

## CHAPTER 2

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# The Health Consequences of Smoking

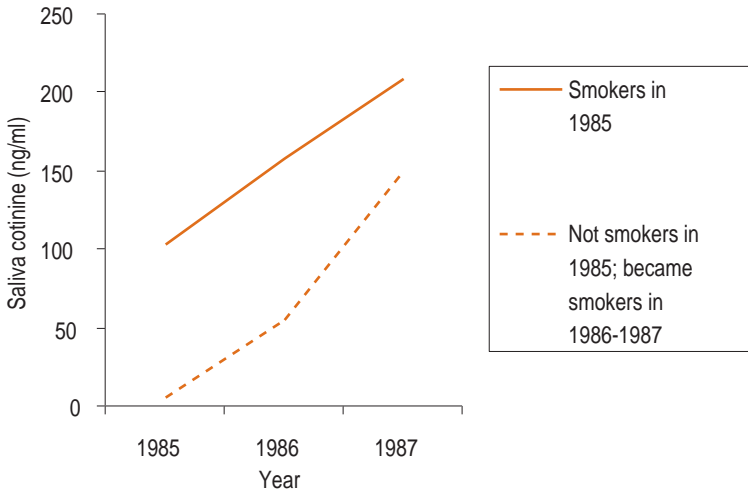
**T**HE impact of tobacco on health has been extensively documented. This report does not seek to repeat this information in detail but simply to summarize the evidence. The section is divided into two parts: first, a brief discussion of nicotine addiction; and second, a description of the disease burden attributable to tobacco.

### The addictive nature of tobacco smoking

Tobacco contains nicotine, a substance that is recognized to be addictive by international medical organizations. Tobacco dependence is listed in the International Classification of Diseases. Nicotine fulfills the key criteria for addiction or dependence, including compulsive use, despite the desire and repeated attempts to quit; psychoactive effects produced by the action of the substance on the brain; and behavior motivated by the “reinforcing” effects of the psychoactive substance. Cigarettes, unlike chewed tobacco, enable nicotine to reach the brain rapidly, within a few seconds of inhaling smoke, and the smoker can regulate the dose puff by puff.

Nicotine addiction can be established quickly. In young adolescents who have recently taken up smoking, saliva concentrations of cotinine, a breakdown product of nicotine, climb steeply over time toward the levels found in established smokers (Figure 2.1). The average levels of nicotine inhaled are sufficient to have a pharmacological effect and to play a role in reinforcing smoking. Yet many young smokers underestimate their risks of becoming addicted. Be-

FIGURE 2.1 NICOTINE INTAKE LEVELS CLIMB RAPIDLY IN YOUNG SMOKERS  
*Saliva concentrations of cotinine in a group of adolescent girls in the United Kingdom*



Source: McNeill, A. D. and others. 1989. "Nicotine Intake in Young Smokers: Longitudinal Study of Saliva Cotinine Concentrations." *American Journal of Public Health* 79(2): 172–75.

tween half and three-quarters of young smokers in the United States say they have tried to quit at least once and failed. Surveys in the high-income countries suggest that a substantial proportion of smokers as young as 16 regret their use of cigarettes but feel unable to stop.

It is of course possible to abstain permanently, as is the case with other addictive substances. However, without cessation interventions, the individual success rates are low. The most recent research concludes that, of regular smokers who try to quit unaided, 98 percent will have started again within a year.

### The disease burden

Within the next year, tobacco is expected to kill approximately 4 million people worldwide. Already, it is responsible for one in 10 adult deaths; by 2030 the figure is expected to be one in six, or 10 million deaths each year—more than any other cause and more than the projected death tolls from pneumonia, diarrheal diseases, tuberculosis, and the complications of childbirth for that year *combined*. If current trends persist, about 500 million people alive today will

eventually be killed by tobacco, half of them in productive middle age, losing 20 to 25 years of life.

Smoking-related deaths, once largely confined to men in the high-income countries, are now spreading to women in high-income countries and men throughout the world (Table 2.1). Whereas in 1990 two out of every three smoking-related deaths were in either the high-income countries or the former socialist states of Eastern Europe and Central Asia, by 2030, seven out of every 10 such deaths will be in low- and middle-income countries. Of the half-billion deaths expected among people alive today, about 100 million will be in Chinese men.

### Long delays between exposure and disease

However, the toll of death and disability from smoking outside the high-income countries has yet to be felt. This is because the diseases caused by smoking can take several decades to develop. Even when smoking is very common in a population, the damage to health may not yet be visible. This point can be most clearly demonstrated by trends in lung cancer in the United States. While the most rapid growth in cigarette consumption in the United States happened between 1915 and 1950, rates of lung cancer did not begin to rise steeply until about 1945. Age-standardized rates of the disease trebled between the 1930s and 1950s, but after 1955 the rates increased much more: by the 1980s, rates were *11-fold* higher than levels in 1940.

In China today, where one-quarter of the world's smokers live, cigarette consumption is as high as it was in the United States in 1950, when per capita consumption levels were reaching their peak. At that stage of the U.S. epidemic, tobacco was responsible for 12 percent of all the nation's deaths in middle age. Forty years later, when cigarette consumption in the United States was already in decline, tobacco was responsible for about *one-third* of the nation's middle-aged deaths. Today, in a striking echo of the U.S. experience, tobacco is estimated to be responsible for about 12 percent of male middle-

TABLE 2.1 CURRENT AND ESTIMATED FUTURE DEATHS FROM TOBACCO (millions per year)

	<i>Number of tobacco deaths in 2000</i>	<i>Number of tobacco deaths projected for 2030</i>
Developed	2	3
Developing	2	7

*Source:* World Health Organization. 1999. *Making a Difference*. World Health Report. 1999. Geneva, Switzerland.

aged deaths in China. Researchers expect that within a few decades, the proportion there will rise to about one in three, as it did in the United States. In contrast, smoking among young Chinese women has not increased markedly in the past two decades, and most of those women who do smoke are older. Thus, on current smoking patterns, female tobacco-attributable deaths in China may actually drop from their current level of about 2 percent of the total to less than 1 percent.

Even in the high-income countries whose populations have been exposed to smoking for many decades, a clear picture of tobacco-related diseases has taken at least 40 years to emerge. Researchers calculate the excess risk of death in smokers through prospective studies that compare the health outcomes of smokers and nonsmokers. After 20 years of follow-up, in the early 1970s, researchers believed that smokers faced a one-in-four risk of being killed by tobacco, but now, with more data, they believe that the risk is one in two.

### How smoking kills

In the high-income countries, long-term prospective studies such as the American Cancer Society's Second Cancer Prevention study, which followed more than 1 million U.S. adults, have provided reliable evidence of how smoking kills. Smokers in the United States are 20 times more likely to die of lung cancer in middle age than nonsmokers and three times more likely to die in middle age of vascular diseases, including heart attacks, strokes, and other diseases of the arteries or veins. Because ischemic heart disease is common in high-income countries, the smoker's excess risk translates into a very large number of deaths, making heart disease the most common smoking-related cause of death in these countries. Smoking is also the leading cause of chronic bronchitis and emphysema. It is associated with cancers of various other organs, including the bladder, kidney, larynx, mouth, pancreas, and stomach.

A person's risk of developing lung cancer is affected more strongly by the amount of time that they have been a smoker than by the number of cigarettes they have smoked daily. Put differently, a threefold increase in the duration of smoking is associated with a 100-fold risk of lung cancer, whereas a threefold increase in the number of cigarettes smoked each day is associated with only a threefold risk of lung cancer. Thus those who start to smoke in their teens and who continue face the biggest risks.

For some years, cigarette manufacturers have marketed certain brands as "low tar" and "low nicotine," a modification that many smokers believe makes cigarettes safer. However, the difference in the risk of premature death for smokers of low-tar or low-nicotine brands compared with smokers of ordinary cigarettes is far less than the difference in risk between nonsmokers and smokers.

## The epidemic varies in place as well as in time

Because most long-term studies have been confined to the high-income countries, data on the health effects of tobacco elsewhere have been scant. However, recent major studies from China, and emerging studies from India, indicate that although the overall risks of persistent smoking are about as great as in high-income countries such as the United States and the United Kingdom, the pattern of smoking-related diseases in these nations is substantially different. The data from China suggest that deaths from ischemic heart disease make up a much smaller proportion of the total number of deaths caused by tobacco than in the West, while respiratory diseases and cancers account for most of the deaths. Strikingly, a significant minority involve tuberculosis. Other differences may emerge in other populations; for instance, in South Asia, the pattern may be affected by a high underlying prevalence of cardiovascular disease. These results underscore the importance of monitoring the epidemic in all regions. Nevertheless, despite the different patterns of smoking-related disease in different populations, it appears that the overall *proportion* who are eventually killed by persistent cigarette smoking is generally about one in two in many populations.

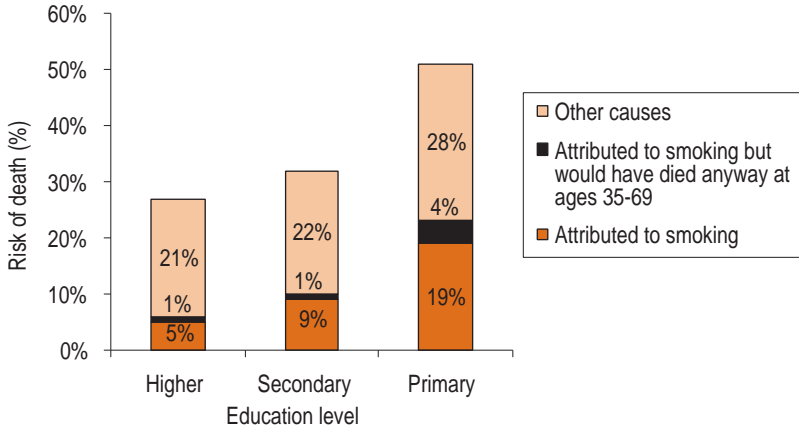
## Smoking and the health disadvantage of the poor

As tobacco use is associated with poverty and low socioeconomic status, so are its damaging effects on health. Analyses for this report show the impact of smoking on the survival of men in different socioeconomic groups (measured by income, social class, or educational level) in four countries where the smoking epidemic is mature—Canada, Poland, the United Kingdom, and the United States.

In Poland in 1996 men with a university education had a 26 percent risk of death in middle age. For men with only primary-level education, the risk was 52 percent—twice as great. By analyzing the proportion of deaths due to smoking in each group, researchers estimate that tobacco is responsible for about two-thirds of the *excess* risk in the group with only primary-level education. In other words, if smoking were eliminated, the survival gap between the two groups would narrow sharply. The risk of death in middle age would fall to 28 percent in men with only primary-level education and 20 percent in those with university education (Figure 2.2). Similar results emerge from the other countries in the study, indicating that tobacco is responsible for more than half of the difference in adult male mortality between those of highest and lowest socioeconomic status in these countries. Smoking has also contributed heavily to the widening of the survival gap over time between affluent and disadvantaged men in these countries (Figure 2.3).

FIGURE 2.2 EDUCATION AND THE RISK OF SMOKING-ATTRIBUTABLE DEATH

Deaths in middle-aged males of different education levels, Poland 1996



Note: Numbers have been rounded.

Source: Bobak, Martin, P. Jha, M. Jarvis, and S. Nguyen. *Poverty and Tobacco*. Background paper.

## The risks from others' smoke

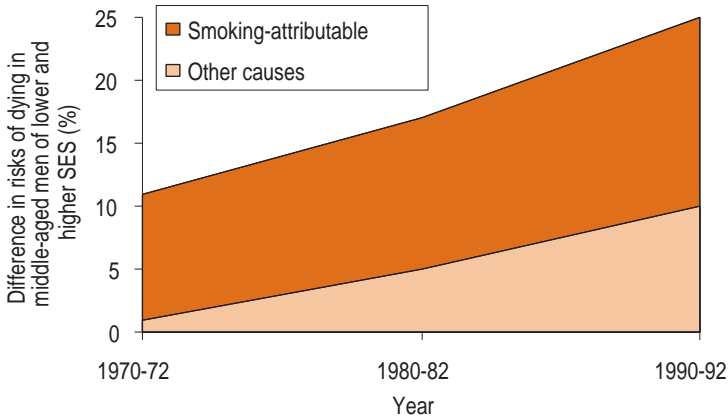
Smokers affect not only their own health but the health of those around them. Women who smoke during pregnancy are more likely to lose the fetus through spontaneous abortion. Babies born to smoking mothers in high-income countries are significantly more likely than the babies of nonsmokers to have a low birth weight and up to 35 percent more likely to die in infancy. They also face higher risks of respiratory disease. Recent research has shown that a carcinogen found only in tobacco smoke is present in the urine of newborn babies born to smokers.

Cigarette smoking accounts for much of the health disadvantage of babies born to poorer women. Among white women in the United States, smoking alone has been found to be responsible for 63 percent of the difference in birth weight between babies born to college-educated women and babies born to those who received a high school education or less.

Adults exposed chronically to others' tobacco smoke also face small but real risks of lung cancer and higher risks of cardiovascular disease,

FIGURE 2.3 SMOKING AND THE WIDENING HEALTH GAP BETWEEN THE RICH AND THE POOR

*Smoking and difference in the risks of death in middle-aged men between higher and lower socioeconomic status (SES) in the United Kingdom*



Note: In the U.K., socioeconomic status is categorized into five groups from I (the highest) to V (the lowest). This figure examines the difference in the risks of dying among middle-aged men of groups I and II versus group V over time.

Source: Bobak, Martin, P. Jha, M. Jarvis, and S. Nguyen. *Poverty and Tobacco*. Background paper.

while the children of smokers suffer a range of health problems and functional limitations.

Nonsmokers who are exposed to smoke include the children and the spouses of smokers, mostly within their own homes. Also, a substantial number of nonsmokers work with smokers, or in smoky environments, where their exposure over time is significant.

### Quitting works

The earlier a smoker starts, the greater the risk of disabling illnesses. In high-income countries with long-term data, researchers have concluded that smokers who start early and smoke regularly are much more likely to develop lung cancer than smokers who quit while they are still young. In the United Kingdom, male doctors who stop smoking before the age of 35 survive about as well as those who never smoked. Those who quit between

the ages of 35 and 44 also gain substantial benefits, and there are benefits at older ages, too.

In sum, then, the epidemic of smoking-related disease is expanding from its original focus in men in high-income countries to affect women in high-income countries and men in low- and middle-income countries. Smoking is increasingly associated with social disadvantage, as measured by income and educational levels. Most new smokers underestimate the risk of becoming addicted to nicotine; by early adulthood, many regret starting to smoke and feel unable to stop. Half of long-term smokers will eventually be killed by tobacco, and half of these will die in middle age.