3
Poverty and smoking

Martin Bobak, Prabhat Jha, Son Nguyen, and Martin Jarvis

This chapter examines the association between poverty and tobacco use. It provides a comprehensive review of the data on smoking prevalence and consumption levels in different socio-economic groups, both within individual countries and internationally. It finds that smoking is more common among poor men (variously defined by income, education, occupation, or social class) than rich men in nearly all countries. In high-income countries, the social gradients of smoking are clearly established for men: smoking has been widespread for several decades, and smoking-attributable mortality can be measured reliably. Analyses of smoking-attributable mortality in middle age (defined as ages 35–69) in Canada, England and Wales, Poland, and the United States reveal that smoking is responsible for most of the excess mortality of poor men in these countries. For women, the situation is more variable, partly reflecting the more recent onset of mass smoking by women in certain parts of the world. Why poor people smoke more remains a complex question that requires further research.

3.1 Introduction

Poverty is a major determinant of premature mortality and ill health. International comparisons show a strong association between economic indicators such as gross domestic product (GDP) and life expectancy (World Bank 1993). Within individual countries for which data exist, lower socio-economic groups experience higher rates of death from most diseases, at any given age, than affluent groups. Poverty affects health through numerous intermediate factors. Most of the major proximal causes of ill health (such as poor water and sanitation, certain sexual behaviors, or poor nutrition) are strongly related to poverty (Marmot and Bobak, in press).

In addition to absolute poverty, seen in most low-income countries and in some middle-income countries, we consider relative poverty—often called relative deprivation—in which an individual is poorer than others in the social hierarchy. Relative poverty is also strongly associated with mortality and other adverse health outcomes in middle-income and high-income countries. For example, in a study of British civil servants, the risk of death gradually increases with decreasing employment grade, despite the fact that no civil servants live in poverty (Rose and Marmot 1981). In high-income countries where absolute poverty is not common, relative poverty is thought to contribute to the social gradient in health (Wilkinson 1996).

An important goal of health policy for many governments in developing and developed countries, and for international agencies, is to reduce inequalities in

health between the rich and the poor (World Bank 1997). In this volume (Chapter 2), Gajalakshmi *et al.* describe trends in tobacco use and tobacco-related disease and death worldwide. Here, we consider the consequences of tobacco use specifically on the poor, focusing on the adverse health effects. There are also many economic consequences of smoking on the poor, such as reduced production and earnings, and effects on investment and consumption, insurance, and labour, but data on these are scantier than even the limited data on health effects reviewed here. The reader is referred to a general discussion on the economic consequences of adult health and disease (Over *et al.* 1992) The chapter reviews the data on smoking prevalence by socio-economic group, between and within countries and over time. Differences in tobacco consumption levels between socio-economic groups are also discussed. The review then examines the evidence from developed countries that tobacco is responsible for much of the excess risk of premature death in lower socio-economic groups. It closes with a short discussion of the possible reasons why the poor smoke more than the rich. It concludes that the adverse health consequences of tobacco use are concentrated more heavily on the poor, and that smoking may be contributing to the widening mortality gap between the rich and the poor in developed countries. The policy implications are complex and are discussed in more detail by Jha *et al.* in Chapter 7.

3.2 Data sources and definitions

Standardized data on smoking prevalence, smoking-attributable mortality, and tobacco expenditure do not exist for all countries. Data for this review were obtained from various sources, often with non-comparable measures for smoking, mortality, or socio-economic class.

3.2.1 Data for smoking prevalence and consumption levels

These data were derived from 89 studies compiled by the World Health Organization (WHO 1997) and others, and used to estimate smoking prevalence, by gender, for each of the seven World Bank regions for 1995 (see Appendix 2 for a list of these regions and Appendix 3 for definitions). In most of these studies, the assessments of smoking prevalence were based on the number of people who reported smoking daily, and excluded others such as occasional smokers. Wherever possible this review, likewise, refers to daily smokers. The definitions of socio-economic class vary between studies: some used education levels, others used occupation, and still others used income levels. These definitions are not comparable in every country, but are correlated with each other and have been used interchangeably in previous studies of poverty and health. For the purposes of this review such data were used to assess the prevalence of smoking in rich and poor groups within countries, and the relative differences between these groups. Additional data on smoking prevalence were obtained from literature searches and contact with researchers. Many of these additional data were restricted to selected groups within populations, such as the poor.

3.2.2 Data on smoking and mortality

These were obtained largely from a review of smoking-attributable mortality in Canada, England and Wales, Poland, and the United States (Jha *et al.*, in press). Data

on mortality by socio-economic class, age, and gender were obtained for these countries. Estimates of the overall risk of death due to smoking in middle age (defined as ages 35–69) were derived using a measure known as the smoking impact ratio (Peto *et al.* 1992, 1994). This method first calculates absolute lung cancer rates (excluding lung cancer not caused by smoking) in any one population, such as Canadian males. The absolute lung cancer rates are used to approximate the proportion due to tobacco of deaths from various other diseases, such as cancers other than lung cancer, vascular and respiratory disease, and othe causes. The proportions are estimated from a prospective study of 1 million Americans conducted in the 1980s (Garfinkel 1985).

3.3 Findings

In this section, we discuss the distribution of smoking across socio-economic groups.

3.3.1 Smoking prevalence in men with low incomes

Gajalakshmi *et al.* (Chapter 2) describe smoking prevalence in men and women by region, and note that the rates among men in low-income and middle-income countries are higher than in high-income countries. The overall smoking prevalence among men in 1995 was 49% in low-income and middle-income countries, while it was 38% in high-income countries. Further data support these findings and show in greater detail the strong inverse relationship between socio-economic status and male smoking prevalence: in 29 countries with data on smoking prevalence, 50% or more of men smoked in 1995. Of these, 22 are low-income or middle-income countries (Table 3.1). Other studies confirm the finding for males. In the WHO MONICA Project (WHO 1989), which collected data on cardiovascular risk factors in 27 populations, mainly in high-income and middle-income countries, the prevalence of smoking among men was higher in the middle-income, former socialist economies of Europe than in the high-income countries. However, this pattern was apparent only for male smoking. In 1995, smoking prevalence among women was 10% in low-income and middle-income countries overall, and 22% in high-income countries. But, while female smoking has remained comparatively rare outside the high-income countries, levels vary sharply between regions. In Latin America and the Caribbean, and Eastern Europe and Central Asia, female smoking prevalence, at 21% and 26%, respectively, was similar to that in high-income countries.

3.3.2 International comparisons of the smoking prevalence 'gradient' between socio-economic groups

Figure 3.1 describes the ratio of smoking prevalence between the lowest and highest socio-economic groups in an analysis of 74 studies from 41 countries. A total of 13, 25, and 36 studies were included for low-income, middle-income, and high-income countries, respectively. Socio-economic group was variously defined on the basis of either income, education, or profession. In total, the studies reveal that differences in smoking

Table 3.1 Estimated smoking prevalence among men, selected countries

Income group	Country	Smoking prevalence (%)
Low-income	Cambodia	80
	Vietnam	73
	China	63
	Bangladesh	60
	Sri Lanka	55
Lower-middle income	Latvia	67
	Russian Federation	67
	Dominican Republic	66
	Tonga	65
	Turkey	63
	Fiji	59
	Tunisia	58
	Panama	56
	Algeria	53
	Indonesia	53
	Samoa	53
	Estonia	52
	Lithuania	52
	Bolivia	50
Upper- middle income	Saudi Arabia	53
	South Africa	52
	Seychelles	51
	Poland	51
High-income	Korea, Rep.	68
	Japan	59
	Kuwait	52

Sources: WHO 1997; Jenkins *et al.* 1997; Chinese Academy of Preventive Medicine 1997.

prevalence between poor and rich groups are greater in low-income countries than those in high-income countries. Using education as a marker for socio-economic status, a regression of this ratio of smoking prevalence between high- and low-education groups to a log of 1994 gross domestic product (GDP) per capita (in constant 1987 dollars) is significant ($y = -0.4177x + 5.4931$, R squared of 0.348).

As Kenkel and Chen (Chapter 8) discuss, levels of information on the hazards of smoking are highest in rich countries. Moreover, several studies indicate that the rich in any country are more likely to make use of health-related information than the poor. Thus our finding that there are greater differences in smoking prevalence between rich and poor groups in low-income countries than in high-income countries is unexpected. The results could represent bias, since studies among low-income countries are fewer and may not be based on representative samples.

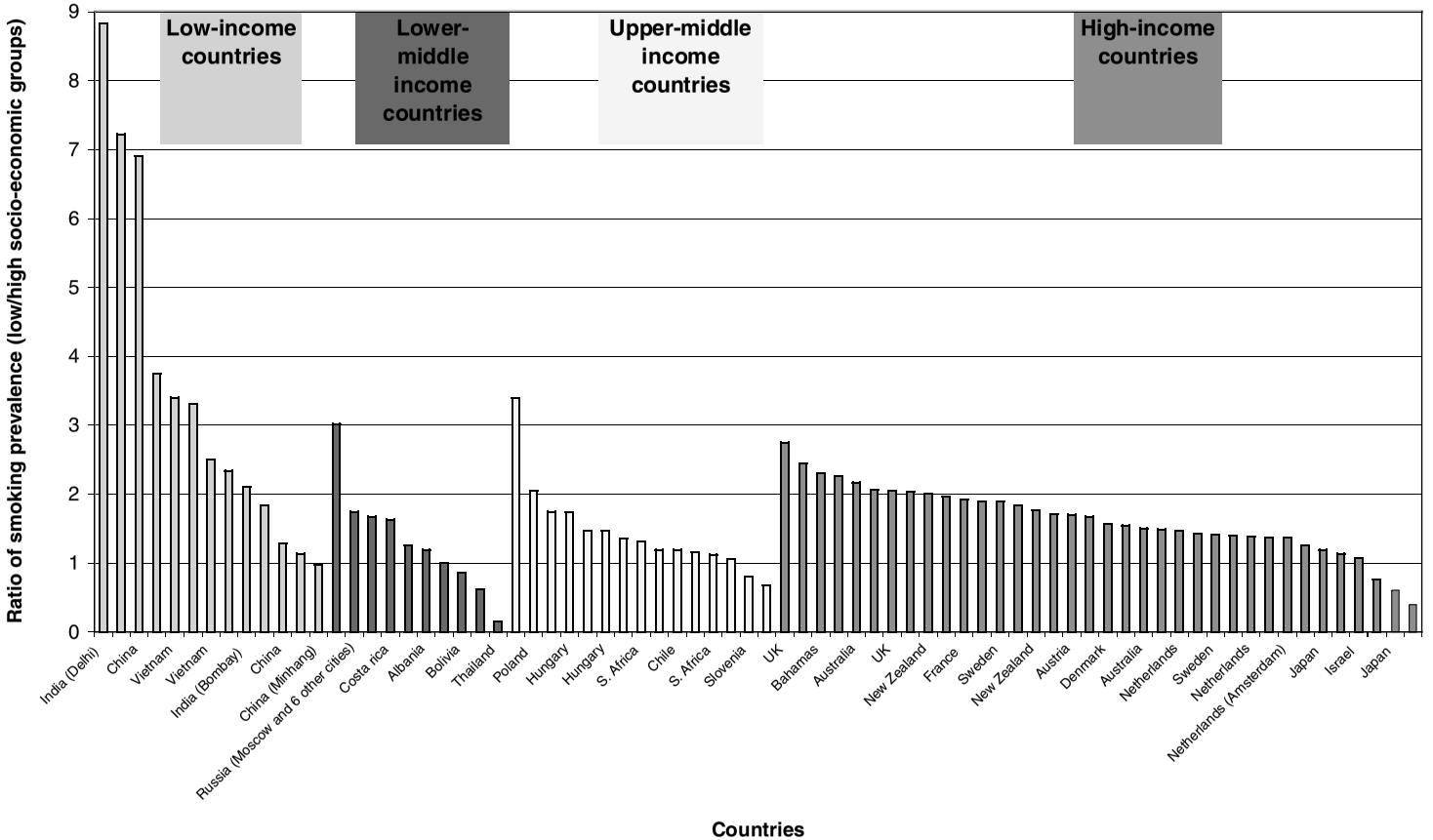

Fig. 3.1 Smoking prevalence in the highest and lowest socio-economic groups, expressed as a ratio, in various countries during the 1980s to 1990s. Source: authors' calculations, based on WHO's unpublished data; Gupta 1996; Narayan *et al.* 1996; Chinese Academy of Preventive Medicine 1997; Gong *et al.* 1995; Zatonski 1996; Hungary Central Statistics Office 1994; Yach *et al.* 1992; European Commission 1996; MarketFile 1998; CDC 1997.

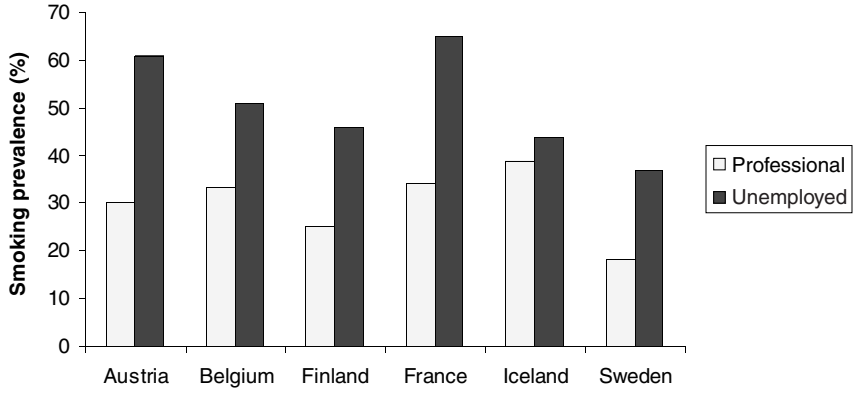

Fig. 3.2 Smoking prevalence among professional and unemployed males in six European countries in the 1990s. Source: European Commission 1994.

3.3.3 Smoking prevalence by socio-economic group within countries

Given the great variation in smoking prevalence between countries, closer scrutiny of studies *within* countries is likely to be informative.

Current prevalence patterns in high-income countries

In high-income countries, the prevalence of smoking is closely and inversely associated with socio-economic status. In the United Kingdom, for instance, only 10% of women and 12% of men in the highest socio-economic group are smokers; in the lowest socio-economic groups the corresponding figures are three-fold greater: 35% and 40% (UK Department of Health 1998). The same inverse relationship is found between education levels and smoking. The pattern and magnitude of the differences was identical in men and women (Wardle *et al.* 1998). A striking feature is that smoking prevalence follows a continuous upward gradient from high to low socio-economic groups. Among British civil servants, the prevalence of smoking falls with each successive employment grade (Marmot *et al.* 1991). The situation is similar in most high-income countries. Figures 3.2 and 3.3 show that the prevalence of smoking is consistently higher in unemployed people than among professionals, in both men and women, in several European countries.

The same relationship is found between education levels and smoking. In the United States, educational status also predicts differences in smoking prevalence more consistently than income, sex, or race (Pamuk *et al.* 1998).

Current smoking patterns in the former socialist economies

The association between socio-economic status and tobacco in the former socialist economies is more complex than in western countries. This may be due to different development in the post-war period and, to a smaller extent, the recent economic

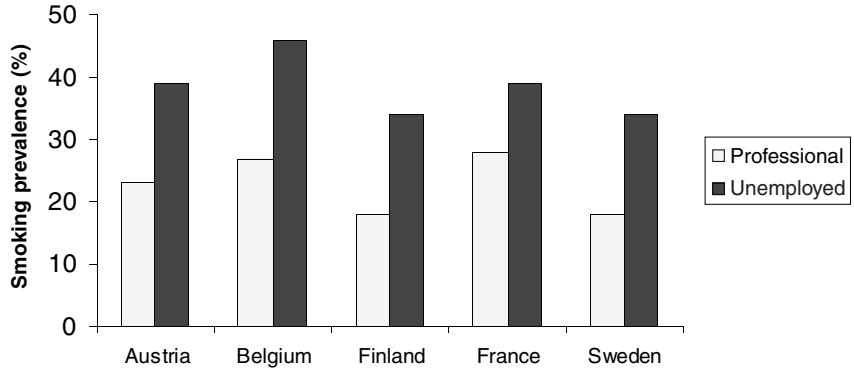

Fig. 3.3 Smoking prevalence among professional and unemployed females in five Euro pean countries in the 1990s. Source: European Commission 1994.

Table 3.2 Smoking prevalence by education level in four Central and Eastern European countries in men during the late 1980s

Age group	Education	Czech	Hungary	Poland: Warsaw (urban)	Poland Tarnobrzeg (rural)	Lithuania
35–44	Primary	51	49	71	66	50
	Secondary	44	35	61	55	56
	University	44	36	49	21	33
45–54.	Primary	47	37	61	62	49
	Secondary	34	22	54	72	37
	University	32	33	33	41	26

Source: WHO 1989.

upheaval in these countries. An analysis of data from Poland, Hungary, the Czech Republic, and Lithuania, collected by the WHO MONICA Project in the late 1980s, shows that the prevalence of smoking was higher among men with lower levels of education than with higher levels of education (Table 3.2). Among women, however, the educational gradient differed by age group. Among younger women, the prevalence of smoking was higher in those with lower education. By contrast, in older age groups, the prevalence increased with higher education (Table 3.3). It is interesting that during the economic transition, differences in smoking prevalence according to educational level increased in the Czech Republic (Bobak *et al.* 1997). This trend was particularly pronounced among women, where an increase in smoking prevalence was recorded among those with the lowest education. In multi-factorial analysis, education was the most prominent predictor of smoking, while material circumstances were less important (Bobak *et al.* 1999).

Table 3.3 Smoking prevalence (%) by education level in four Central and Eastern European countries in women during the late 1980s

Age group	Education	Czech Rep.	Hungary	Poland Warsaw (urban)	Poland Tarnobrzeg (rural)	Lithuania
35–44	Primary	37	42	60	11	<1
	Secondary	30	42	54	35	8
	University	22	28	41	30	8
45–54	Primary	17	19	34	6	5
	Secondary	25	29	36	23	5
	University	57	33	21	14	5

Source: WHO 1989.

The situation is different in Russia. A survey in a national sample of the Russian population in 1996 (McKee *et al.* 1998) showed that there was no apparent association between smoking and either education or income among men. Interestingly, material deprivation (measured as not having enough money to buy food, clothes, or fuel) was positively related to smoking prevalence. Intriguing and potentially important are the differences between men and women. First, smoking prevalence was generally lower in women than in men. The same was found in the Lithuanian MONICA study. Second, there was a strong age effect, possibly a cohort effect. Smoking prevalence was five times higher in young women than in those aged over 55 years. Third, smoking prevalence was three times higher in urban than in rural women.

Current patterns in other middle-income and low-income countries

Studies of smoking prevalence in developing countries are fewer and their results are more often mixed, depending on the type of population studied. In some low-income and middle-income countries, smoking was reported to be more prevalent among the more affluent (Gunther *et al.* 1988; Strebel *et al.* 1989; Taylor *et al.* 1996); this contrasts with the gradient seen in high-income countries. On the other hand, many studies in low-income countries, particularly in more recent years, found a social gradient similar to that of Western countries (Siegrist *et al.* 1990; Chung *et al.* 1993; Duncan *et al.* 1993; Gupta *et al.* 1994). Tobacco use is now more prevalent among the poor in India, China, Brazil, Mexico, Vietnam, Guatemala, Poland, Hungary, South Africa, and Costa Rica (Table 3.4). Figure 3.4, for example, shows education level to be a strong determinant of smoking in Chennai, India (Gajalaksmi and Peto 1997). Much depends on the study population used. A collaborative study by the International Clinical Epidemiology Network (INCLEN) examined prevalence of risk factors by socio-economic status in 12 centers in seven middle-income and low-income income countries (Noguiera *et al.* 1994). In each center, the study population was 200 middle-aged men drawn at random within the locality (not designed to be necessarily representative of the general population). Smoking prevalence was positively (but not significantly) related to education in three populations: Sao Paulo, Brazil; and Santiago and Temuco, both in Chile.

Table 3.4 Gradient in smoking prevalence between high and low socio-economic groups, various countries

Place (reference)	Difference in smoking prevalence	Comparisons
India (Delhi) (Narayan *et al.* 1996)	8.8-fold	Skilled and unskilled workers vs. professionals, supervisors and officers.
India (Bombay) (Gupta 1996)	7.2-fold	Illiterate vs. college.
China (Chinese Academy of Preventive Medicine 1997)	6.9	No schooling vs. college and above (females).
Brazil (World Bank 1990)	5.0-fold	Uneducated vs. secondary schooled adults.
Mexico (WHO unpublished data)	3.4-fold	Workers vs. professionals.
Vietnam (Jenkins *et al.* 1997)	3.4-fold	Less than 5 years vs. more than 16 years of schooling.
Guatemala (WHO unpublished data)	3.0-fold	Unskilled worker vs. skilled worker.
Vietnam (Jenkins *et al.* 1997)	2.5-fold	Peasant vs. white collar.
Poland (Zatonski 1996)	2.1-fold	Unskilled workers vs. white collar.
Cuba (WHO unpublished data)	1.7-fold	Agriculture and industrial worker vs. professional.
South Africa (Yach *et al*. 1992)	1.7-fold	Completed 6 years of schooling vs. completed 6 years of university.
Hungary (Hungary Central Statistics Office 1994)	1.7-fold	High school vs. college and university education.
Costa Rica (WHO unpublished data)	1.6-fold	Technical worker vs. professional.

Source: authors' calculations from various studies.

It was inversely related to education (the so-called 'Western pattern') in five populations: Bogota, Colombia; Chengdu and Shanghai, both in China; and Khon Kaen and Sonkia, both in Thailand.The relationship was flat in the remaining four centers: Rio de Janeiro, Brazil; Bangkok, Thailand; Manila, Philippines; and Yogyakarta, Indonesia. Smoking tends to be more common in urban areas (Strebel *et al*. 1989; Swai *et al*. 1993),

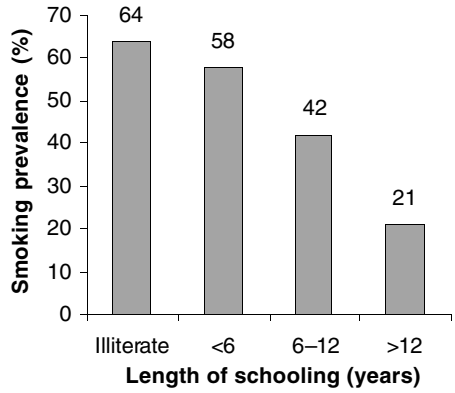

Fig. 3.4 Smoking prevalence among men in Chennai, India, by educational level. Source: Gajalakshmi and Peto 1997.

partly because of higher income levels and higher levels of tobacco promotion. Finally, when several indicators of social position are available, the inverse gradient is often pronounced along the educational axis, but less closely related to material deprivation (Chung *et al*. 1993; Duncan *et al*. 1993).

3.3.4 Trends over time

Reliable data on trends in smoking prevalence in different socio-economic groups are available only for high-income countries. In most of these countries, socio-economic differences in smoking have been increasing in recent decades. In Norway, smoking prevalence among high-income and low-income men, respectively, was 75% and 60% in 1955; by 1990, the rates had fallen to 28% and 40%, respectively (Lund *et al*. 1995) (Fig. 3.5), and smoking had become more prevalent among poorer men than among richer men. Thus the rich were the first to pick up the smoking habit and they were also the first to quit. Similarly, men were the first to start smoking, and may also be quitting sooner than women. In the United Kingdom in 1973, the absolute differences in smoking prevalence between the least and most deprived groups were about 33% and 31% in men and women, respectively. By 1996, those absolute differences increased to 46% and 44%, mainly because the decline in smoking was much slower among the more deprived (Wardle *et al*. 1998) (Table 3.5). In the United States, smoking prevalence declined between 1974 and 1987 nine times faster in the most educated group than in the least educated group(USDHHS 1989). It is clear that public health efforts to educate the public about the ill-health effects of smoking are not reaching all socio-economic groups equally and that higher socio-economic groups benefit more from information.

Changes over time, such as those described above, may help to explain the different smoking patterns in different countries seen at any one point in time. The smoking epidemic goes through different stages. Initially, smoking is more common among the more affluent groups and rarer among the poor. This pattern appears to reverse over

Table 3.5 Trends in smoking prevalence (%) by social class in the United Kingdom, 1974–94

Year	Social class I (men)	Social class V (men)	Social class I (women)	Social class V (women)
1974	29	61	25	43
1976	25	58	28	38
1978	25	60	23	41
1980	21	57	21	41
1982	20	49	21	41
1984	17	49	15	36
1986	18	43	19	33
1988	16	43	17	39
1990	16	48	16	36
1992	14	42	13	35
1994	16	40	12	34

Source: Wardle *et al*. 1998.

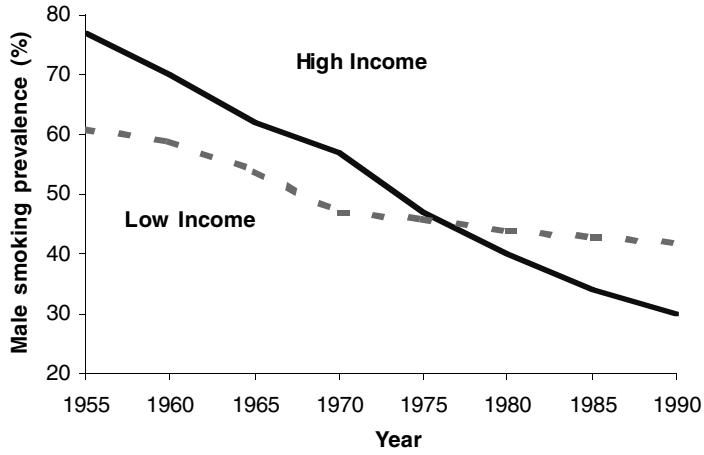

Fig. 3.5 Smoking trends in Norwegian men by income group, 1955–90. Source: Lund *et al*. 1995.

time, at least in countries for which data are available. The 'switch-over', which emerged first in Western countries, is well illustrated by the data from Norway. It is likely that the switch-over is also at least partly responsible for a similar change in the socio-economic gradient in coronary heart disease in these countries (Marmot *et al*. 1978; Morgenstern 1980; Mackenbach *et al.* 1989). In some low-income countries a higher prevalence of smoking is still seen in higher socio-economic groups. (Sarvoyatham and Berry 1968; Shaper 1973; Vaughan 1978; Chadha *et al*. 1992). Some middle-income and low-income countries, including the former socialist economies, may have been undergoing this

change of social gradient more recently. Women have taken up smoking in mass numbers more recently and thus changes in the links between tobacco consumption and socio-economic status are still evolving. For example, Russian women may be undergoing the transition at present, and at a more rapid speed, than in Western countries.

3.3.5 Comparisons of cigarette consumption levels between and within countries

Cigarette consumption per capita is still higher in high-income countries, at 20 cigarettes a day, than in low-income and middle-income countries, at 13 per day (Chapter 2). However, with consumption falling in high-income countries and rising in low-income countries, the gap is narrowing quickly. Within the past 20 years, the ratio of cigarette consumption between developed and developing countries has fallen from 3.3 to 1.8 (Chapter 2).

Within individual countries there are few data on the number of cigarettes smoked daily by different socio-economic groups. In high-income countries, with some exceptions, the poor and less educated smoke more cigarettes per day than the richer and more educated. For example, Australian adult smokers with fewer than 9 years of education consume 22% more cigarettes, respectively, than those with university degrees (Hill and White 1995). Similarly, in the United States, daily cigarette consumption is 14% higher in smokers with a high-school education, or less, than in those with more than 17 years of schooling (Rogers *et al.* 1995). Chinese male smokers with a college education or above consume 15% fewer cigarettes than those with primary or middle-school education (Chinese Academy of Preventive Medicine 1997). In India, not surprisingly, smokers with college-level education tend to consume more cigarettes, which are relatively more expensive, while smokers with low levels of education consume larger numbers of the inexpensive *bidis*. Nevertheless, when both *bidis* and cigarettes are combined in the calculation of consumption, smokers with college education smoke much less than those with secondary education or less (Gupta and Mehta, in press).

3.4 Smoking and the excess mortality of the poor in developed countries

Since the poorer groups in developed countries appear to smoke more than the rich, tobacco-related deaths would be expected to be more common among them than among the rich. Smoking is, therefore, a powerful mediator of the association between poverty and mortality. For the purposes of this review, new analyses were commissioned of smoking-attributable mortality by socio-economic group (Jha *et al*. in press), in order to estimate what fraction of the mortality difference between rich and poor group can be explained by smoking. Such analyses are most reliable among males in developed countries, where smoking has been common for a long time and where reliable statistics exist on causes of death by socio-economic group. Analyses were commissioned for Canada, England and Wales, Poland, and the United States (see Figs 3.6–3.9).

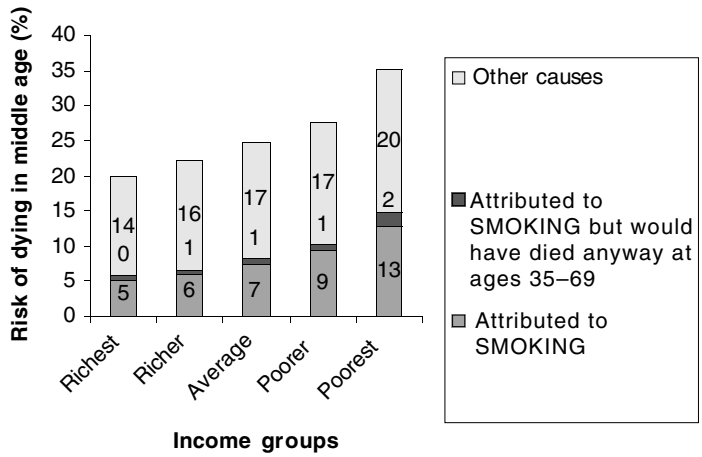

Fig. 3.6 The contribution of smoking to the risk of premature death among males at ages 35–69, by income group, Canada, 1991. Source: Jha *et al.*, in press.

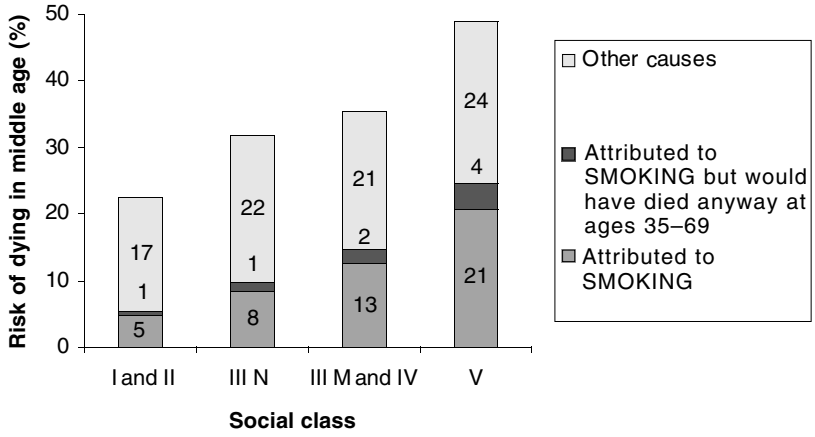

Fig. 3.7 The contribution of smoking to the risk of premature death among males at ages 35–69, by social class, England and Wales, 1991. Source: Jha *et al.*, in press. Note: In the UK, at the time of the study, socio-economic status was categorized into five groups from I (the highest) to V (the lowest). N represents nonmanual workers and M represents manual workers.

Figure 3.6 shows results for urban areas in Canada in 1991, using income as the indicator of socio-economic status. Overall, urban Canadian males in the richest quintile of income had a 19% risk of death between ages 35 and 69, whereas those in the poorest quintile had a 35% risk. The risks of death attributable to smoking were 5% and 15%, respectively (risk ratio 3). Avoiding deaths caused by smoking would thus

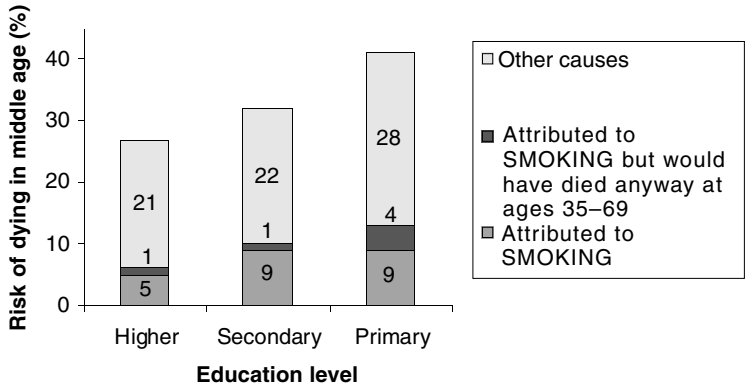

Fig. 3.8 The contribution of smoking to the risk of premature death among males at ages 35–69, by education level, Poland, 1996. Source: Jha *et al.*, in press.

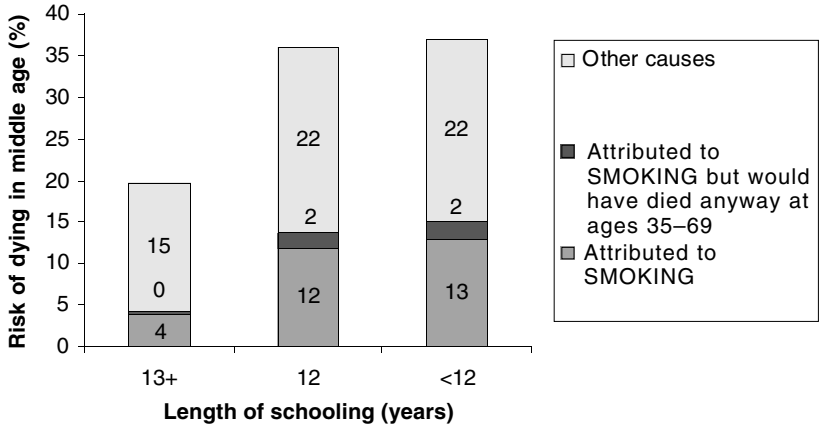

Fig. 3.9 The contribution of smoking to the risk of premature death among males at ages 35–69, by education level, United States, 1996. Source: Jha *et al.*, in press.

reduce the risks of death to 14% and 20%, respectively, and the ratio of risk in the lowest versus the highest educational groups to 1.4.

The calculations are virtually identical for Poland, where education is the available indicator of socio-economic status (see Fig. 3.8). The overall risk of death in 1996 between ages 35 and 69 for a male with university education was 27%. For a man with primary education it was 51%, about twice as great. The risks of death attributable to smoking were 6% and 23%, respectively; thus the risk ratio is 3.8, almost the same as in England and Wales. Avoiding deaths caused by smoking would reduce the risks of death to 21% and 28%, respectively. The ratio of risks between the lowest and highest education groups would fall to 1.3.

In the United States, where education is the available indicator of socio-economic status, the results are similar (see Fig. 3.9). The overall risk of death in 1996 between

ages 35 and 69 for a man with 13 or more years of education was 19%. For a man with less than 12 years of education, it was 37%, a risk ratio of 1.9. The risks of death attributable to smoking are 4% and 15%, respectively, a risk ratio of 3.8. Avoiding deaths caused by smoking would reduce the risks of death to 15% and 22%, respectively. The ratio of risk between the lowest and the highest education groups would be reduced from 1.9 to 1.5.

Data on women from Canada, Poland, and the United States suggest a similar profile, although the effects are somewhat smaller, probably because the female population started smoking more recently than the male population, with the result that the risks may currently be underestimated. In the United States, if smoking-attributable disease could be eliminated, the ratio of risk for death between the highest and lowest socio-economic groups of middle-aged women would fall from 1.7 to 1.5. For Canada, it would fall from 1. 5 to 1.3, and in Poland, from 1.8 to 1.6. Data on social class for women in England and Wales are not shown because they are less reliable, as women were at that time classified by their husband's social class.

In addition to cross-sectional differences in mortality, smoking is also partly responsible for the widening of socio-economic differences over time. In Canada, the risk of death in middle age for men in the poorest income group fell from 46% in 1971 to 35% in 1996—a decline of about 24%. The risk of death from smoking-attributable causes fell from 17% in 1971 to 15% in 1996—a decline of only 12%. In contrast, in the richest income group, the risk of death in men fell from 32% to 20%, a decline of 38%; and the risk of death from smoking-attributable disease fell from 9% to 6%, a decline of about one-third. In Canada, in relative terms, the gap in mortality risk between poorest and richest income group increased from 1.4 for total risk and 1.9 for smoking-attributable risk in 1971, to 1.8 for total risk and 3 for smoking-attributable risk in 1991.

In England and Wales, the risk of death in middle age for men in the lowest socio-economic group marginally increased between 1970–72 and 1990–92, from 47% to 49%. (Note that the numbers of people in the lowest social classes changed over time, so the two time periods are not directly comparable.) The risk attributed to smoking also rose marginally from 24% to 25%. In contrast, for men in social classes I or II, the total risk of death in middle age fell from 30% in 1970–72 to 23% in 1990–92, a 36% decline. The risk of death attributable to smoking fell from 13% to 6%, a 54% decline. In relative terms the gap between mortality in lowest and highest social classes increased from 1.6 for total risk and 1.8 for smoking-attributable risk in 1970–72, to 2.1 for total risk and 4.2 for smoking-attributable risk in 1990–92. In England and Wales, if the lowest social class had had the same rate of decline in smoking-attributable mortality, the total risk in the lowest social class would have been 34% in 1991. The relative gap between the lowest and the highest social classes in 1990–92 would have narrowed from 2.1 to 1.5. In the absence of smoking, relative differences in total risk between low and high social classes would have narrowed even further to 1.4 in 1991.

Thus, in Canada, England and Wales, Poland, and the United States, smoking is responsible for much of the socio-economic gradient in male mortality. Eliminating smoking-attributable differences would approximately halve the social gradients in mortality among men in these four countries. The apparently smaller effects among women can be explained by the fact that the female tobacco epidemic is at an earlier stage.

The results from this analysis—which used an indirect measure to assess tobacco-attributable deaths—are consistent with studies where the effects of smoking are directly observed, for example, in cohort and case-control studies. Such studies find that adjusting for smoking typically reduces, but does not eliminate, the differences in mortality rates between socio-economic groups (Novotny *et al*. 1993). Other data also point to similar conclusions. Lung cancer incidence rates decrease as educational status increases. In one study in the United States, lung cancer incidence was 78% higher for whites with fewer than 12 years of education, than for whites who were college graduates; for African Americans, lung cancer incidence was 38% higher for persons with fewer than 12 years of education compared to college graduates. People with an annual income of less than $15 000 were 70–80% more likely to develop lung cancer than persons with annual incomes of more than $30 000 (Baquet *et al.* 1991). Lung cancer also shows a strong trend of decreasing risk with increasing income for white men; the rate in the lowest income group was 50% higher than that for the highest income group. Similar patterns were noted for black men; the rate in the lowest income group was 20% higher than that of the highest income group (Devesa and Diamond 1983). Low socio-economic status, as measured by employment status, family income, or education, is also strongly related to increased mortality from chronic obstructive pulmonary disease (Higgins 1992).

These results are based on data from industrialized countries and may, therefore, not apply in low-income countries where the tobacco epidemic is less advanced. Unfortunately, reliable data by socio-economic status are not available in low-income countries, and corresponding calculations cannot, therefore, be done. However, as the tobacco epidemic in low-income and middle-income countries matures, it is plausible that social patterns and impacts of smoking will be similar to those in high-income countries.

3.5 Why is smoking more prevalent among poor people?

As we have seen, smoking tends to be more prevalent among the poor than the rich in most settings; but the reasons for this are unclear. The success of strategies intended to reduce smoking will depend in part on a better explanation of this phenomenon. Poverty itself is not a cause of smoking. Indeed, the fact that tobacco is consumed more by groups for which it is, in relative terms, more expensive, is paradoxical. It is important to note that the poor do not smoke more than the rich in every country, and that education may be a more important predictor of smoking than material circumstances.

Several hypotheses have been put forward to explain the socio-economic gradient in smoking. These hypotheses relate mostly to Western countries, but may well apply to other populations. First, it is argued that the poor and less educated are less aware of the health hazards of smoking and thus more likely to adopt this harmful practice. Second, it is argued that smoking may be a self-medication used to regulate mood, manage stress, and to cope with the strains of material deprivation (Graham 1987, 1994). However, this self-medication hypothesis is not very tenable due to the lack of sedative or anxiolytic effects of nicotine. Third, it is argued that the adoption of

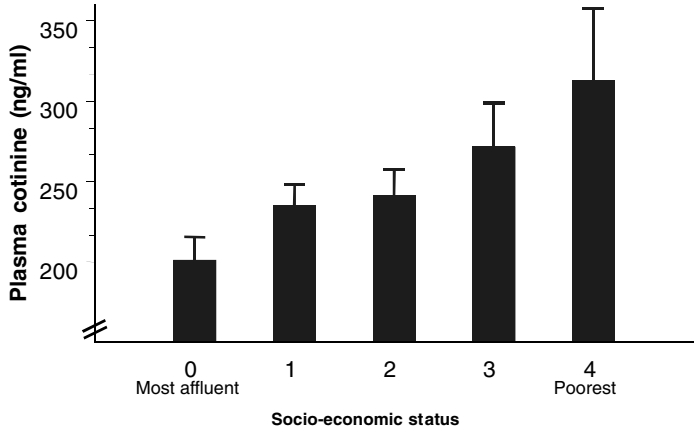

Fig. 3.10 Plasma cotinine in adult smokers by socio-economic status. Source: Wardle *et al.* 1999

smoking may be a replacement reward, as smoking is often described as one of the few things a poor person can do for himself or herself (Graham 1994). Fourth, economic hypotheses suggest that, given the same perceived benefits from smoking, a person whose income is low would have less to lose from future health problems than a person with a higher income. Finally, there is some evidence to suggest that the extent of nicotine dependence in poor smokers may be greater, although this observation cannot alone explain why poor people smoke more in the first place.

Data from the United Kingdom show that across increasing levels of social disadvantage there is a gradient in nicotine dependence as indicated by markers such as the time between waking and smoking the first cigarette of the day, or perceived difficulty in abstaining from cigarettes (Jarvis 1998; Wardle *et al.* 1998). Plasma cotinine concentrations measured in representative population samples in the Health Survey for England, which provide an objective measure of total nicotine intake over time and hence of nicotine dependence, show a similar picture, being lowest in the most affluent and highest in the poorest smokers (see Fig. 3.10). Data from the United States comparing cotinine levels in black and white smokers support these observations. Higher cotinine concentrations and higher nicotine intakes per cigarette smoked are seen in black than white smokers (Wagenknecht *et al.* 1990; English *et al.* 1994; Caraballo *et al.* 1998; Perez-Stable *et al.* 1998). Thus, in addition to any barriers to cessation due to factors such as lower awareness and concern about health risks, and a less supportive social environment, poor smokers face further difficulties through higher levels of addiction to nicotine, through both higher cigarette consumption and higher intake of nicotine per cigarette.

It is likely that deprivation affects the risk of smoking at different stages:

(1) by increasing the risk of starting to smoke;
(2) by increasing the risk of higher degree of dependence, and
(3) by reducing the chance of successful quitting.

Indeed, data from the United States and the United Kingdom suggest that not only are the poor and the less educated less likely to attempt to quit smoking, but their chances of becoming successful quitters are also lower (Jones 1994).

3.6 Conclusions

Although more research is still needed, there is little doubt that the poorest socio-economic groups suffer the consequences of tobacco use more than the richest. Analyses presented here suggest that smoking prevalence in most developing countries is already highest among the poor, and that if these countries experience a similar pattern to the high-income countries, the gap in smoking between rich and poor groups will widen over time. The implications for poor adults in middle age are considerable. In Canada, England and Wales, Poland, and the United States, middle-age mortality differences between rich and poor would fall by between one-half and two-thirds if smoking could be eliminated. If the burden of tobacco-related disease among the poor could be reduced, overall death rates in middle age would fall considerably. The policy implications of these findings are several and are dealt with in subsequent chapters.

References

Baquet, C. R., Horm, J. W., Gibbs, T., and Greenwald, P. (1991). Socio-economic factors and cancer incidence among blacks and whites. *J. Natl. Cancer. Inst.*, **83**(8), 551–7

Bobak, M., Skodova, Z., Pisa, Z., Poledne, R., and Marmot, M. (1997). Political changes and trends in cardiovascular risk factors in the Czech Republic 1985–1992. *J. Epidemiol. Comm. Hlth.*, **51**, 272–7.

Bobak, M., Hertzman, C., Skodova, Z., and Marmot, M. (1999). Socio-economic status and cardiovascular risk factors in the Czech Republic. *Int. J. Epidemiol.*, **28**, 46–52.

Caraballo, R. S., Giovino, G. A., Pechacek, T. F., Mowery, P. D., Richter, P. A., Strauss, W. J. *et al.* (1998). Racial and ethnic differences in serum cotinine levels of cigarette smokers. *JAMA*, **280**, 135–9.

Chadha, S. L., Gopinath, N., and Ramachandran, K. (1992). Epidemiological study of coronary heart disease in Gujaratis in Delhi (India). *Indian J. Med. Res.*, **96**, 115–21.

Chinese Academy of Preventive Medicine (1997). *National Prevalence Survey of Smoking Pattern*. Beijing: China Science and Technology Press.

Chung, M. H., Chung, K. K., Chung, C. S., and Raymond, J. S. (1993). Health-related behaviours in Korea: smoking, drinking, and perinatal care. *Asia-Pacific J. Publ. Health*, **6**, 10–5.

Devesa, S. S. and Diamond, E. L. (1983). Socio-economic and racial differences in lung cancer incidence. *Am. J. Epidemiol.*, **118**(6), 818–31.

Duncan, B. B., Schmidt, M. I., Achutti, A. C., Polanczyk, C. A., Benia, L. R., and Maia, A. A. (1993). Socio-economic distribution of non-communicable disease risk factors in urban Brazil: the case of Porto Alegre. *Bull. Pan American Health Organization*, **27**(4), 337–49.

English, P. B., Eskenazi, B., and Christianson, R. E. (1994). Black–white differences in serum cotinine levels among pregnant women and subsequent effects on infant birthweight. *Am. J. Public Health*, **84**(9), 1439–43.

European Commission 1996. *Tobacco consumption 1970–1994 in the member states of the European Union and in Norway and Iceland*. Stockhom: Statistics Sweden

Gajalakshmi, C. K. and Peto, R. (1997). *Studies on Tobacco in Chennai, India*. Presented at the 10th World Conference on Tobacco or Health, Chinese Medical Association, Beijing.

Garfinkel, L. (1985). Selection, follow up and analyses in the American Cancer Society prospective studies. In *Selection, Follow-up and Analyses in Prospective Studies: a Workshop* (ed. L. Garfinkel, S. Ochs and M. Mushinski), pp. 49–52. NCI Monograph 67. National Cancer Institute, NIH Publication No. 85–2713.

Gong, Y. L., Koplan, J. P., Feng, W., Chen, C. H., Zheng, P., and Harris, J. R. (1995). Cigarette smoking in China: prevalence, characteristics and attitudes in Minhang District. *JAMA*, **274**, 1232–4.

Graham, H. (1987). Women's smoking and family health. *Soc. Sci. Med.*, **25**, 47–56.

Graham, H. (1994). Gender and class as dimensions of smoking behaviour in Britain: insights from a survey of mothers. *Soc. Sci. Med.*, **38**, 691–8.

Gunther, H. K., Laguardia, A. S., Dilba, V., Piorkowski, P., and Bohm, R. (1988). Hypertension and social factors in a developing country. *J. Hypertens.*, **6** (Supplement), S608–S610.

Gupta, P. and Mehta, H. C. A cohort study of all-cause mortality among tobacco users in Mumbai, India. *Int. J. Public Health* (In press.)

Gupta, P. C. (1996). Survey of sociodemographic characteristics of tobacco use among 99,598 individuals in Bombay, India using handheld computers. *Tobacco Control*, **5**(2), 114–20.

Gupta, R., Gupta, V. P., and Ahluwalia, N. S. (1994). Educational status, coronary heart disease, and coronary risk factors prevalence in rural population of India. *BMJ*, **309**, 1332–6.

Higgins, M. (1991). Risk factors associated with chronic obstructive lung disease. *Annals of the New York Academy of Sciences*, **624**, 7–17.

Hill, D. J. and White, V. M. (1995). Australian adult smoking prevalence in 1992. *Aust. J. Public Health,* **19**(3), 305–8.

Jarvis, M. J. (1998). *Epidemiology of tobacco dependence*. Paper presented at First International Conference of the Society for Research on Nicotine and Tobacco, Copenhagen.

Jenkins, C. N., Dai, P. X., Ngoc, D. H., Kinh, H. V., Hoang, T. T., Bales, S. *et al.* Tobacco use in Vietnam: prevalence, predictors and the role of transnational tobacco corporations. JAMA. **277**: 1726–31.

Jha, P., Peto, R., Jarvis M., Lopez, A. D., Boreham, J., Zatonski, W. In press. Differences in male mortality due to smoking by education, income or social class. *British Medical Journal* (in press).

Jones, A. M. (1994). Health, addiction, social interaction and the decision to quit smoking. *J. Health Econ.*, **13**(1), 93–110.

Lund, K. E., Roenneberg, A., and Hafstad, A. (1995). The social and demographic diffusion of the tobacco epidemic in Norway. In *Tobacco and Health* (ed. K. Slama), pp. 565–71. New York: Plenum Press.

Mackenbach, J., Looman, C. W. N., and Kunst, A. E. (1989). Geographic variation in the onset of decline of male ischemic heart disease mortality in the Netherlands. *Am. J. Public Health,* **79***,* 1621–7.

Marketfile. Online tobacco database. 1998. http://www.marketfile.com/market/tobacco/index.htm

Marmot, M. G. and Bobak, M. Contribution of social factors to ill health. In *Causes of Avoidable Mortality* (ed. A. Lopez). Geneva: World Health Organization. (In press.)

Marmot, M. G., Adelstein, M. M., Robinson, N., and Rose, G. A. (1978). Changing social class distribution of heart disease. *BMJ*, **2**, 1109–12.

Marmot, M. G., Davey Smith, G., Stansfeld, S., Patel, C., North, F., Head, J. *et al.* (1991). Health inequalities among British civil servants: the Whitehall II study. *Lancet,* **337***,* 1387–93.

McKee, M., Bobak, M., Rose, R., Shkolnikov, V., Chenet, L., and Leon, D. (1998). Patterns of smoking in Russia. *Tobacco Control*, **7**, 22–6.

Morgenstern, H. (1980). The changing association between social status and coronary heart disease in a rural population. *Soc. Sci. Med.,* **14A***,* 191–201.

Narayan, K. M., Chadha, S. L., Hanson, R. L., Tandon, R., Shekhawat, S., Fernandes, R. J. *et al.* (1996). Prevalence and patterns of smoking in Delhi: cross sectional study. *BMJ*, **312**(7046), 1576–9.

Nogueira, A., Marcopito, L., Lanas, F., Galdames, D., Jialiang, W., Jing, F. *et al.* (1994). Socio-economic status and risk factors for cardiovascular disease: a multicentre collaborative study in the International Clinical Epidemiology Network (INCLEN). *J. Clin. Epidemiol.*, **47**, 1401–9.

Novotny, T. E., Shane, P., Daynard, R., and Connolly, G. N. (1993). Tobacco use as a sociologic carcinogen: The case for a public health approach. In *Cancer Prevention*. (ed. DeVita, V.T.), pp 1–15. Philadelphia, PA: J.B. Lippencott Company.

Over, M., Ellis, R. P., Huber, J. H., and Solon, O. (1992). The consequences of adult ill-health. In *The Health of Adults in the Developing World* (ed. G. A. Feachem, T. Kjellstrom, J. L. Murray, M. Over and M. A. Phillips), pp. 161–99. New York, N.Y.: Oxford University Press.

Pamuk, E., Makuc, D., Heck, K., Reuben, C., and Lochner, K. (1988). *Socio-economic Status and Health Chart Book. Health, Unites States, 1998*. Hyattsville, Maryland: National Center for Health Statistics.

Perez-Stable, E. J., Herrera, B., Jacob, P., and Benowitz, N. L. (1998). Nicotine metabolism and intake in black and white smokers. *JAMA*, **280**, 152–6.

Peto, R., Lopez, A. D., Boreham, J., Thun, M., and Heath, C. J. (1992). Mortality from tobacco in developed countries: indirect estimation from national vital statistics. *Lancet,* **339**, 1268–78.

Peto, R., Lopez, A. D., Boreham, J., Thun, M., and Heath, C. J. (199•). *Mortality from Smoking in Developed Countries 1950–2000: Indirect Estimates from National Vital Statistics.* Oxford: Oxford University Press.

Rogers, R. G., Nam, C. B., and Hummer, R. A. (1995). Demographic and socio-economic links to cigarette smoking. *Soc. Biol.*, **42**(1–2), 1–21.

Rose, G. and Marmot, M. G. (1981). Social class and coronary heart disease. *Br. Heart J.*, **45**, 13–9.

Sarvoyatham, S. G. and Berry, J. N. (1968). Prevalence of coronary heart disease in an urban population on Northern India. *Circulation*, **37**, 939–53.

Shaper, A. G. (1973). Coronary heart disease. In *Cardiovascular Disease in the Tropics* (ed. A. G. Shaper, M. S. R. Hutt, Z. Fejfar), pp. 148–159. London: British Medical Association.

Siegrist, J., Bernhardt, R., Feng, Z. and Schettler, G. (1990). Socio-economic differences in cardiovascular risk factors in China. *Int. J. Epidemiol.*, **19**, 905–10.

Strebel, P., Kuhn, L. and Yach, D. (1989). Determinants of cigarette smoking in the black township population of Cape Town. *J. Epidemiol. Comm. Hlth.*, **43**, 209–213.

Swai, A. B., McLarty, D. G., Kitange, H. M., Kilima, P. M., Tatalla, S., Keen, N. *et al.* (1993). Low prevalence of risk factors for coronary heart disease in rural Tanzania. *Int. J. Epidemiol.*, **22**, 651–9.

Taylor, O. G., Oyediran, O. A., Bamgboye, A. E., Afolabi, B. M., and Osuntokun, B. O. (1996). Profile of some risk factors for coronary heart disease in a developing country: Nigeria. *Afr. J. Med. Sci.*, **25**, 341–6.

UK Department of Health (1998). *Smoking Kills: A White Paper on Tobacco.* London: The Stationary Office. (http://www.official-documents.co.uk/document/cm41/4177/contents.htm)

US CDC (Center for Disease Control and Prevention). (1997). Cigarette smoking among adults—United States, 1995. *MMWR Morb Mortal Wkly Rep*, **46**(51), 1217–20.

USDA (US Department of Agriculture) (1998). US Department of Agriculture Database, USDA: Washington DC, USA.

US Department of Health and Human Services (1989). *Reducing the Health Consequences of Smoking: 25 Years of Progress.* A Report of the Surgeon General, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Rockville, Maryland. DHHS Publication No. (CDC)89–8411.

Vaughan, J. P. (1978). A review of cardiovascular diseases in developing countries. *Ann. Trop. Med. Parasitol*., **72**, 101–9.

Wagenknecht, L. E., Cutter, G. R., Haley, N. J., Sidney, S., Manolio, T. A., Hughes, G. H. *et al*. (1990). Racial differences in serum cotinine levels among smokers in the Coronary Artery Risk Development in (Young) Adults Study. *Am. J. Public Health*, **80**(9), 1053–6.

Wardle, J., Farrell, M., Hillsdon, M., Jarvis, M. J., Sutton, S., and Thorogood, M. (1999). Smoking, drinking, physical activity and screening uptake and health inequalities. In *Inequalities in Health* (ed. Gordon, D., Shaw, M., Dorling, D., and Davey Smith, G.), pp. 213–39. Bristol: The Policy Press.

Wilkinson, R. G. (1996). *Unhealthy Societies. The Afflictions of Inequality.* London: Routledge.

World Bank (1990). *Brazil: The New Challenge of Adult Health*. Washington D.C., The World Bank.

World Bank (1997). *Sector Strategy: Health, Nutrition, and Population*. Washington DC: The World Bank Group.

World Bank. World Development Report (1993). *Investing in Health*. New York: Oxford University Press for the World Bank.

World Health Organization (1989). The MONICA project. A world-wide monitoring system for cardiovascular diseases. *Wld. Hlth. Statist. Ann*., 27–149.

World Health Organization (1997). *Tobacco or Health: a Global Status Report*. Geneva., World Health Organization.

Yach, D., McIntyre, D., and Saloojee, Y. (1992). Smoking in South Africa: the health and economic impact. *Tobacco Control*, **1**, 272–80.

Zatonski, W. (1996). *Evolution of health in Poland since 1988*. Warsaw, Maria Sklodowska-Curie Cancer Center and Institute of Oncology.