channels for Reaching Hispanics

Providing services to Hispanic Americans, whether at the individual level, in a clinical setting, or for an entire community, requires a working knowledge of social and cultural issues. Financial access to health care, immigrant documentation status, reasons for emigration from Latin America, and SES in the United States are all essential issues that persons planning to work with Hispanics must recognize. Because the proportion of Hispanic health professionals in the United States does not come close to the proportion of Hispanics in the population, non-Hispanics will be providing a substantial number of services; awareness of specific cultural issues may help to reduce the known barriers.

On average, Hispanics are younger, less educated, and have an SES level intermediate between that of whites and blacks who are not Hispanic. More than 80 percent of Hispanics reside in urban areas and nearly 90 percent live in New York, Florida, Illinois, New Jersey, and five Southwestern states (California, Texas, New Mexico, Arizona, and Colorado). Although Hispanics are a racially diverse group, with each country of origin imparting unique characteristics, there are more similarities than differences among Hispanic subgroups in this country. For example, Spanish is the language preferred

for use at home by 60 percent of Hispanic adults, which creates a bonding among subgroups (Pérez-Stable, 1987).

To promote smoking cessation and prevent smoking initiation among Hispanics, interventions must incorporate culturally appropriate information about why and how to quit smoking. Standard use of broadcast Spanish that avoids regional idioms should be used in all of the media components. Hispanic physical types that represent the national groups in the area also should be used as models and communicators.

The Spanish-language media can play an important role in promoting nonsmoking. Television and radio public service announcements can be produced at low cost and aired on the major Spanish-language stations in a specific area. These public service announcements can include culturally appropriate messages about smoking and how to quit, with community leaders talking about the disadvantages of smoking and former smokers talking about why they quit and what benefits they have gained. Less acculturated Hispanics are more likely to listen to radio, and discussions of smoking and health by Hispanic experts on locally popular radio talk shows can be an effective way of reaching Hispanics. The call-in talk show format allows for listener participation, lively discussions, and testimonials by former smokers.

There are Spanish-language newspapers publishing weekly or monthly in most U.S. areas that have a significant Hispanic population. In some urban areas (e.g., Los Angeles, Miami, and New York), a prominent daily newspaper is widely read by Hispanics, but in many areas the absence of a daily newspaper in Spanish means that Hispanics read English language newspapers (Alcalay et al., 1987-1988). Newspapers and magazines are susceptible to influence by the tobacco industry's advertising dollars and thus may be less amenable than radio and television to promoting nonsmoking; however, other printed media in Spanish may have an important role in promoting smoking cessation. For example, posters showing a family quitting cigarettes, flyers with motivational messages, pamphlets with information on how to help a smoker quit, and billboards promoting the no-smoking message can all be part of a Hispanic-focused program of smoking control. The messages in printed media should be aimed at nonsmoking family members as well as smokers, in order to make the most of the powerful characteristic of familial regard among Hispanics.

Content of Messages

Hispanics tend to have a collective loyalty to the extended family that ranks higher than individual needs (*familialismo*), and this quality may be useful in an effort to change smoking behavior. For example, motivating fathers or mothers to quit

smoking in order to prevent their children's smoking and to decrease the likelihood of harm to their children is an appropriate and effective strategy to use among Hispanics. The extended family network remains much more intact among Hispanics in general when compared with whites, even after several generations have passed since immigration (Sabogal et al., 1987). The family network can be used also to persuade smokers to quit. An example of a vignette related to real-life issues in the community is a television public service announcement showing a delighted Hispanic mother reading a letter from her son, who writes that he has quit smoking on Mother's Day because of his children.

Hispanic people often will establish relationships with health professionals and other authority figures out of a paternalistic dependence. Because of this cultural trait of respect for authority figures, physicians and other health professionals in a clinical setting may be especially effective in counseling Hispanic smokers about quitting. Physicians need to implement a more authoritative style, use standard counseling techniques to promote cessation, and order adjunctive pharmacologic methods as needed. Authoritative experts have enhanced credibility in promoting nonsmoking among Hispanics both at an individual encounter and through a public health campaign. This relationship, however, depends on maintenance of respect for the individual regardless of social standing, and it can disintegrate if non-Hispanics are not aware of these cultural scripts. For example, Triandis and colleagues (1984) described the cultural script of *simpatía* that differentiates Hispanics from whites; this script means that Hispanics are more likely than whites to expect a high frequency of positive social interaction and a low frequency of neutral or negative social interactions. Inattention to the presence of this script may lead to misunderstandings when Hispanics and people of other cultures interact in any social setting.

Although Hispanics report having less awareness than that of other groups about where to obtain information on smoking cessation services, they state also that they need less help in quitting and feel more capable of quitting on their own. In fact, the most frequently cited method by Hispanic smokers in helping them to quit is *voluntad propia*, or willpower. Promotion of willpower with self-help methods, such as the *Guía para Dejar de Fumar* (Sabogal et al., 1988), is an effective strategy to use among Hispanic smokers.

Compared to white smokers, Hispanics perceive their smoking to be less dependent on situational cues and more dependent on social cues. The importance of cigarette smoking with a group of friends or at a social gathering is greater for Hispanics than for whites. Thus, antismoking messages must

include culturally appropriate ways to resist social pressures to smoke. Hispanics were more concerned also about the effects of smoking on interpersonal relationships and about smoking making their clothes and their breath smell bad. This also should be incorporated into antismoking messages. Finally, Hispanics report a greater concern about the effects of smoking on their health and the health of their children. Thus, graphic presentations of the adverse health effects of smoking on smokers and their loved ones may be effective if presented within a context that offers ways to quit smoking.

Helping smokers quit with the more traditional cessation group approach has not been widely accepted by Hispanic smokers, even when offered free of charge at convenient hours and locations. Use of a series of Spanish-language audiotapes that include professionally enacted vignettes to illustrate the principles of relapse prevention, relaxation techniques, and assertiveness when coping with social temptations to smoke may be widely applicable through radio programs. One approach to complement the standard group cessation is to offer counseling sessions for smokers over the telephone. It has the advantage of being time-efficient, allows for a much wider dissemination of quitting techniques, and should be cost-effective.

CONCLUSIONS

- In the limited number of settings where interactions between the multiple components of a smoking control program have been examined, there appears to be a synergistic effect.
- Interaction between the multiple components of the environmental system and the multiple message channels that compose a comprehensive strategy for smoking control is expected, in light of current social behavior theory, and the anticipated interaction has been incorporated into most recent comprehensive, community-based, smoking control approaches, such as COMMIT and ASSIST.
- The targeting of women by tobacco advertising has been associated with a dramatic rise in the number of women who smoke and who develop smoking-related diseases.
- Approaches toward blacks include programs to counter targeted advertising within black neighborhoods, increasing the priority and resources available for smoking control within black groups, and encouraging the dissemination of programs and materials developed for use in the black community.
- The recognition of the importance of acculturation and Hispanic social and cultural issues is essential in implementing smoking control programs in Hispanic communities. Approaches that emphasize family impact may be particularly useful.

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