Chapter **46**

Tobacco Addiction

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Cigarette smoking and other forms of tobacco use impose a large and growing global public health burden. Worldwide, tobacco use is estimated to kill about 5 million people annually, accounting for 1 in every 5 male deaths and 1 in 20 female deaths of those over age 30. On current smoking patterns, annual tobacco deaths will rise to 10 million by 2030. The 21st century is likely to see 1 billion tobacco deaths, most of them in low-income countries. In contrast, the 20th century saw 100 million tobacco deaths, most of them in Western countries and the former socialist economies.

Hundreds of millions of premature tobacco deaths could be avoided if effective interventions were widely applied in low- and middle-income countries. Numerous studies from high-income countries and a growing number from low- and middle-income countries provide robust evidence that tobacco tax increases, timely dissemination of information about the health risks of smoking, restrictions on smoking in public and workplaces, comprehensive bans on advertising and promotion, and increased access to cessation therapies are effective in reducing tobacco use and its consequences. Cessation by the 1.1 billion current smokers is central to meaningful reductions in tobacco deaths over the next five decades. New analyses presented here find that higher tobacco taxes could prevent 3 million tobacco deaths by 2030 among smokers alive today. Reduced uptake of smoking by children would yield benefits chiefly after 2050. Price and non-price interventions are, for the most part, highly cost-effective.

This chapter begins with an overview of smoking trends and tobacco's health consequences, followed by a discussion of the economic rationale for government intervention, with a focus on the uniquely addictive properties of nicotine. A review of the effectiveness of tobacco-control policies in reducing tobacco initiation and in increasing cessation follows. A cost-effectiveness analysis of these interventions is provided. Finally, the constraints to implementing tobacco-control policies are discussed.

SMOKING TRENDS

Tobacco use, in both smoked and nonsmoked forms, is common worldwide. This chapter focuses on smoked tobacco, chiefly cigarettes and *bidis* (tobacco hand rolled in the leaf of another plant, *temburi,* which is popular in India and parts of Southeast Asia), because smoked tobacco is more common—accounting for about 65 to 85 percent of all tobacco produced worldwide (WHO 1997)—and causes more disease and more diverse types of disease than does oral tobacco use.

Prevalence

A systematic review of 139 studies on adult smoking prevalence (Jha and others 2002) found that more than 1.1 billion people worldwide smoke, with about 82 percent of smokers residing in low- and middle-income countries. Table 46.1 provides an update of these estimates for the population in 2000. Globally, male smoking far exceeds female smoking, with a smaller gender difference in high-income countries. Smoking prevalence is highest in Europe and Central Asia, where 35 percent of all adults are smokers.

While overall smoking prevalence continues to increase in many low- and middle-income countries, many high-income countries have witnessed decreases, most clearly in men. A

Table 46.1 Estimated Smoking Prevalence (by Gender) and Number of Smokers, 15 Years of Age and Older, 2000

	Smoking prevalence (percent)			Total smokers	
World Bank region	**Males**	**Females**	**Overall**	**Millions**	**Percentage of all smokers**
East Asia and the Pacific	63	5	34	429	38
Europe and Central Asia	56	17	35	122	11
Latin America and the Caribbean	40	24	32	98	9
Middle East and North Africa	36	5	21	37	3
South Asia	32	6	20	178	15
Sub-Saharan Africa	29	8	18	56	6
Low- and middle-income economies	49	8	29	920	82
High-income economies	37	21	29	202	18

Source: Authors.

study in 36 mostly Western countries, from early 1980 to the mid 1990s, suggested that the decrease in smoking prevalence observed among men was caused by the higher prevalence in younger age groups of those who have never smoked. Among women, there was little overall change in smoking prevalence because the increasing prevalence of smokers in younger cohorts counterbalanced increasing cessation in older age groups (Molarius and others 2001).

Cessation

Ex-smoking rates are a good measure of cessation at a population level. In *some* high-income countries, the prevalence rates of ex-smokers have increased over the past two to three decades. For example, in the United Kingdom, smoking prevalence among males over age 30 fell from 70 percent in the 1950s to 30 percent in 2000; female smoking prevalence fell from 40 to 20 percent over the same period. Much of the decrease arose from cessation. Today, two times as many ex-smokers as smokers exist among those age 50 or over. Currently, 30 percent of the U.K. male population is made up of former smokers (Peto and others 2000). Polish male cessation rates have also increased, partly because of control programs. One of every four adult Polish males described himself as an ex-smoker (Zatonski and Jha 2000). In contrast, the prevalence of male ex-smokers in most developing countries is low: 10 percent in Vietnam, 5 percent in India, and 2 percent in China (Jha and others 2002). Even those low figures may be falsely elevated because they include people who quit because either they were too ill to continue or they had early symptoms of tobacco-related illness (Martinson and others 2003).

HEALTH CONSEQUENCES OF SMOKING

The health consequences of smoking are often assumed to be widely understood. In fact, ignorance of the magnitude of tobacco hazards is widespread in terms of both individual health and population policy. Thus, the salient aspects of tobacco epidemiology are outlined in this section.

Key Messages for the Individual Smoker

More than 50 years of epidemiology on smoking-related diseases have led to three key messages for individual smokers worldwide (Doll and others 2004; Peto and others 2003).

- The eventual risk of death from smoking is high, with about one-half to two-thirds of long-term smokers eventually being killed by their addiction.
- These deaths involve a substantial number of life years forgone. About half of all tobacco deaths occur at ages 35 to 69, resulting in the loss of about 20 to 25 years of life, compared with the life expectancy of nonsmokers.
- Cessation works: those adults who quit before middle age avoid almost all the excess hazards of continued smoking.

Worldwide, about 80 percent of deaths among the 2.7 billion adults over age 30 involve vascular, respiratory, or neoplastic disease. Smoking is associated with an increase in the frequency of many of these diseases, although important differences exist between and across populations. The following discussion focuses on the consequences of smoking on adult mortality. Detailed epidemiological reviews of worldwide mortality from smoking are found elsewhere (C. Gajalakshmi and others 2000; V. Gajalakshmi and others 2003; Gupta and Mehta 2000; Liu and others 1998; Niu and others 1998; Peto and others 1994).

Current Mortality and Disability from Smoking

Recent updates of indirect estimates of global tobacco mortality (Ezzati and Lopez 2003; M. Ezzati, personal communication, November 2004) indicate that in 2000, 5.0 million premature deaths were caused by tobacco. About half (2.6 million) of those deaths were in low-income countries. Males accounted

Table 46.2 Tobacco Mortality and Total DALYs by Gender, 2000
(thousands)

World Bank region	Tobacco deaths		Total DALYs	
	Males	Females	Males	Females
East Asia and the Pacific	829	274	13,116	4,128
Europe and Central Asia	754	161	12,407	2,686
Latin America and the Caribbean	177	97	2,789	1,613
Middle East and North Africa	97	28	1,676	554
South Asia	768	187	12,397	3,285
Sub-Saharan Africa	105	66	1,659	1,091
Low- and middle-income economies	2,730	813	44,044	13,357
High-income economies	929	548	12,304	6,866
World	3,659	1,361	56,347	20,222

Source: Ezzati and Lopez 2003; Mathers and others 2006.
Note: The terms *high-income* and *former socialist economies* as used in the text correspond roughly to high-income and Europe and Central Asia regions using the World Bank classification. *Low-income countries* corresponds roughly to East Asia and the Pacific, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa.

for 3.7 million deaths, or 72 percent of all tobacco deaths. About 60 percent of male and 40 percent of female tobacco deaths were of middle-aged persons (ages 35 to 69).

In high-income countries and former socialist economies, the 1 million middle-aged male tobacco deaths were largely composed of cardiovascular disease (0.45 million) and lung cancer (0.21 million). In contrast, in low-income countries, the leading causes of death among the 1.3 million male tobacco deaths were cardiovascular disease (0.4 million), chronic obstructive pulmonary disease (0.2 million), other respiratory disease (chiefly tuberculosis, 0.2 million), and lung cancer (0.18 million). The specific numbers of deaths from tobacco and of total disability-adjusted life years (DALYs) by gender and World Bank region are shown in table 46.2. Disability estimates are not discussed here; however, disability is highly correlated with mortality in most settings.

Past and Future Trends in Mortality

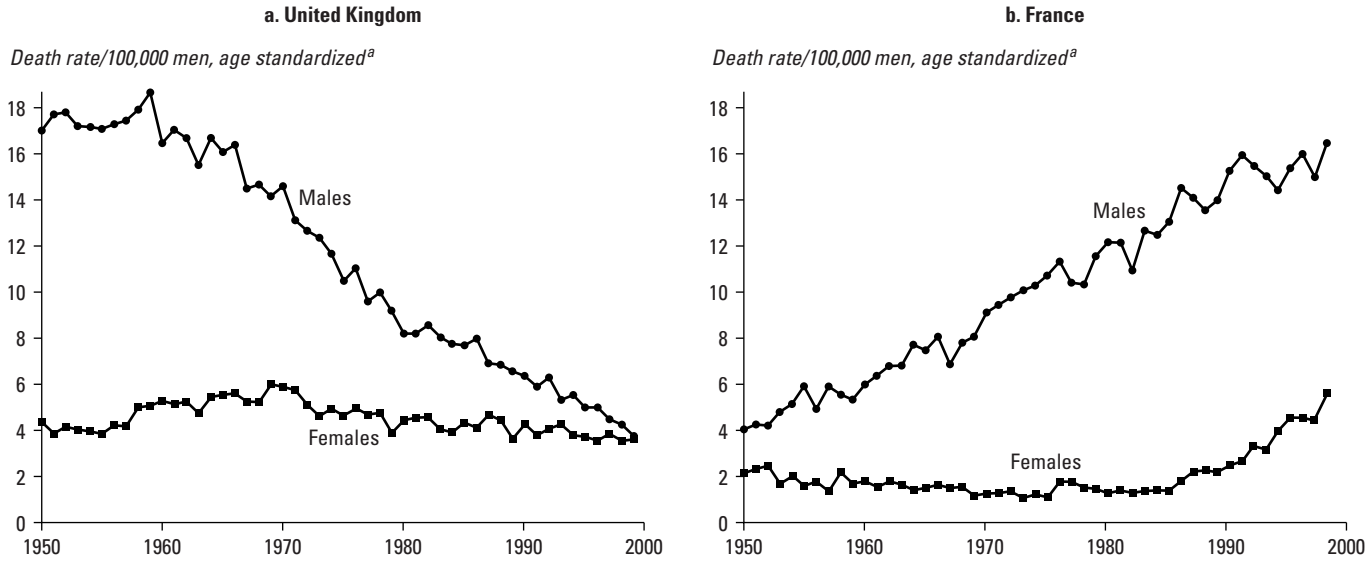
In high-income and former socialist economies with more complete and reliable mortality statistics, one can measure the effects of increased smoking prevalence and subsequent decreases that have been observed among large numbers of adults. These changes are best documented by examining lung cancer mortality rates among young adults because lung cancer is not often misclassified with other causes of death at young ages and it is almost entirely attributable to smoking.

Age-Standardized Lung Cancer Mortality Rates

Age-standardized male lung cancer rates at ages 35 to 44 per 100,000 men in the United Kingdom had fallen from 18 in 1950 to 4 by 2000. In contrast, comparable French male lung cancer rates show the reverse pattern (Peto and others 2003; figure 46.1). In France, the increase in smoking occurred some decades later than in the United Kingdom, and declines in smoking began only after 1990. Similarly, a large increase in female lung cancer at young ages was avoided in the United Kingdom, but female lung cancer at young ages continues to rise in France.

Future increases in tobacco deaths worldwide are expected to arise from increased smoking by males in developing countries and by women worldwide. Such increases are a product of population growth and increased age-specific tobacco mortality rates, the latter relating to both smoking duration and the amount of tobacco smoked. Peto and others (1994) have made the following calculation: if the proportion of young people taking up smoking continues to be about half of men and one-tenth of young women, there will be about 30 million new long-term smokers each year. As previously noted, epidemiological studies in developed and developing countries suggest that half of these smokers will eventually die from smoking. However, if we conservatively assume that "only" about one-third of smokers die as a result of smoking, then smoking will eventually kill about 10 million people a year. Thus, for the 25-year period from 2000 to 2025, there would be about 150 million tobacco deaths, or about 6 million deaths per year on average; from 2025 to 2050, there would be about 300 million tobacco deaths, or about 12 million deaths per year.

Further estimations are more uncertain, but current smoking trends and projected population growth indicate that from 2050 to 2100 there will be an additional 500 million tobacco deaths. These projections for the next three to four decades are comparable to retrospective and early prospective epidemiological studies in China (Liu and others 1998; Niu and others 1998), which suggest that annual tobacco deaths will rise to 1 million before 2010 and to 2 million by 2025, when the young adult smokers of today reach old age. Similarly, results from a large retrospective study in India suggest that 1 million annual deaths can be expected from male smokers by 2025 (V. Gajalakshmi and others 2003). With other populations in Asia, Eastern



Source: Peto and others 2003.

a. Mean of annual rates in component five-year age groups (35–39, 40–44).

Figure 46.1 Changes in Lung Cancer Mortality at Age 35 to 44 in the United Kingdom and France, 1950–99

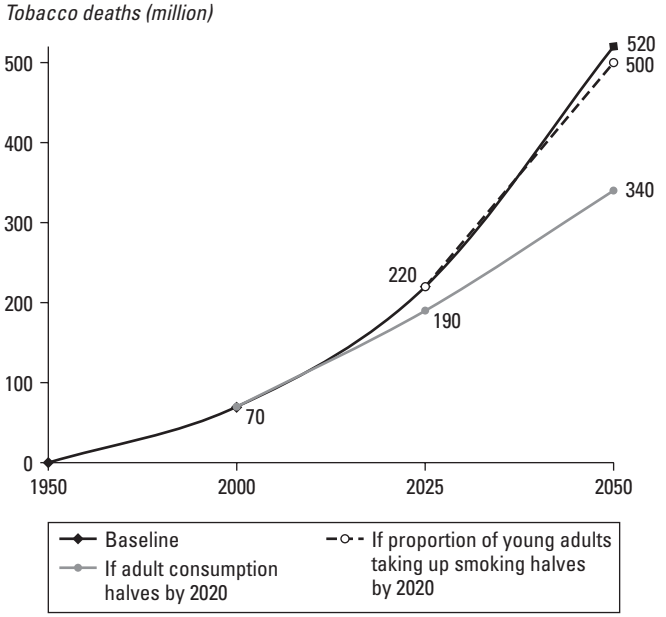
Europe, Latin America, the Middle East, and (less certainly) Sub-Saharan Africa showing similar growth in population and age-specific tobacco death rates, the estimate of some 450 million tobacco deaths over the next five decades appears plausible. Almost all of these deaths will be among current smokers.

Benefits of Cessation

Current tobacco mortality statistics reflect past smoking behavior, given the long delay between the onset of smoking and the development of disease. The prevention of a substantial proportion of these tobacco deaths before 2050 requires adult cessation. For example, halving the per capita adult consumption of tobacco by 2020 (akin to the declines in adult smoking in the United Kingdom) would avert about 180 million tobacco deaths. Continuing to reduce the percentage of children who start to smoke will prevent many deaths, but its main effect will be on mortality rates in 2050 and beyond (figure 46.2; Jha and Chaloupka 2000a; Peto and Lopez 2001).

Substantial evidence indicates that smoking cessation reduces the risk of death from tobacco-related diseases. Among doctors in the United Kingdom, those who quit smoking before the onset of major disease avoided most of the excess hazards of smoking (Doll and others 2004). The benefits of quitting were largest in those who quit before middle age (between ages 25 and 34 years) but were still significant in those who quit later (between ages 45 and 54 years).

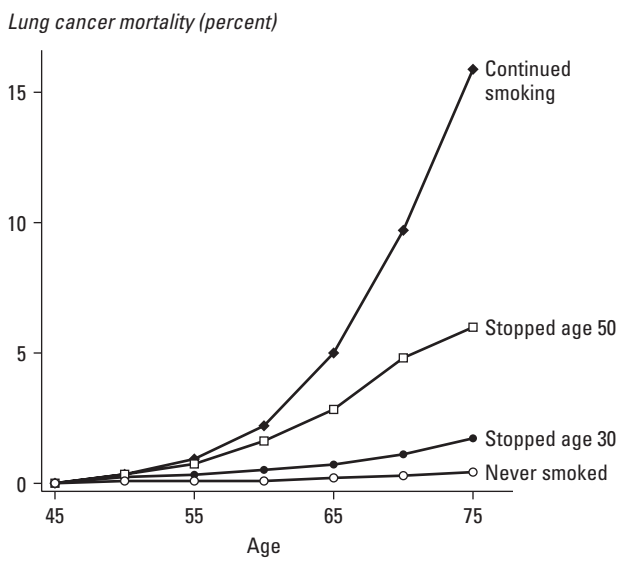
Cessation before middle age avoids more than 90 percent of the lung cancer risk attributable to tobacco, with quitters possessing a pattern of survival similar to that of persons who have never smoked. In the United Kingdom, among those who stopped smoking, the risk of lung cancer fell steeply with time since cessation. For men who stopped at ages 60, 50, 40, and 30, the cumulative risks of lung cancer by age 75 were



Source: Jha and Chaloupka 2000a; Peto and Lopez 2001.

Note: Peto and others (1994) estimate 60 million tobacco deaths between 1950 and 2000 in industrial countries. This figure estimates an additional 10 million tobacco deaths between 1990 and 2000 in developing countries. The figure also assumes no tobacco deaths before 1990 in developing countries and minimal tobacco deaths worldwide before 1950. Projections for deaths from 2000 to 2050 are based on Peto and Lopez (2001).

Figure 46.2 Tobacco Deaths in the Next 50 Years under Current Smoking Patterns



Source: Peto and others 2000.

Figure 46.3 Stopping Works: Cumulative Risk of Lung Cancer Mortality in U.K. Males, 1990 rates

10 percent, 6 percent, 3 percent, and 2 percent, respectively (Peto and others 2000; figure 46.3). These results have been supported by a recent multicenter study of men in four European countries; for men who quit smoking at age 40, the study found that the excess lung cancer risk avoided was 85 percent, 91 percent, and 80 percent in the United Kingdom, Germany, and Italy, respectively (Crispo and others 2004). Smoking cessation is uncommon in most developing countries, but some evidence exists that, among Chinese men, quitting also reduces the risks of total and vascular mortality (Lam and others 2002).

RATIONALE FOR GOVERNMENT INTERVENTION

In addition to the public health burden caused by tobacco, an economic rationale exists for government to intervene to reduce tobacco use:

- Consumers have inadequate information about the health consequences of tobacco use (Jha and others 2000; Warner and others 1995). Specifically, the decision to initiate smoking is made primarily by youths, whose ability to make fully informed, appropriately forward-looking decisions is questioned by society in many different contexts (minimum ages for drinking, driving, and voting, for instance). In industrial countries, about 80 percent of adult smokers begin smoking before age 20. Even if children and young adults have information on future risks, they tend to discount that future risk greatly.
- The addictive nature of tobacco is underappreciated and poorly understood. Although general awareness of risks is better in high-income countries, many people still underestimate tobacco's danger relative to other health risks, and many smokers fail to fully internalize these risks (Weinstein 1998).
- Smokers may impose costs on others from passive tobacco smoke or, more controversially, from higher health care costs (Lightwood and others 2000; Warner 2003).

The reader is referred to more detailed discussions on the welfare economics of tobacco (Barnum 1994; Jha and others 2000; Peck and others 2000; Warner and others 1995; and several background papers in the Disease Control Priorities Project Working Paper Series). We discuss nicotine addiction because this newer evidence has profound implications for explaining smoking behavior and for devising control policies.

Nicotine Addiction

Before the landmark 1988 U.S. Surgeon General's report, which suggested that cigarettes and other forms of tobacco are addictive and that nicotine is the major agent in tobacco responsible for addiction, the prevailing view was that tobacco use was largely a voluntary behavior or personal choice (Koop 2003). Since that time, clinicians, behavioral scientists, researchers, and public health experts have increasingly recognized manufactured tobacco products as some of the most addictive and deadly dependence-producing substances available. Although numerous factors have been identified that can contribute to the reinforcement of the smoking habit—for example, the synergistic and independent effects of other compounds in tobacco smoke (such as tar and acetaldehyde) or the sensory and environmental stimuli associated with smoking (such as tobacco advertising)—little debate exists that nicotine is a significant contributor to the development and maintenance of the smoking habit (Markou and Henningfield 2003). In most aspects of dependence, nicotine is on par with other powerfully addictive drugs, such as heroin and cocaine. Newer evidence has converged on the following key points.

Biological Aspects. Nicotine is a psychoactive drug that triggers a cascade of neurobiological events in the reward areas of the brain and throughout the body that can, in turn, act in concert to reinforce tobacco use (Markou and Henningfield 2003). Even a short-term exposure to nicotine has been shown to induce long-lasting changes of the excitatory input into the brain's reward system, which may be an important early step in the path to addiction (Laviolette and van der Kooy 2004). Notably, in some experimental models, if nicotine's neurobiological effects are blocked pharmacologically, or if nicotine is removed from cigarette smoke, smoking eventually ceases

(Jarvis 2004). The overwhelming property of nicotine that leads to its frequent use is the occurrence of nicotine withdrawal, for which cigarette smoke provides rapid relief. Though each individual differs greatly in his or her sensitivity to nicotine dependence, evidence suggests that most adults are susceptible to the biological effects of nicotine and tobacco (Picciotto 2003).

Psychological Aspects. In addition to the unique neurobiology of nicotine, the ready availability of tobacco influences the uptake of smoking as well as the development and maintenance of dependence. With illicit drugs, legal and social barriers constantly test a user's drive to consume the drug. In contrast, a smoker is presented with nearly ubiquitous opportunities and frequent cues to both purchase and use tobacco because of mass marketing and promotion of tobacco (Shiffman and West 2003). Young people, who are attracted to many risk behaviors, such as fast driving or binge drinking, do not "learn" from early smoking in the way that most young people become safer drivers and moderate drinkers as adults (Jha and others 2000; O'Malley, Bachman, and Johnston 1988).

Economics. The traditional economic formulation of costs and benefits tends not to take into account the unique properties of addiction (see Chaloupka, Tauras, and Grossman 2000 for a review). Newer models have begun to incorporate factors such as lack of information, regret, and addiction itself. One key innovation by Gruber and Koszegi (2001, 2002) permits smokers to be time inconsistent, meaning that, given preferences, smokers would make different decisions at different points in time. This approach, now widely used within the new field of behavioral economics, admits conflict between what smokers would like for themselves today and what they would like for themselves in the future.

Implications for Control Programs. These newer economic models have several implications for control programs. First is the need for much more aggressive tobacco taxation to deter the development of tobacco smoking. Estimates suggest that, in the United States, optimal taxation taking into account smoking initiation and nicotine addiction would be at least US$1 higher per pack (Gruber 2003; Gruber and Koszegi 2002; Gruber and Mullainathan 2002). The second implication is that the usual assumption that higher taxes reduce the welfare or satisfaction of continuing smokers may not be true. Higher taxes enhance welfare by acting like an external control device over the time-inconsistent preferences of smokers, which would reduce the likelihood of smoking initiation.

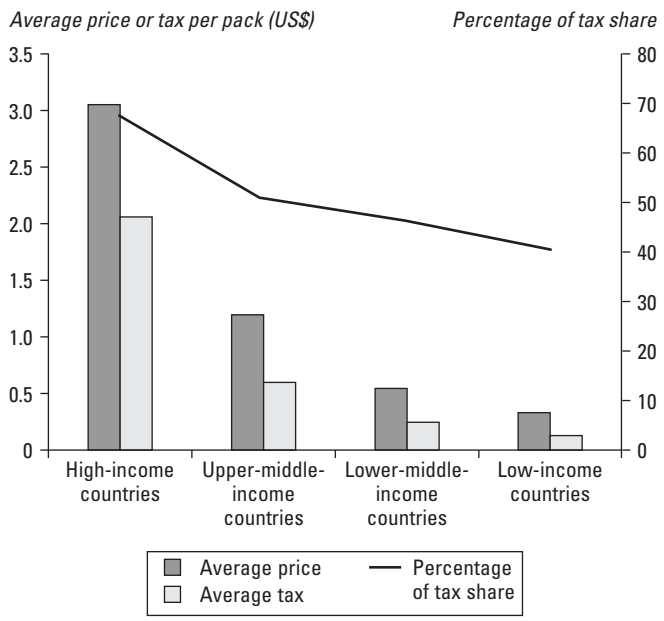
The third implication is that the overall economic benefits of tobacco control, taking into account addiction, are likely to be substantially positive. Earlier cost-benefit analyses have shown that if even modest costs are assigned to uninformed smoking choices, the net economic costs of tobacco are profoundly negative (Barnum 1994; Peck and others 2000). While some of the methods for such costing have been disputed, newer economic evidence supports the idea that widespread hazards of tobacco use lead to major economic costs. Jamison, Lau, and Wang (2005) have outlined that male survival explains income growth independent of changes in physical capital, education, fertility, economic openness, and technical progress. Thus, if adult male survival in the former socialist economies of Europe had been that of high-income countries, annual growth rates over the past three decades would have been about 1.4 percent rather than 1 percent, making 1990 per capita income about 12 percent higher, or an absolute value of US$140 billion. The chief determinant of the mortality gap between the former socialist economies and high-income countries from 1960 to 1990 is smoking (Peto and others 1994; Zatonski and Jha 2000). More recent economic studies that have put a value on "statistical life" suggest that smoking cessation generates huge benefits. For example, Murphy and Topel (2003) find that in the United States, the value of reduced mortality from all causes between 1970 and 1998 amounted to US$2.6 trillion per year, or half of gross domestic product (GDP) growth during the period. Fully US$1.1 trillion per year arose from reduced heart disease, of which at least one-third was from reduced smoking and saturated fat in diets (Cutler and Kadiyala 2003; see chapter 15 for a fuller discussion on the economic benefits of disease control).

INTERVENTIONS TO REDUCE DEMAND FOR TOBACCO

Numerous studies, mostly from high-income countries, have examined the effect of interventions aimed at reducing the demand for tobacco products on smoking and other kinds of tobacco use. The small but growing number of studies from low- and middle-income countries provide useful lessons about differences in the effect of these interventions between these countries and high-income countries. The following is a review of the effect of price and non-price interventions in reducing demand for smoking, including a discussion of each intervention's effect on initiation and cessation. A more complete study of the effectiveness of various interventions is available elsewhere (Jha and Chaloupka 2000b).

Tobacco Taxation

Nearly all governments tax tobacco products. However, significant differences exist across countries in levels of tobacco taxation. Some of these taxes are specific or per unit taxes; others are expressed as a percentage of wholesale or retail prices (ad valorem taxes). As illustrated in figure 46.4, taxes tend to be absolutely higher and account for a greater share of the retail price (two-thirds or more) in high-income countries. In



Source: Authors.

Figure 46.4 Average Cigarette Price, Tax, and Percentage of Tax Share per Pack, by Income Group, 1996

low- and middle-income countries, taxes are generally much lower and account for less than half of the final price of cigarettes. In the United States, federal and state excise taxes on cigarettes were one-third lower, in real terms, in 1995 than their peak level of the mid 1960s. However, taxes rose sharply over the next eight years and stood at US$1.12 per pack as of 2002.

Well over 100 studies from high-income countries clearly demonstrate that increases in taxes on cigarettes and other tobacco products lead to significant reductions in cigarette smoking and other tobacco use (Chaloupka, Hu, and others 2000). These reductions reflect the combination of increased smoking cessation, reduced relapse, lower smoking initiation, and decreased consumption among continuing tobacco users.

Studies from Canada, the United Kingdom, the United States, and many other high-income countries generally estimate that the price elasticity of cigarette demand ranges from −0.25 to −0.50, indicating that a 10 percent increase in cigarette prices will reduce overall cigarette smoking by 2.5 to 5.0 percent (Chaloupka, Hu, and others 2000; U.S. DHHS 2000). Estimates from a limited number of studies from low- and middle-income countries suggest a greater price elasticity of −0.8 in such countries. Recent studies using survey data have concluded that half or more of the effect of price on overall cigarette demand results from reducing the number of current smokers (CDC 1994; Wasserman and others 1991). Higher taxes increase both the number of attempts at quitting smoking and the success of those attempts (Tauras 1999; Tauras and Chaloupka 2003). A study in the United States (Taurus 1999) suggested that a 10 percent increase in price would result in 11 to 13 percent shorter smoking duration or a 3.4 percent higher probability of cessation.

Many recent studies from the United States have used individual-level data to explore differences in the price elasticity of cigarette demand by age, with a particular emphasis on youth and young adults (Chaloupka, Hu, and others 2000; U.S. DHHS 2000). Given that most smoking behavior becomes firmly established during teenage years and young adulthood, interventions that are effective in preventing smoking initiation and the transition to regular, addicted smoking will have significant long-term public health benefits. Estimates from these recent studies conclude that an inverse relationship exists between price elasticity and age, with estimates for youth price elasticity of demand up to three times those obtained for adults (Gruber 2003; Ross, Chaloupka, and Wakefield 2001). Several recent studies have begun to explore the differential effect of cigarette prices on youth smoking uptake, concluding that higher cigarette prices are particularly effective in preventing young smokers from moving beyond experimentation into regular, addicted smoking (Emery, White, and Pierce 2001; Ross, Chaloupka, and Wakefield 2001).

In the United Kingdom and the United States, increases in the price of cigarettes have had the greatest effect on smoking among the lowest-income and least educated populations (CDC 1994; Townsend, Roderick, and Cooper 1998). Furthermore, it was estimated that smokers in U.S. households below median income level are four times more responsive to price increases than smokers in households above median income level. In general, estimates of price elasticity for low- and middle-income countries are about double those estimated for high-income countries, implying that significant increases in tobacco taxes in these countries would be effective in reducing tobacco use.

Restrictions on Smoking

Over the past three decades, as the quantity and quality of information about the health consequences of exposure to passive smoking have increased, many governments, especially in high-income countries, have enacted legislation restricting smoking in a variety of public places and private worksites. In addition, increased awareness of the consequences of passive smoke exposure, particularly to children, has led many workplaces and households to adopt voluntary restrictions on smoking. Although the intent of those restrictions is to reduce nonsmokers' exposure to passive tobacco smoke, the policies also reduce smokers' opportunities to smoke. Additional reductions in smoking, especially among youths, will result from the changes in social norms that are introduced by adopting these policies (U.S. DHHS 1994).

In Western populations, comprehensive restrictions on cigarette smoking have been estimated to reduce population

smoking rates by 5 to 15 percent (see review by Woolery, Asma, and Sharp 2000) and can also lead to changes in social norms regarding smoking behavior, especially among youths. As with higher taxes, these restrictions reduce both the prevalence of smoking and cigarette consumption among current smokers. Smoking bans in workplaces generally reduce the quantity of cigarettes smoked by 5 to 25 percent and reduce prevalence rates by up to 20 percent (Levy, Friend, and Polishchuk 2001). No-smoking policies were most effective when strong social norms against smoking helped make smoking restrictions self-enforcing.

Health Information and Counteradvertising

The 1962 report by the British Royal College of Physicians and the 1964 U.S. Surgeon General's Report were landmark tobacco-control events in high-income countries. These publications resulted in the first widespread press coverage of the scientific links between smoking and lung cancer. The reports were followed, in many countries, by policies requiring health warning labels on tobacco products, which were later extended to tobacco advertising.

Research from high-income countries indicates that these initial reports and the publicity that followed about the health consequences of smoking led to significant reductions in consumption, with initial declines of between 4 and 9 percent and longer-term cumulative declines of 15 to 30 percent (Kenkel and Chen 2000; Townsend 1993). Efforts to disseminate information about the risks of smoking and of other tobacco use in low- and middle-income countries have led to similar declines in tobacco use in those countries (Kenkel and Chen 2000). In addition, mass media antismoking campaigns, in many cases funded by earmarked tobacco taxes, have generated reductions in cigarette smoking and other tobacco use (Kenkel and Chen 2000; Saffer 2000). Decreases in smoking prevalence were largest in Western countries, where the public is constantly and consistently reminded of the dangers of smoking by extensive coverage of issues related to tobacco in the news media (Molarius and others 2001).

In many low- and middle-income countries, a lack of awareness continues to exist about the risks of mortality and disease posed by smoking. For example, a national survey in China in 1996 found that 61 percent of smokers thought that tobacco did them "little or no harm" (Chinese Academy of Preventive Medicine 1997). In high-income countries, smokers are aware of the risks, but a recent review of psychological studies found that few smokers judge the size of these risks to be higher and more established than do nonsmokers, and that smokers minimize the personal relevance of these risks (Weinstein 1998).

Bans on Advertising and Promotion

Cigarettes are among the most heavily advertised and promoted products in the world. In 2002, cigarette companies spent US$12.5 billion on advertising and promotion in the United States alone, the highest spending level reported to date (U.S. Federal Trade Commission 2004). Tobacco advertising efforts worldwide include traditional forms of advertising on television, radio, and billboards and in magazines and newspapers as well as favorable product placement; price-related promotions, such as coupons and multipack discounts; and sponsorship of highly visible sporting and cultural events.

Numerous econometric studies, largely from the United Kingdom and the United States, have explored the relationship between cigarette advertising and promotional expenditure and cigarette demand. In general, these studies have resulted in mixed findings, with most studies concluding that advertising has a small positive effect on demand (Chaloupka, Hu, and others 2000; Townsend 1993). However, critics of these studies note that econometric methods, which estimate the effect of a marginal change in advertising expenditures on smoking, are ill suited for studying the effect of advertising (Chaloupka, Hu, and others 2000; U.S. Federal Trade Commission 2004; Townsend 1993). Approaches used by other disciplines, including survey research and experiments that assess reactions to and recall of cigarette advertising, do support the hypothesis that increases in cigarette advertising and promotion directly and indirectly increase cigarette demand and smoking initiation (U.S. DHHS 1994; U.K. Department of Health 1992). These studies conclude that cigarette advertising is effective in getting and retaining children's attention, with the strength of the association strongly correlated with current smoking behavior, smoking initiation, and smoking intentions.

Comprehensive advertising and promotion bans on cigarettes provide more direct evidence on the effect of advertising these products (Saffer 2000). One study using data from 22 high-income countries for the period 1970 through 1992 provides strong evidence that comprehensive bans on cigarette advertising and promotion led to significant reductions in cigarette smoking. The study predicts that a comprehensive set of tobacco advertising bans in high-income countries could reduce tobacco consumption by more than 6 percent, taking into account price and non-price control interventions (Saffer and Chaloupka 2000). However, the study concludes that partial bans have little effect on smoking behavior, given that the tobacco industry can shift its resources from banned media to other media that are not banned.

Smoking Cessation Treatments

Near-term reductions in smoking-related mortality depend heavily on smoking cessation. Numerous behavioral smoking cessation treatments are available, including self-help manuals, community-based programs, and minimal or intensive clinical interventions (U.S. DHHS 2000). In clinical settings, pharmacological treatments, including nicotine replacement

therapies (NRT) and bupropion, have become much more widely available in recent years in high-income countries through deregulation of some NRT from prescription to over-the-counter status (Novotny and others 2000; U.S. DHHS 2000). The evidence is strong and consistent that pharmacological treatments significantly improve the likelihood of quitting, with success rates two to three times those when pharmacological treatments are not used (Novotny and others 2000; Raw, McNeill, and West 1999; U.S. DHHS 2000). The effectiveness of all commercially available NRT seems to be largely independent of the duration of therapy, the setting in which the therapy is provided, regulatory status (over-the-counter versus prescribed therapy), and the type of provider (Novotny and others 2000). Over-the-counter NRT without physician oversight have been used in many countries for a number of years with good success.

Although NRT are successful in treating nicotine addiction, the markets for NRT and other pharmacological therapies are more highly regulated and less affordable than are nicotine-containing tobacco products. Recent evidence indicates that the demand for NRT is related to economic factors, including price (Tauras and Chaloupka 2003). Policies that decrease the cost of NRT and increase availability—such as mandating private health insurance coverage of NRT, including such coverage in public health insurance programs, and subsidizing NRT for uninsured or underinsured individuals—would likely lead to substantial increases in the use of these products. Given the demonstrated efficacy of NRT in treating smoking, these policies could generate significant increases in smoking cessation.

INTERVENTIONS TO REDUCE THE SUPPLY OF TOBACCO

The key intervention on the supply side is the control of smuggling. Recent estimates suggest that 6 to 8 percent of cigarettes consumed globally are smuggled (Merriman, Yurekli, and Chaloupka 2000). Of note, the tobacco industry itself has an economic incentive to smuggle, in part to increase market share and decrease tax rates (Joossens and others 2000; Merriman, Yurekli, and Chaloupka 2000). Although differences in taxes and prices across countries create a motive for smuggling, a recent analysis comparing the degree of corruption in individual countries with price and tax levels found that corruption within countries is a stronger predictor of smuggling than is price (Merriman, Yurekli, and Chaloupka 2000). Several governments are adopting policies aimed at controlling smuggling. In addition to harmonizing price differentials between countries, effective measures include prominent tax stamps and warning labels in local languages, better methods for tracking cigarettes through the distribution chain, aggressive enforcement of antismuggling laws, and stronger penalties for those caught violating these laws (Joossens and others 2000). Recent analysis suggests that, even in the presence of smuggling, tax increases will reduce consumption and increase revenue (Merriman, Yurekli, and Chaloupka 2000).

In contrast to the effectiveness of demand-side interventions, there is much less evidence that interventions aimed at reducing the supply of tobacco products are as effective in reducing cigarette smoking (Jha and Chaloupka 1999, 2000a). The U.S. experience provides mixed evidence about the effectiveness of limiting youth access to tobacco products in reducing youth tobacco use (U.S. DHHS 2000; Woolery, Asma, and Sharp 2000). In addition, the effective implementation and enforcement of these policies may require infrastructure and resources that do not exist in many low- and middle-income countries. A preliminary discussion is occurring in Canada about reducing its number of retail outlets for tobacco from the current 65,000. Neither the effect of such a move nor its enforcement costs are well known. Crop substitution and diversification programs are often proposed as a means of reducing the supply of tobacco. However, little evidence exists that such programs would significantly reduce the supply of tobacco, given that the incentives for growing tobacco tend to attract new farmers who would replace those who abandon tobacco farming (Jacobs and others 2000). Similarly, direct prohibition of tobacco production is not likely to be politically feasible, effective, or economically optimal. Finally, although trade liberalization has contributed to increases in tobacco use (particularly in low- and middle-income countries), restrictions on trade in tobacco and tobacco products that violate international trade agreements or draw retaliatory measures (or both) may be more harmful (Taylor and others 2000).

EFFECTIVENESS AND COST-EFFECTIVENESS OF TOBACCO-CONTROL INTERVENTIONS

Using a static model of the cohort of smokers alive in 2000, we estimate the number of deaths attributable to smoking over the next few decades that could be averted by (a) price increases, (b) NRT, and (c) a package of non-price interventions other than NRT. Cost-effectiveness of these policy interventions was calculated by weighing the approximate public sector costs against the years of healthy life saved, measured in DALYs. The details of an earlier version of this model have been published previously (Ranson and others 2002).

Results of Model Projections

The following is an updated analysis, using higher price increases and a greater effectiveness for NRT than did the

Table 46.3 Reductions in Future Tobacco Deaths among Smokers Alive in 2000 from Price Increases of 10 Percent, 33 Percent, 50 Percent, and 70 Percent by World Bank Region

World Bank region	Baseline smoking-attributable deaths (millions)	Reduction in number of deaths (millions)							
		10 percent price increase		33 percent price increase		50 percent price increase		70 percent price increase	
		Low	High	Low	High	Low	High	Low	High
East Asia and the Pacific	173	2.9	8.7	9.6	27.5	14.5	37.5	20.3	46.2
(percent)		(1.7)	(5.0)	(5.5)	(15.9)	(8.4)	(21.7)	(11.7)	(26.8)
Europe and Central Asia	51	0.9	2.6	2.8	8.1	4.3	11.2	6.0	13.8
(percent)		(1.7)	(5.1)	(5.6)	(16.0)	(8.5)	(22.0)	(11.8)	(27.2)
Latin America and the Caribbean	40	0.7	2.1	2.3	6.7	3.5	9.5	4.9	11.6
(percent)		(1.8)	(5.3)	(5.8)	(16.8)	(8.8)	(23.7)	(12.3)	(29.1)
Middle East and North Africa	13	0.2	0.7	0.8	2.2	1.2	3.1	1.6	3.8
(percent)		(1.7)	(5.2)	(5.8)	(16.6)	(8.7)	(23.2)	(12.2)	(28.5)
South Asia	62	0.9	2.6	2.9	8.5	4.4	12.5	6.2	16.0
(percent)		(2.4)	(8.6)	(9.5)	(27.7)	(14.3)	(40.6)	(20.1)	(52)
Sub-Saharan Africa	23	0.4	1.1	1.3	3.7	1.9	5.5	2.7	6.6
(percent)		(1.6)	(4.9)	(5.4)	(15.9)	(8.2)	(23.6)	(11.5)	(28.5)
Low- and middle-income countries	362	6.0	17.9	19.7	56.8	29.8	79.2	41.7	98.2
(percent)		(1.6)	(4.9)	(5.4)	(15.7)	(8.2)	(21.9)	(11.5)	(27.1)
High-income countries	81	0.6	2.6	2.1	8.5	3.2	12.2	4.5	16.2
(percent)		(0.8)	(3.2)	(2.6)	(10.6)	(4.0)	(15.1)	(5.6)	(20.0)
World	443	6.6	20.5	21.8	65.3	33.0	91.5	46.2	114.3
(percent)		(1.5)	(4.6)	(4.9)	(14.7)	(7.5)	(20.7)	(10.4)	(25.8)

Source: Authors' calculations.

original (Ranson and others 2002). This analysis is conservative in its assumptions about effectiveness and generous in its assumptions about the costs of tobacco control.

Potential Effect of Price Increases. With a price increase of 33 percent, the model predicts that 22 million to 65 million smoking-attributable deaths will be averted worldwide, which is approximately equivalent to 5 to 15 percent of all smoking-attributable deaths expected among those who smoke in 2000 (see table 46.3). Low- and middle-income countries account for about 90 percent of averted deaths. East Asia and the Pacific alone will account for roughly 40 percent of averted deaths. Total smoking-attributable deaths averted worldwide range from 33 million to 92 million for a 50 percent price increase and 46 million to 114 million for a 70 percent price increase. A 70 percent price increase would avert 10 to 26 percent of all smoking-attributable deaths worldwide.

Of the tobacco-related deaths that would be averted by a price increase, 80 percent would be male, reflecting the higher overall prevalence of smoking in men. The greatest relative effect of a price increase on deaths averted is among younger cohorts. Note that these projections use conservative price increases. In certain countries, such as Poland and South Africa, recent tax increases have doubled the real price of cigarettes (Guindon, Tobin, and Yach 2002).

Potential Effect of Nicotine Replacement Therapies. Provision of NRT with an effectiveness of 1 percent is predicted to result in the avoidance of about 3.5 million smoking-attributable deaths (table 46.4). NRT of 5 percent effectiveness would have about five times the effect. Again, low- and middle-income countries would account for roughly 80 percent of the averted deaths. The relative effect of NRT (of 2.5 percent effectiveness) on deaths averted is 2 to 3 percent among individuals age 15 to 59 and lower among those age 60 and older (results not shown).

Potential Effect of Non-price Interventions Other Than NRT. A package of non-price interventions, other than NRT, that decreases the prevalence of smoking by 2 percent is predicted to prevent about 7 million smoking-attributable deaths (more than 1.6 percent of all smoking-attributable deaths among those who smoked in 2000; see table 46.4). A package of interventions that decreases the prevalence of smoking by 10 percent would have an effect five times greater. Low- and middle-income countries would account for approximately four-fifths

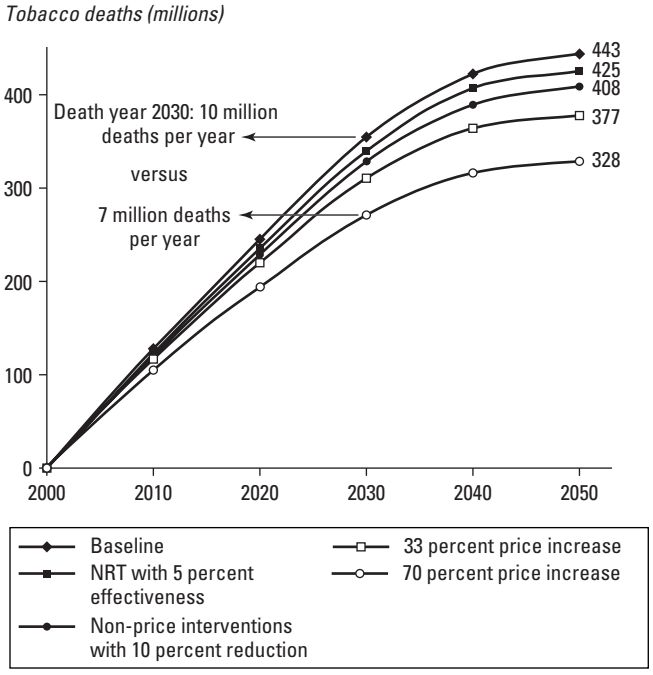
Table 46.4 Reductions in Future Tobacco Deaths among Smokers Alive in 2000 from Price Increases of 33 Percent, Increased NRT Use, and a Package of Non-price Measures by World Bank Region

World Bank region	Baseline smoking-attributable deaths (millions)	Reduction in number of deaths (millions)					
		33 percent price increase		NRT effectiveness		Non-price intervention effectiveness	
		Low elasticity	High elasticity	1 percent	5 percent	2 percent	10 percent
East Asia and the Pacific	173	9.6	27.5	1.4	6.9	2.8	13.8
(percent)		(5.5)	(15.9)	(0.8)	(4.0)	(1.6)	(8.0)
Europe and Central Asia	51	2.8	8.1	0.4	2.1	0.8	4.1
(percent)		(5.6)	(16.0)	(0.8)	(4.0)	(1.6)	(8.1)
Latin America and the Caribbean	40	2.3	6.7	0.3	1.7	0.7	3.4
(percent)		(5.8)	(16.8)	(0.8)	(4.2)	(1.7)	(8.5)
Middle East and North Africa	13	0.8	2.2	0.11	0.6	0.2	1.1
(percent)		(5.8)	(16.6)	(0.8)	(4.2)	(1.7)	(8.4)
South Asia	62	2.9	8.5	0.4	2.2	0.9	4.3
(percent)		(9.5)	(27.7)	(1.4)	(7.2)	(2.8)	(13.9)
Sub-Saharan Africa	23	1.3	3.7	0.2	0.9	0.4	1.8
(percent)		(5.4)	(15.9)	(0.8)	(4.0)	(1.6)	(7.9)
Low- and middle-income countries	362	19.7	56.8	2.9	14.3	5.7	28.6
(percent)		(5.4)	(15.7)	(0.8)	(4.0)	(1.6)	(7.9)
High-income countries	81	2.1	8.5	0.6	3.1	1.2	6.1
(percent)		(2.6)	(10.6)	(0.8)	(3.8)	(1.5)	(7.6)
World	443	21.8	65.3	3.5	17.4	6.9	34.7
(percent)		(4.9)	(14.8)	(0.8)	(3.9)	(1.6)	(7.8)

Source: Authors.

of quitters and averted deaths. The greatest relative effect of non-price interventions on deaths averted would be among younger cohorts.

Figure 46.5 summarizes the potential effect of a set of independent tobacco-control interventions, using 33 and 70 percent price increases (using a high elasticity of −1.2 for low- and middle-income regions and −0.8 for high-income regions), a 5 percent effectiveness of NRT, and a 10 percent reduction from non-price interventions other than NRT. In this cohort of smokers alive in 2000, approximately 443 million are expected to die in the next 50 years in the absence of interventions. A substantial fraction of these tobacco deaths are avoidable with interventions. Price increases have the greatest effect on tobacco mortality, with the most aggressive price increase of 70 percent having the potential to avert almost one-quarter of all tobacco deaths. Even a modest price increase of 33 percent could potentially prevent 66 million tobacco deaths over the course of the next 50 years. Although NRT and other non-price interventions are less effective than price increases, they can still avert a substantial number of tobacco deaths (18 million and 35 million deaths, respectively). The greatest effect of these tobacco-control interventions would occur after 2010, but a substantial number of deaths could be avoided even before then.



Source: Authors.

Note: Price increases assume a high price elasticity (–1.2 for low- and middle-income countries and –0.8 for high-income countries).

Figure 46.5 Potential Effect of Tax Increases, NRT, and Non-price Interventions on Tobacco Mortality, 2000–50

Note that no attempt has been made in this analysis to examine the effect of combining the various packages of interventions (for example, price increases with NRT, or NRT and other non-price interventions). A number of studies have compared the effect of price and non-price interventions; few empirical attempts have been made to assess how these interventions might interact. Although price increases have been found in this analysis to be the most cost-effective antismoking intervention, policy makers should use both price and non-price interventions to counter smoking. Non-price measures may be required to affect the most heavily dependent smokers, for whom medical and social support in stopping will be necessary. Furthermore, these non-price measures may be effective in increasing social acceptance and support of tobacco price increases.

Cost-Effectiveness of Antismoking Interventions. In general, price increases are found to be the most cost-effective antismoking intervention. A 33 percent price increase (our base case scenario) could be achieved for a cost of US$13 to US$195 per DALY saved globally, or US$3 to US$42 in low-income countries and US$85 to US$1,773 in high-income countries. Wider access to NRT could be achieved for between US$75 and US$1,250 per DALY saved, depending on which assumptions are used. Non-price interventions other than NRT could be implemented for between US$233 and US$2,916 per DALY saved (table 46.5). Thus, NRT and other non-price measures are slightly less cost-effective than price increases but remain cost-effective in many settings. The cost-effectiveness of NRT is highly sensitive to the actual price of the NRT. NRT with a price of US$25 have a cost-effectiveness of US$75 per DALY compared with US$329 for an NRT price of US$150 (data not shown).

For a given set of assumptions, the variation in the cost-effectiveness of each intervention between low- and middle-income regions is relatively small and sensitive to the discount rate (data not shown). All three interventions are most cost-effective in South Asia and Sub-Saharan Africa. The difference between low- and middle-income countries and high-income countries is more pronounced. For NRT, the cost per year of healthy life gained is 3 to 10 times higher in high-income countries than elsewhere. For non-price interventions other than NRT, the cost in high-income countries is 22 times higher, and for price increases, almost 42 times higher. Of note, the estimates of cost-effectiveness are given as wide ranges, which reflect the range of assumptions used.

For price increases, the high-end estimates are roughly 25 times the low-end estimates, and this difference is consistent among the regions. For NRT, the high-end estimates are 2.5 to 10 times the low-end estimates, varying among the regions. For non-price interventions other than NRT, the high-end estimates are 20 times the low-end estimates, and this difference is consistent among the regions.

The cost-effectiveness results can be compared against existing studies only for high-income countries because of a lack of studies situated elsewhere. Our estimates of deaths avoided for a 10 percent price increase are conservative compared with those of Moore (1996) and Warner (1986).

Table 46.5 Range of Cost-Effectiveness Values for Price Increase, NRT, and Non-price Interventions, 2000
(2002 U.S. dollars per DALY saved)

World Bank region	Baseline smoking-attributable deaths (millions)	33 percent price increase		NRT with effectiveness of 1 to 5 percent		Non-price interventions with effectiveness of 2 to 10 percent	
		Low-end estimate	High-end estimate	Low-end estimate	High-end estimate	Low-end estimate	High-end estimate
East Asia and the Pacific	173	2	30	65	864	40	498
Europe and Central Asia	51	3	42	45	633	55	685
Latin America and the Caribbean	40	6	85	53	812	109	1,361
Middle East and North Africa	13	6	89	47	750	115	1,432
South Asia	62	2	27	54	716	34	431
Sub-Saharan Africa	23	2	26	42	570	33	417
Low- and middle-income countries	362	3	42	55	761	54	674
High-income countries	81	85	1,773	175	3,781	1,166	14,572
World	443	13	195	75	1,250	233	2,916

Source: Authors.

COMPREHENSIVE TOBACCO-CONTROL PROGRAMS

In recent years, several governments, mostly in high-income countries, have adopted comprehensive programs to reduce tobacco use, often funded by earmarked tobacco tax revenues. The programs generally have similar goals for reducing tobacco use:

- preventing initiation among youths and young adults
- promoting cessation among all smokers
- reducing exposure to passive tobacco smoke
- identifying and eliminating disparities among population subgroups (U.S. DHHS 1994).

Furthermore, the programs have one or more of four key components: community interventions engaging a diverse set of local organizations; countermarketing and health information campaigns; program policies and regulations (such as taxes, restrictions on smoking, bans on tobacco advertising, and access to better cessation treatments); and surveillance and evaluation of potential issues, such as smuggling (U.S. DHHS 1994). Programs have placed differing emphasis on these four components, with substantial diversity among the types of activities supported within each component. Disaggregating current tobacco-control program spending reveals that the greatest effect can be achieved through a focus on macro-level changes, such as policy change. Recent analyses from the United Kingdom and United States clearly indicate that these comprehensive efforts have been successful in reducing tobacco use and in improving public health (Farrelly, Pechacek, and Chaloupka 2003; Townsend, Roderick, and Cooper 1998; U.S. DHHS 1994). In California, for example, the state's comprehensive tobacco-control program has produced a rate of decline in tobacco use double that seen in the rest of the United States.

The cost of implementing control programs is low. Table 46.6 provides the estimated total costs of implementing price and NRT interventions by World Bank region. Current estimates of the costs of implementing a comprehensive tobacco-control program range from US$2.50 to US$10 per capita in the United States. The U.S. Centers for Disease Control and Prevention recommends spending US$6 to US$16 per capita for a comprehensive tobacco-control program in the United States (CDC 1999). Canadian spending on tobacco-control programs was approximately US$1.70 per capita in 1996 (Pechmann, Dixon, and Layne 1998). At the highest recommended spending level (US$16 per capita) in the United States, annual funding for a comprehensive tobacco program would equal only 0.9 percent of U.S. public spending, per capita, on health.

Evidence from the United States demonstrates that states with the greatest prevalence of smoking have a greater marginal effect with their tobacco-control spending, suggesting that the potential gains from modest investments in comprehensive tobacco-control measures are large. Each US$10 spent per capita on tobacco control annually has resulted in a 55 percent reduction (variation of 20 to 70 percent) in per capita cigarette consumption (Tauras and others 2005). In the United States, US$10 translates into 0.03 percent of per capita GDP in 2003.

Table 46.6 Estimated Cost of Price Intervention and NRT Programs
(2002 U.S. dollars)

				Cost of NRT (US$25 to US$150) (millions)					
		Cost for price increase (millions)		To treat 1 percent of current smokers			To treat 5 percent of current smokers		
World Bank region	GDP (billions)	Low-end estimate (0.02 percent GDP)	High-end estimate (0.05 percent GDP)	US$25	US$50	US$150	US$25	US$50	US$150
East Asia and the Pacific	1,802	360	901	1,079	2,158	6,474	5,395	10,791	32,372
Europe and Central Asia	1,136	227	568	318	635	1,906	1,588	3,176	9,529
Latin America and the Caribbean	1,673	335	836	250	500	1,500	1,250	2,500	7,499
Middle East and North Africa	694	139	347	84	169	506	422	843	2,530
South Asia	655	131	327	2,312	1,926	3,853	11,558	2,312	1,926
Sub-Saharan Africa	319	64	159	868	723	1,447	4,340	868	723
Low- and middle-income countries	6,279	1,256	3,138	4,911	6,111	15,686	24,553	20,490	54,579
High-income countries	25,992	5,198	12,996	3,034	2,529	10,114	15,172	3,034	2,529
World	32,271	6,454	16,134	7,945	8,640	25,800	39,725	23,524	57,108

Source: Authors.

CONSTRAINTS TO EFFECTIVE TOBACCO-CONTROL POLICIES

Although substantial evidence exists concerning the effectiveness of numerous policy interventions to reduce tobacco use, the use of these interventions globally is uneven and limited (see a more formal analysis in Chaloupka and others 2001). World Bank data reveal that ample room exists to increase tobacco taxes. In 1995, the average percentage of all government revenue derived from tobacco tax was 0.63 percent. Middle-income countries averaged 0.51 percent of government revenue from tobacco taxes, while lower-income countries averaged only 0.42 percent. An increase in cigarette taxes of 10 percent globally would raise cigarette tax revenues by nearly 7 percent, with relatively larger increases in revenues in high-income countries and smaller increases in revenues in low- and middle-income countries (Sunley, Yurekli, and Chaloupka 2000). Despite this evidence, price increases have been underused. Guindon, Tobin, and Yach (2002) studied 80 countries and found that the real price of tobacco, adjusted for purchasing power, fell in most developing countries from 1990 to 2000.

Why does so much variation exist in tobacco-control policies? The political economy of tobacco control has been inadequately studied. A few plausible areas of interest are outlined here. First, the recognition of tobacco as a major health hazard appears to be the impetus for most of the tobacco-control policies in many high-income countries. Some evidence shows that improved national capacity and local needs assessment could increase the likelihood that tobacco-control measures will be adopted. For example, econometric analyses in South Africa geared to local policy requirements substantially increased the willingness of the government to implement tobacco-control policies (Abedian and others 1998). Second, tobacco-control budgets are only a fraction of what is required. Funding is needed not so much to implement programs as to fight off tobacco industry tactics and to build popular support for control. Third, the most obvious constraint to tobacco control is political opposition, which is difficult to quantify. Opposition from the tobacco industry is well organized and well funded (Pollock 1996).

A key tool for addressing political opposition is earmarking tobacco taxes. Earmarking has been successfully used in several countries, including Australia, Finland, Nepal, and Thailand. Of the 48 countries currently in the World Health Organization's European region, 12 earmark taxes for tobacco control and other public health measures. The average level of allocation is less than 1 percent of total tax revenue (WHO 2002). Earmarking does introduce clear restrictions and inefficiencies on public finance, and for this reason alone most macroeconomists do not favor earmarking, no matter how worthy the cause. However, analysis suggests that the efficiency or "dead-weight losses" from earmarking tobacco taxes are minimal (Hu, Xu, and Keeler 1998). Furthermore, earmarking tobacco taxes can be justified if governments use the funds to benefit those who pay (the *benefits principle*), provide assured funding for tobacco-control policies and programs, and secure public support for new or higher tobacco taxes. Earmarked taxes also have a political function in that they help concentrate political winners of tobacco control and thus influence policy. Earmarked funds that support broad health and social services (such as other disease programs) broaden the political and civil society support base for tobacco control. In Australia, broad political support from the Ministries of Sports and Education helped convince the Ministry of Finance that raising tobacco taxes was possible. Indeed, after an earmarked tax was passed, the Ministry of Finance went on to raise tobacco taxes further without earmarking (Galbally 1997). Additionally, targeting revenue from tobacco taxes to other health programs for the poorest socioeconomic groups could produce double health gains—reduced tobacco consumption combined with increased access to and use of health services. In China, a 10 percent increase in cigarette taxes would decrease consumption by 5 percent and would increase government revenue by 5 percent. The increased earnings could finance a package of essential health services for one-third of China's poorest 100 million citizens in 1990 (Saxenian and McGreevey 1996).

Finally, a key pillar in tobacco control that can help overcome some of these constraints is the Framework Convention on Tobacco Control (FCTC). The World Health Assembly of the World Health Organization adopted the FCTC in May 2003. It consists of a series of negotiated protocols within a general framework. The first three protocols are negotiations covering smuggling, advertising, and treatment of tobacco addiction. Countries agreeing to the negotiated protocols are to adopt appropriate legislation and, if necessary, implement the appropriate measures. As of February 2005, 168 countries had signed the FCTC, 57 had ratified it, and it had come into force on February 27, 2005.

CONCLUSION

Worldwide, only two large and growing causes of death exist. One is HIV-1 infection, and the other is tobacco. On current consumption patterns, about 1 billion people in the 21st century will be killed by their addiction to tobacco. Strong evidence shows that tobacco tax increases, the dissemination of information about health risks from smoking, restrictions on smoking in public places and workplaces, comprehensive bans on advertising and promotion, and increased access to cessation therapies are effective both in reducing tobacco use and in improving the health of populations. Despite this evidence, these policies, especially higher taxes, have been

applied aggressively only in a few high-income countries, covering a small proportion of the world's smokers. Limited implementation of effective tobacco control in developing countries is due to political constraints as well as the lack of awareness of the unique effectiveness and cost-effectiveness of these interventions.

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