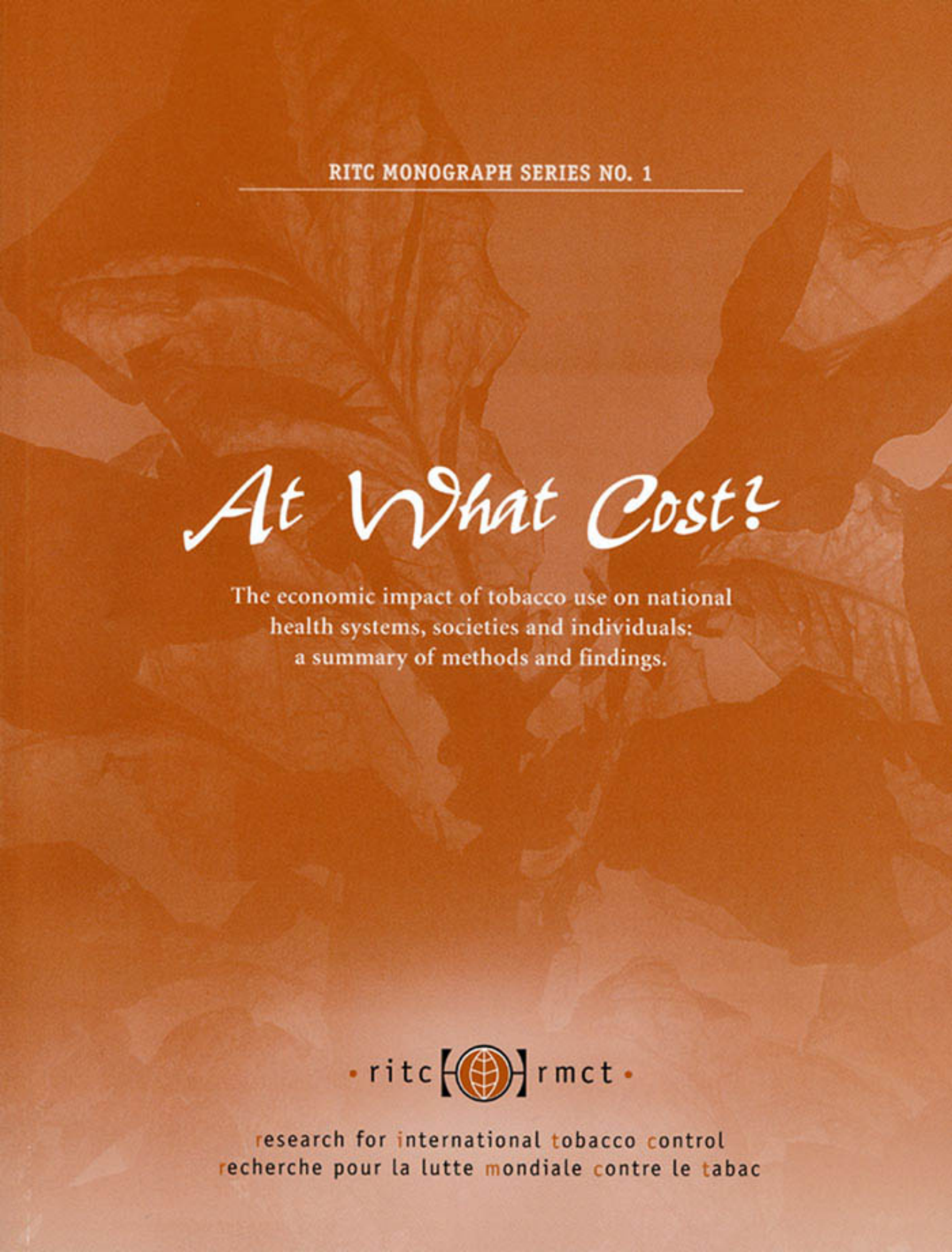
RITC MONOGRAPH SERIES NO. 1

At What Cost?

The economic impact of tobacco use on national health systems, societies and individuals: a summary of methods and findings.



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Executive Summary

Chapter 1: Introduction to the Tobacco Epidemic

Tobacco use is widely acknowledged as the single most important preventable cause of health problems worldwide. Despite this consensus, approximately 1.1 billion individuals smoke worldwide, and over 4 million people currently die of tobacco use each year (1). By 2030, the total number of smokers is expected to reach about 1.6 billion out of a global population of 8.5 billion, with approximately 10 million smokers dying annually. Current worldwide smoking patterns suggest that 500 million people alive today will eventually die of tobacco use (2). The problem is more serious in the developing world, where the number of smokers is expected to increase at the rate of 2% per year, outstripping global population growth. On the other hand, tobacco consumption is decreasing in the developed world at an average of 1% per year (3). Of the estimated 10 million annual tobacco-related deaths expected by 2030, 7 million are expected to occur in developing countries (4).

Since tobacco use is a global health problem, countries should cooperate to address the situation on an international level even as they tailor their tobacco control efforts to their own unique circumstances. To advance effective tobacco control policies, data concerning the health and economic consequences of the epidemic are required, as well as information on how these health sequelae and costs are distributed among individuals, households, communities, and society at large. Costs to society at large must be further distinguished from those of the public health-care system, as the proportion of costs borne by the latter varies from one country to another depending on political, economic, social, and cultural factors. Standardized economic evaluation methods are needed to help governments and researchers measure the real costs of tobacco use to their societies, thus paving the road to informed tobacco control policies.

Research for International Tobacco Control (RITC) produced this report in an attempt to lay the groundwork for future comparative and conclusive research in the field of tobacco-related economic evaluation, with a focus on developing countries. The aims of this report are as follows:

- To provide an overview of the role and methods of economic studies in tobacco control policy development, and to assess the advantages and disadvantages of each methodology;
- To provide an analysis of the most recent and important findings concerning the impact of tobacco use on individuals and health-care systems in various societies, particularly (as information permits) in developing countries;
- To provide an analysis of the findings and methodologies of studies examining the impact of tobacco use in specific population subgroups;
- To provide an analysis of economic assessments of interventions to reduce the demand for tobacco; and
- To set the stage for future economic research in the area of tobacco control policy by (a) identifying gaps in existing research and opportunities for effective future contributions; and (b) identifying the relevant information sources for analysis of the economic impact of tobacco use, and reflecting on the availability and utility of each.

Chapter 2: Economic Studies and Tobacco Control Policy Development

Tobacco use imposes serious economic costs on society. Research into the economic burden of tobacco use provides important information that can be used to inform political debate and raise public awareness (2). Economic studies can: (a) allow developing countries to substantiate the magnitude of the tobacco epidemic and to quantify its impact; (b) provide a means of data analysis and interpretation that can be used to help develop effective tobacco control policies; and (c) be used to evaluate the cost-effectiveness of tobacco control policies in an effort to optimally allocate scarce resources.

Governments may pursue several policy options to control the demand for and supply of tobacco. Demand can be controlled through tax increases, advertising bans, public health announcements in the media, warning labels, the publication and dissemination of research on the health consequences of smoking, and restrictions on tobacco use in work or public settings. Tobacco supply can be controlled through outright prohibition, crop substitution, trade restriction, and antismuggling efforts (2).

Research that quantifies the health impact of tobacco use can play a key role in encouraging policy-makers to adopt new tobacco control policies or strengthen existing ones. An effective way of doing this is to use the cost-of-illness (COI) study. A COI study aims to measure all the costs associated with a specific disease, including direct, indirect and intangible costs (e.g., the costs associated with a cleaner household environment due to the absence of secondhand smoke). The general objective of a COI study is to increase the understanding of the nature and extent of an illness and its consequences for society.

Several other types of economic study designs can contribute to tobacco control policy development, particularly concerning resource allocation. These include:

1. Cost-effectiveness analysis (CEA): a comparison of at least two interventions or programs that have a common health outcome (e.g., reduction of blood pressure, life-years saved). This analysis is performed to assess the efficiency of spending relative to program effectiveness in a situation where, for a given level of resources, the decision-maker wishes to maximize the health benefits conferred to the population of concern.

A major limitation of this approach is its inability to compare interventions with differing clinical outcomes or effects.

2. Cost-minimization analysis (CMA): similar to CEA, although a measure of health outcome is not selected, and only program costs are compared. In essence, the programs under evaluation are assumed to have the same degree of effectiveness, and the lowest cost program should be favored. The conditions under which CMA is the most appropriate analytic design are relatively stringent, and this method is hence decreasing in frequency of use.

3. Cost-utility analysis (CUA): an adaptation of CEA that aims to provide information on costs per health effect gained. Health effect gained is measured through a standardized outcome measure, such as a quality-adjusted life-year (QALY) or a disability-adjusted life-year (DALY). The QALY, for example, measures the outcome of a treatment or intervention in terms of the number of years of life saved, adjusted for quality. Standardization of outcome measure is designed to increase the scope of comparison between interventions, thereby overcoming a limitation of CEA. Both CUA and CEA calculate costs in the same way.

4. Cost-benefit analysis (CBA): measures costs and benefits in commensurate terms, usually monetary. By valuing all costs and benefits in the same units, CBA has the potential to compare diverse interventions using the net benefit criterion, which favors increased use of interventions with the greatest net gain.

Although CEA, CMA, CUA, and CBA are designed to help draw conclusions about the efficiency of several policy alternatives, relatively few tobacco control studies to date have employed these methods. It is hoped this report will raise awareness of these methods and encourage their use in the domain of tobacco control.

Chapter 3: Synopsis: Economic Assessments of the Burden of Tobacco Use on Societies

Smoking is a risk factor for a wide variety of diseases, resulting in increased health expenditures. Also, smoking-related morbidity may lead to lost productivity or premature death, resulting in costs to the smoker, the employer, and society at large. A growing literature exists on the economic impact of smoking on societies throughout the world. The majority of published studies have been undertaken in developed countries, using data from North America and Europe, as well as Japan, Australia, and New Zealand. Relatively few studies have examined the economic impact of smoking in developing countries. For the most part, published data on the economic impact of tobacco use consist of large-scale studies attempting to estimate population-level or country-level direct and indirect tobacco-related costs.

Some important DALY-based estimates of global trends exist. DALYs attributable to tobacco use in 2020 may be as much as three times higher in developing regions versus developed regions (i.e., 94,537 DALYs versus 29,141 DALYs). For developing regions, this would be more than a fivefold increase from 1990 estimates (i.e., to 94,537 DALYs from 16,772 DALYs). Comparatively, for the developed world, the increase from 1990 would be only 1.5 times (to 29,141 DALYs from 19,410 DALYs). These estimates highlight the increasing problem that tobacco dependency poses for developing nations (5).

Most studies at the country-specific level employed the COI methodology, rather than the DALY methodology. At the country level, tobacco use was estimated to account for approximately $7.6 billion (in 1992 U.S. dollars) in costs to Canadian society, including $2.2 billion in direct medical-care costs and $5.4 billion in lost productivity (6).[†] In the United States, total

[†] All currencies throughout this report have been converted into U.S. dollars, using exchange rates in effect on December 31 of the year in question for the study. Exchange rates were obtained from the U.S. Federal Reserve Bank of St. Louis, "Exchange Rates, Balance of Payments and Trade Data," at http://www.stls.frb.org/fred/data/exchange.html#discontinued (accessed June 25, 2002).

smoking-attributable costs for medical care in 1993 were calculated to be $50 billion ($26.9 billion for hospital expenditures, $15.5 billion for physician expenditures, $4.9 billion for nursing-home expenditures, $1.8 billion for prescription drugs, and $900 million for home health-care expenditures) (7). Lifetime costs for smokers in the Netherlands were estimated to be $72,000 per person among men and $94,700 per person among women, based on a study using 1988 data (8). Smoking-attributable health-care cost estimates for Germany in 1996 were $20.8 billion, with 51% of this figure composed of direct health-care costs and 49% composed of indirect costs (9). The cumulative direct medical cost of smoking-related morbidity in the United Kingdom would, according to estimates, reach approximately $45.8 billion over a period of 20 years, beginning in 1999. A smoking cessation strategy for this same period is predicted to have a total cost of $167.8 million, which translates into approximately $1,944 per life-year saved and $35,640 per death averted (10). In Australia, the direct and indirect costs of smoking to the government in fiscal year 1989/1990 totaled $553.5 million. Of this amount, $346.9 million was attributable to health-care costs, and 56% ($194.3 million) of these health-care costs pertained to hospital care (11). New Zealand researchers found that if all New Zealanders were nonsmokers, then the savings in costs of hospital resources to taxpayers in 1986 would be $41.3 million (12). Total smoking-attributable medical costs in China were $620 million in 1988, including $460 million for outpatient costs and $160 million for inpatient costs (13). In Japan, a study based on 1995–1997 data found mean per capita monthly tobacco-attributable medical costs to be $1,868 for deceased smokers, $203 for those who had withdrawn from the study, and $214 for survivors (14).

Overall, the studies in this chapter pointed to one common finding: tobacco use exacts a severe economic toll on health-care resources and thereby affects governments' ability to devote resources to other social priorities.

Chapter 4: Synopsis: Economic Assessments of the Burden of Tobacco Use in Population Subgroups

This chapter provides a synopsis of the findings and methodologies of studies examining the impact of tobacco use on specific population subgroups (i.e., women, children, and the poor) based on a variety of criteria (i.e., income and education).

Historically, the number of smokers rose as incomes rose within populations. In the early decades of the smoking epidemic, smokers in high-income countries were more likely to be affluent than poor. This pattern appears to have reversed among men in the past three or four decades, as affluent men in high-income countries have increasingly quit smoking, whereas poorer men have not quit. For example, in Norway, the percentage of men with high incomes who smoked fell from 75% in 1955 to 28% in 1990. Over the same period, the proportion of male smokers with low incomes declined much less steeply, from 60% in 1955 to 48% in 1990 (2).

A similar inverse relationship is found between education levels and smoking. On average, individuals who have received little or no education are more likely to smoke than those who are more educated. Studies in Brazil, China, India, South Africa, Vietnam, and several Central American nations confirm this pattern (2).

There is, however, reason to believe these inverse relationships do not necessarily hold in the developing world. While little research currently exists on the distribution of smoking prevalence among population subgroups in the developing world, a survey in Khartoum, Sudan, showed that 64% of doctors and university lecturers, and 34% of medical students, smoke. Similar results have been shown in other major urban centres of the developing world, such as Nairobi, Kenya, and Shanghai, China (15).

Tobacco use is a growing problem for women worldwide. Smoking kills over half a million women globally each year, and this number is increasing rapidly. It is estimated that between 1950 and 2000, 10 million women have died from smoking. In developed countries, such as the United Kingdom and the United States, cigarette smoking is now the single most important preventable cause of premature death in women, accounting for at least a third of all deaths in women aged 35–69 (16).

In developed countries, the proportion of female smokers has declined over time at a slower rate than among male smokers. More troubling is the growing number of teenaged female smokers. In the United States, smoking rates among female high school seniors have increased from 18% in 1991 to 24% in 1997 (17).

There are a number of tobacco-related health issues that are specific to women. For example, smoking has a damaging effect on women's reproductive health and is associated with reduced fertility and early menopause. Also, estimates suggest 29% of deaths from cervical cancer are caused by smoking, and smoking while taking the birth control pill can increase the risk of heart disease tenfold (18–21).

Smoking by women also has adverse effects on the fetus during pregnancy. In the United States, smoking is believed to be responsible for 15% of all preterm births and 20%–30% of infants with low birth weight that require perinatal intensive care (22, 23).

Infants and primary school-aged children who live in households with smokers are at a significantly greater risk for a variety of illnesses (i.e., upper and lower respiratory tract infections) (23). In the United States, the condition of 400,000 to 1 million asthmatic children has been worsened by exposure to secondhand smoke, and the odds of developing asthma are twice as high among children whose mothers smoke at least 10 cigarettes a day. These conditions represent a significant proportion of all childhood morbidity and therefore increase both the demand for pediatric health services and direct medical costs (17).

Estimates suggest parental smoking results in more than 5.4 million excess cases of childhood disease and 6,200 excess childhood deaths in the United States (24). Tobacco-related morbidity in children results in annual direct medical expenditures of $4.6 billion, and mortality leads to a cost of $8.2 billion (25). For indirect costs, it was found that smoking causes an estimated 44,000 male and 19,000 female deaths at ages 15–54 in the United States, leaving 31,000 fatherless and 12,000 motherless youths. The resulting expenditure for the U.S. federal government-funded social security survivors' insurance tax was approximately $1.4 billion in 1994 (26).

Tobacco use has a disproportionate impact on vulnerable population subgroups, such as women, children, and people of low socioeconomic status. More research must be conducted to understand whether the impact is different in developing countries compared to developed countries.

Chapter 5: Synopsis: Economic Assessments of Interventions to Reduce the Demand for Tobacco

Governments can pursue a variety of intervention strategies to reduce the demand for tobacco. These strategies are divided into two broad groups: prevention and cessation. Prevention strategies include tobacco taxation, restrictions on selling tobacco products (e.g., to minors), restrictions on areas where tobacco can be smoked, provision of health information, advertising against tobacco, and bans on tobacco advertising and tobacco-sponsored promotions.

Cessation strategies include behaviour therapy, community interventions, physician counseling, and pharmacotherapy.

The published literature suggests tobacco taxation policies are an effective means of lowering cigarette consumption. For example, the World Health Organization (WHO), using a World Bank estimate, states that a tax increase of 10% worldwide would cause 42 million people to give up smoking and avert at least 10 million tobacco-related deaths (27). The effectiveness of taxation rests with the inverse relationship between tobacco price and consumption. Tax increases, however, should not be pursued without considering their potential impact on the demand for other "sin" products. Some evidence suggests higher cigarette taxes could lead to increased demand for liquor, or to higher consumption of smokeless tobacco.

Evidence suggests that tobacco advertising bans can reduce the demand for tobacco products. For example, one study predicted the European Commission's (EC) directive to ban tobacco advertising entirely by the year 2006 could reduce tobacco consumption by 6.3% and cigarette consumption by 7.9% in 11 EC countries (29). However, the evidence on the effectiveness of advertising bans as a sole policy instrument is equivocal, and suggests they are more effective when implemented as part of a comprehensive tobacco control strategy. To date, most of the economic studies on the effectiveness of tobacco advertising and advertising bans have been conducted in developed countries. As the tobacco industry continues its aggressive marketing of tobacco products in developing countries, research on the impact of both tobacco advertising and advertising bans would shed light on their effectiveness within the developing country context. In particular, countries where smoking among women is still low but advertising by the tobacco industry is rising, present researchers with an opportunity to study the effects of the industry's marketing strategies and how advertising bans might effectively counter the growth of the tobacco epidemic among women in these countries.

Smoking cessation strategies generally lead to additional costs per additional life-year saved, or additional costs per QALY. For example, one study of nicotine gum as an adjunct to physician counseling found the additional cost per life-year saved from this combination therapy to be as high as $6,465 for individual males (29). The authors of the study, as was the norm for economic evaluations of cessation strategies, concluded the therapy was cost-effective despite the additional cost. Many of these studies, however, did not compare the intervention in question to another therapeutic option, so an unanswered question in this research was often "cost-effective compared to what?"

Research has demonstrated the potential of tobacco prevention and cessation strategies to curb tobacco use. The next step in this area should be to study which strategies, and combinations thereof, would be suitable for the developing world. Additionally, research must be pursued to clear up misconceptions (e.g., tobacco taxation could generate unemployment for plantation workers) and remove structural constraints (e.g., availability of pharmaceutical therapies such as nicotine replacement therapy (NRT)) that could act as barriers to the implementation of appropriate strategies in the developing world.

Chapter 6: Conclusions and Recommendations

This chapter summarizes the general conclusions of the report and provides recommendations for future tobacco control research. The report demonstrates that economic studies have a critical role to play in measuring the real costs of tobacco use to developing countries, and in informing tobacco control policy development.

The report's conclusions can be summarized as follows:

- Tobacco consumption exacts a significant economic toll on developed and developing countries;
- The economic impact of tobacco use is particularly severe in the developing world, where tobacco-related expenditures compete with other social priorities for relatively scarce resources;
- The situation in the developing world is worsening, as the epidemic is growing rapidly and disproportionately in low- and middle-income countries;
- Tobacco control interventions are demonstrably effective in reducing tobacco consumption; and
- Tobacco control research is under-funded relative to the importance of the problem, and its potential to positively impact policy development.

The report makes the following recommendations for future tobacco control research:

- Economic tobacco control studies should focus on developing countries, and on vulnerable population subgroups, such as women, children and the poor;
- Developing country studies monitoring the burden of disease and its associated economic impact should be encouraged. Where feasible, studies should take advantage of existing data sources such as the Living Standards Measurement Study (LSMS) of the World Bank, or the WHO/CDC's NATIONS dataset. Studies should also explore alternatives to the prevalence based COI methodology;
- Developing country research tailored to assessing tobacco control policies and interventions in local contexts should be encouraged; and
- Economic evaluations of prevention and cessation interventions should be done in local developing country contexts, as costs and effectiveness are likely to vary. Cost-effectiveness studies should improve their methods by expanding the analytical perspective to reflect the societal perspective, and by reporting incremental rather than average cost-effectiveness ratios.

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Chapter 1:
Introduction to the Tobacco Epidemic

1.1 The Tobacco Epidemic

"Very rarely do we have the ability to predict an epidemic so far in the future and also have the knowledge to prevent it."

11th World Conference on Tobacco or Health (9)

Tobacco use is now widely acknowledged to be the single most important preventable cause of health problems worldwide (1). Despite this consensus, approximately 1.1 billion people smoke worldwide, and over 4 million people currently die of tobacco use each year (1). Between 2025 and 2030, the total number of smokers is expected to reach about 1.6 billion out of a global population of 8.5 billion, with approximately 10 million smokers dying annually (2). Current worldwide smoking patterns suggest that 500 million people alive today will eventually die of tobacco use (2). About 100 million of these deaths will occur among Chinese men alone (2).

Once largely a problem in developed countries, the tobacco epidemic has become a growing concern in many developing countries as well. In high-income countries, the trend in overall numbers of smokers has shown a general decline over the past three decades. In low- and middle-income countries, however, the overall number of smokers is increasing, and these now account for more than 80% of today's total worldwide smoking population (2). The tobacco epidemic has therefore expanded from its original locus, high-income countries, to low-income regions.

A 1988 WHO press release reported that while tobacco markets are decreasing in Western, industrialized countries at the rate of 1% per year, tobacco consumption is *increasing* in developing countries at an average rate of 2% per year, outstripping global population growth (3). Of the estimated 10 million annual tobacco-related deaths expected by 2030, 7 million will occur in developing countries (4).

People in developing countries now consume approximately one-third to just over one-half of the world's tobacco (1). To illustrate this, between 1970 and 1990, for every tonne of tobacco that Canadian adults gave up, populations in the low- and middle-income countries of Africa, Latin

America, Asia and the Middle East consumed approximately 20 additional tonnes (5). Unfortunately, legislative controls and other measures used to limit the use of tobacco either do not exist or function poorly in most developing countries (3).

The increase in cigarette smoking in developing countries is largely due to the shift in attention of transnational tobacco companies from the developed world, where they face a powerful antismoking climate, to the markets in the developing world. In low- and middle-income countries, tobacco companies are successfully targeting their advertising at women, the young, and the business and professional classes.

China is the largest producer and consumer of cigarettes in the world (3). Over half the global increase in tobacco use between 1976 and 1986 took place in China, where 61% of males over 15 years of age and almost 75% of males aged 45–64 are smokers (7). Overall, China has about 300 million smokers, and has been labeled the prize of the tobacco market. According to one study, male lung cancer mortality in China is expected to rise to 900,000 annual deaths in 2025, from 30,000 deaths in 1975 (7).

Bangladesh is another notable case. In the past 10 to 15 years, cigarette consumption has more than doubled in that country, and over 100,000 acres of land that could produce food are planted with tobacco instead (8). Tobacco is a direct competitor for land with transplanted aman, the major rice crop, and with wheat. Lung cancer is already the third most common cancer among males, and annual deaths from this cause are expected to increase by 1,200 within 15 years (8). A more important health risk, however, may be the reduction in nutritional status of young children that results from expenditure on tobacco products in households whose income for food purchases is already marginal. Smoking only five cigarettes a day in a poor household in Bangladesh could lead to a monthly dietary deficit of 8,000 calories (8), which could be fatal for already malnourished children.

Given the perilous situation concerning tobacco use in the developing world, the time is right for researchers and policy-makers to focus on the problem before the dire predictions described above become matters of fact.

1.2 Tobacco Control Efforts

Tobacco use is a global problem that requires countries to cooperate in strong international action even as they tailor their tobacco control efforts to their own unique circumstances. In October 2000, representatives from 150 countries convened in Geneva, Switzerland, to begin negotiating the first international convention to address a health issue in the 50-year history of the WHO. Due to be completed by 2003, this agreement is known as the Framework Convention on Tobacco Control (10).

Developing countries are already overwhelmed by problems of malnutrition and endemic infectious diseases, and these problems are exacerbated by the absence of adequate health services (6). These countries can ill afford the increase in mortality caused by the tobacco epidemic, whether measured in terms of loss of human health, or in terms of economic costs (e.g., use of medical- and health-care services, lost productivity, fires, or the use of land to grow tobacco) (4).

Because the tobacco epidemic is more recent in developing countries, the adverse health consequences are not yet as evident as they are in developed countries (4). Basic epidemiological information is lacking in many developing countries. Of countries that do have such data, most of the reliable or countrywide surveys that were used to extract the data were initiated too late to be useful at this time. As a result, there is insufficient information on trends in the diseases and mortality caused by smoking (4, 6). Public knowledge of tobacco hazards is also often lacking or absent (6).

The problem is compounded by the fact that life expectancy at birth in developing countries is 63 years, 12 years shorter than in developed countries (4). Tobacco-related health problems in developing countries have hitherto been masked by this shorter life expectancy, as some smokers die from other causes (4). In some poor countries, however, the epidemic of smoking-related diseases already rivals infectious disease and malnutrition as a priority public health problem (1). As life expectancy increases, the tobacco toll will become even more evident (4). According to the WHO, "smoking diseases will appear in developing countries before communicable diseases and malnutrition have been controlled, and thus the gap between wealthy and poor countries will widen further" (3). It is therefore imperative that preventive action be taken to combat the ill effects of tobacco use.

The governments of many developing countries underestimate the direct and indirect costs of tobacco use, while they tend to overestimate the importance of tobacco for their national economies. Consequently, many governments have not yet implemented tobacco control policies to discourage tobacco use. An enhanced understanding of the economic dimensions of the tobacco epidemic is required to advance effective tobacco control policies in developing countries. Data concerning the health and economic consequences of the epidemic are also needed, as well as information on how these health sequelae and costs are distributed among individuals, households, communities, and society at large. Costs to society at large must be further distinguished from those of the public health-care system, as the proportion of costs borne by the latter varies from country to country, depending on political, economic, social, and cultural factors. Standardized economic evaluation methods are needed to help governments and researchers measure the real costs of tobacco use to their societies, thus paving the road to informed tobacco control policies.

RITC produced this report in an attempt to lay the groundwork for future comparative and conclusive research in the field of tobacco-related economic evaluation, with a focus on developing countries. This report reviews and synthesizes the literature on tobacco-related economic evaluation, and documents the methodologies used to measure the costs of tobacco use to health-care systems and societies. It is directed at a general audience of tobacco control researchers and policy-makers, especially in developing countries, and researchers familiar with economic evaluation methods but unfamiliar with the relevance of these methods to the study of the tobacco epidemic.

1.3 Aims of Report

The aims of this report are as follows:

- To provide an overview of the role and methods of economic studies in tobacco control policy development, and to assess the advantages and disadvantages of each methodology (Chapter 2);
- To provide an analysis of the most recent and important findings concerning the impact of tobacco use on individuals and health-care systems in various societies, particularly (as information permits) in developing countries (Chapter 3);
- To provide an analysis of the findings and methodologies of studies examining the impact of tobacco use in specific population subgroups (Chapter 4);
- To provide an analysis of economic assessments of interventions to reduce the demand for tobacco (Chapter 5); and
- To set the stage for future economic research in the area of tobacco control policy by (a) identifying gaps in existing

research and opportunities for effective future contributions, and (b) identifying the relevant information sources for analysis of the economic impact of tobacco use, and reflecting on the availability and utility of each (Conclusions, Appendices).

1.4 Methodology of Report

The MEDLINE, HealthSTAR, EconLit, and Cochrane Database of Systematic Reviews databases were searched to identify published articles related to the economics of tobacco use. Three categories of words were formed to generate a comprehensive search of articles related to tobacco (keywords: "tobacco", "cigarette", "smoking", "smoker"), economics ("cost", "expenditures", "economic evaluation", "economic impact"), and developing countries ("developing countries", "developing world", "third world"). The three groupings were then combined to identify articles related to the economics of tobacco and, more specifically, articles dealing with this topic in developing countries. The scope of each database and the dates covered in the search are presented in Table 1, and a detailed description of the contents of each database is given in Appendix A.

The literature identified throughout this methodology is presented in the following chapters.

All currencies in this report have been converted into U.S. (United States) dollars. For any study reporting results in a currency other than U.S. dollars, a conversion was made using exchange rates in effect on December 31 of the year in question for the study. Exchange rates were obtained from the U.S. Federal Reserve Bank of St. Louis ("Exchange Rates, Balance of Payments and Trade Data," at www.stls.frb.org/fred/data/exchange.html#discontinued, accessed June 25, 2002).

Table 1.1 Databases and Dates Covered in the Literature Review.

Database	Scope	Dates Covered
MEDLINE	Biomedical literature	1966–2001
HealthSTAR	Health services, technology, administration, and research	1975–2000
EconLit	International economic journals	1969–2001
Cochrane Database of Systematic Reviews	Systematic reviews of the effects of health care	2001

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Chapter 2:
Economic Studies and Tobacco Control Policy Development

"Real changes in society can be made only when the economic dimension of the issue in question is fully understood."

Gro Harlem Bruntland, MD, Director General, World Health Organization (1)

2.1 Introduction

Tobacco's adverse consequences impose serious economic costs on society. Research into the economic burden of tobacco use provides important information that can be used to inform political debate and raise public awareness (2). This chapter outlines the role of economic studies in tobacco control policy development, provides an overview of the most important methods used by economists, and describes the relative advantages and disadvantages of each methodology.

2.2 The Role of Economic Studies in Tobacco Control Policy Development

There are several ways that economic studies can contribute to tobacco control policy development.

First, economic studies can contribute to the development of effective tobacco control policies and the assessment of their impact. Economic studies can also aid in analyzing a variety of mechanisms to reduce the demand for and supply of tobacco, including assessing the cost-effectiveness of tobacco control interventions. Since there is less research — and less consensus — on the cost-effectiveness of tobacco control interventions, particularly in the developing country context, this report will place particular emphasis on these issues.

Many governments in developing countries are reluctant to curtail tobacco production and use, as they enjoy significant revenues from excise taxes on cigarettes and the export of tobacco leaf (3). Macroeconomic and econometric tobacco studies analyze data related to the tobacco economy to develop effective tobacco control policies and assess their economic impact. Relevant data include trade (import and export) and agricultural production statistics for tobacco and tobacco products, and information

on the production of tobacco leaves, land area devoted to tobacco farming, employment in tobacco manufacturing, annual per capita and total tobacco consumption (usually cigarette), and prices of tobacco products. Important outcomes in a macroeconomic tobacco control analysis will typically include the impact of the policy on tobacco consumption, the national economy, government revenues, employment, and the distribution of post-tax income.

Comprehensive tobacco control policies based on such studies have been shown to be effective in reducing tobacco use in both developed and developing countries, thus contributing to long-term reductions in tobacco-induced morbidity and premature mortality without harming economies (3, 4). Government strategies to further these ends typically combine fiscal and nonfiscal measures. Econometric evidence has shown that the most important determinant of cigarette consumption is the price (5), and that for every 10% increase in cigarette prices, consumption is likely to decrease by about 4% in developed countries and 8% in developing countries (5). The effect appears to be particularly marked in youth. The same 10% increase in the price of tobacco translates into a reduction of approximately 12% in tobacco consumption by adolescents. This material has been well-analyzed elsewhere (2), and it will not be the focus of this report.[†]

Second, economic studies may help developing countries to substantiate the magnitude of the tobacco epidemic and quantify its impact. Such studies make use of epidemiological estimates of morbidity and disability for specific conditions (e.g., lung cancer), or specific risk factors (e.g., smoking), and translate them into estimates of costs and cost-effectiveness. Studies of the economic burden of tobacco use can be used to prioritize research investment and spending on health interventions, with the aim of realigning spending toward investments and interventions that will have the largest impact on populations and vulnerable groups in the developing world. For example, it is worthwhile to note that global expenditures on tobacco control research are modest in spite of the significant burden of tobacco-related disease. Furthermore, most economic studies have taken place predominantly in developed countries and are only partially relevant to the socioeconomic and political climate in many developing countries (3).

Third, many countries lack information on the cost-effectiveness of tobacco control interventions, such as community-based interventions to prevent smoking, and tobacco cessation programs. Program evaluation information of this sort is designed to improve the allocation of resources across different health interventions to maximize health. It may be that there are relatively low-cost preventive or smoking cessation measures that yield relatively large health benefits. Expanding provision of such interventions should, therefore, be considered.

With the above summary in mind, the remainder of this chapter outlines the basic methods used in economic studies to investigate the magnitude and burden of the tobacco epidemic, and economic studies that are concerned with tobacco control interventions.

2.3 Macroeconomic Studies of Tobacco Control Policies

Macroeconomic tobacco control analyses typically include the impact of the policy on tobacco consumption, the national economy, government revenues, employment, and the distribution of post-tax income. A considerable body of work exists on macroeconomic issues related to the tobacco epidemic, and many of the key findings are analyzed and discussed in the landmark 1999 World Bank Report, *Curbing the Epidemic:*

[†] A macroeconomic analysis of a highly effective excise tax-based tobacco control strategy (i.e., South Africa) is found in van Walbeek (6). This and other useful related publications are available online at http://www.idrc.ca/ritc/en/publications/index.html.

Box 2.1 Dispelling Concerns Regarding the Implementation of Tobacco Control Strategies.

Controlling tobacco can result in job losses
Reducing the demand for cigarettes does not imply a lower employment level. Money spent on tobacco would instead be spent elsewhere, leading to replacement jobs for those individuals who lost their occupations in the tobacco industry. There may be some countries, notably in sub-Saharan Africa, that could suffer an employment drop from a worldwide reduction in cigarette smoking because their economies are heavily reliant on tobacco farming. This drop, however, would occur gradually, perhaps over a generation, and adjustment policies could be developed to mitigate the employment effects of a drop in demand.

Higher tobacco taxes reduce government revenue
Evidence has shown that increases in tobacco taxes produce a net gain in government revenues because addicted consumers react slowly to upward price pressures. A global 10% increase in cigarette excise taxes would boost tax revenues by roughly 7%.

Higher tobacco taxes lead to more smuggling
Very high tax rates will still produce net gains in revenue and lead to decreased consumption. An appropriate policy would be to adopt tax increases and a tough stance against smuggling.

Higher tobacco taxes will disproportionately affect poor consumers
Since poor consumers are more sensitive to price increases than rich consumers, their use of tobacco products can be expected to drop more dramatically after a tax increase. Consequently, their relative financial burden will diminish.

Governments and the Economics of Tobacco Control (2). This section excerpts some of the key issues and findings from the executive summary of the report, available online in its entirety at http://www1.worldbank.org/tobacco/reports.asp.

2.3.1 *Macroeconomic Theory and Smoking*

Macroeconomic theory posits that consumers are the best decision-makers regarding how to spend their own money. This theory is based on two assumptions: (a) consumers make rational and informed spending decisions after weighing the costs and benefits of taking action; and (b) consumers incur all the costs of their actions. When consumers act in accordance with these two assumptions, macroeconomic theory asserts that society maximizes the efficient allocation of resources.

Smokers experience beneficial effects from smoking (e.g., pleasure, relief of stress) and weigh these against the costs of tobacco exposure (e.g., ill health, money spent). For smokers to continue their behaviour (and pay to do so), macroeconomic theory would suggest they perceive the benefits of tobacco use to outweigh the costs. However, purchasing tobacco products is different from purchasing other consumer goods, for four reasons: (a) nicotine is addictive; (b) some smokers are not completely aware of the higher risks of disease and premature death associated with tobacco use; (c) smoking usually begins in the teenage years or early adulthood, when people do not always have the capacity to fully understand the risk of addiction and the costs of tobacco use; and (d) some smoking costs (e.g., higher health-care costs in public health-care systems) are borne by nonsmokers, a fact that may encourage smokers to continue smoking because they alone do not bear all of the costs.

Because not all smokers completely understand the risks involved in smoking, or incur the full costs of their behaviour, governments may consider pursuing intervention strategies to help provide adults with enough information to make an informed choice. Strategies may also be directed at protecting nonsmokers from exposure to secondhand smoke or discouraging young people from taking up the habit. Government strategies may aim to reduce either the demand for or the supply of tobacco (2).

2.3.2 Strategies to Reduce Tobacco Demand

2.3.2.1 Raising Taxes

Raising the price of tobacco products through increased taxation is an effective means of reducing demand in both high- and low-income countries. As reported in a review by the World Bank (2), higher taxes are associated with lower consumption and a reduction in the number of ex-smokers who resume the habit. Additionally, higher taxes discourage people from taking up the habit. A 10% increase in cigarette price will on average reduce consumption by approximately 4% in high-income countries and 8% in low- and middle-income countries.

The World Bank report (2) states that the optimal level of taxation is difficult to establish because it is dependent on numerous factors (e.g., the extent to which protecting children is an objective, the desired revenue gains, the required degree of reduction in disease burden). In countries with taxation policies to control tobacco demand, and where cigarette consumption has fallen, taxes account for at least two-thirds of the retail price of a pack of cigarettes. These taxes account for two-thirds or more of the price in high-income countries, and no more than half the price in low-income countries (2).

2.3.2.2 Nonprice Measures

Several initiatives are reported (2) to fall into the domain of nonprice measures: tobacco advertising bans, public health announcements in the media, warning labels, the publication and dissemination of research on the health consequences of smoking, and restrictions on tobacco use in work or public settings. These measures have the most impact on populations with a limited awareness of the health dangers of smoking. Advertising bans can reduce demand by approximately 7% in high-income countries.

2.3.2.3 Nicotine Replacement Therapy

This strategy involves helping people who wish to quit smoking gain access to NRT (e.g., “the patch”) (2). Replacement therapy enhances the effectiveness of efforts to quit and can reduce withdrawal costs. Currently, NRT is difficult to obtain in many countries.

The individual impact of each strategy is not known because the strategies are often implemented in combinations. Yet the presence of one strategy can facilitate the effectiveness of the others, so these initiatives should be pursued as a group (2).

Chapter 5 synthesizes the economic evidence on the effectiveness of such measures to reduce the demand for tobacco.

2.3.3 Strategies to Reduce Tobacco Supply

The World Bank report (2) includes the following within the rubric of strategies to reduce tobacco supply: outright prohibition, crop substitution, trade restriction, and efforts to contain smuggling. According to the World Bank, the first three strategies have constraints that could prevent smooth implementation. First, a complete ban would not likely garner enough public support to be politically acceptable, and would also require governments to forego tax revenue. As for the second option, farmers are reluctant to

Box 2.2 Recommended Actions to Curb Tobacco Use.

Governments interested in strong tobacco control initiatives should:

- Raise taxes based on the tax rates of countries where smoking levels have fallen after a tax hike;
- Publish and distribute research on the health effects of tobacco, add warning labels to tobacco products, adopt advertising and promotion bans, and restrict smoking in public places and in the workplace; and
- Increase access to nicotine replacement and other cessation therapies.

International organizations (e.g., United Nations agencies) should:

- Highlight the importance of tobacco control in their programs;
- Support research into the causes, effects, and costs of smoking;
- Examine the cost-effectiveness of tobacco control policies and initiatives; and
- Address international tobacco control matters (e.g., tax harmonization to deter smuggling).

support crop substitution because the incentives to grow tobacco are far greater than for many other crops. The third option would have minimum effect since trade restrictions, such as import limits or bans, do not have much impact on global cigarette consumption. Only the fourth option — antismuggling policies (e.g., tough law enforcement, tax stamps) — would have positive benefits, because they can preserve government tax revenue, which can then be devoted to demand-oriented curbs against smoking (2).

A detailed description of the methods used to conduct macroeconomic studies lies beyond the scope of this report. Those interested in learning more about the methods, or in performing macroeconomic analyses, are advised to consult the *Economics of Tobacco Control Toolkit* available online at **http://www1.worldbank.org/tobacco/toolkit.asp.**

The toolkit was developed for people who want to research issues concerning the economics of tobacco control in a specific country. It provides detailed information and guidance on the various elements of a macroeconomic analysis, including how to estimate the price elasticity of demand for tobacco products, and how these elasticity estimates can be used to predict the likely impact of changes in tax rates on consumption and government revenues. In addition, the toolkit addresses how to consider issues in the design and administration of tobacco taxes; how to estimate tobacco-related employment and the possible impact that a fall in tobacco consumption would have on total employment; and how to investigate the likely impact of tobacco control on the poor. The toolkit will also aid in researching what types of tobacco products are being smuggled and illustrate different methods that can be used to estimate the size of the smuggling problem.

2.4 Methods: Cost Assessment for Use in Disease Burden and Economic Evaluation Studies

The remainder of this chapter presents the methodologies used in economic studies designed to substantiate the magnitude of the tobacco epidemic and quantify its impact, or to assess the cost-effectiveness of tobacco control interventions. As such studies require

consideration of costs, this section introduces some necessary concepts and terminology; subsequent sections describe different methods for using cost information in economic studies.

2.4.1 The Opportunity Cost Principle

Economics can be described as a science that studies how society manages its scarce resources (7). For economists, scarcity describes the fact that resources are limited rather than infinite. Moreover, because resources are scarce, consumption of a resource for any given purpose imposes costs, which implies that alternative uses of that resource are foregone.

Costs to society occur when resources are diverted from uses to which they would have otherwise been put, or when the total amount of goods and services available to be consumed is reduced (8). The economist defines costs based on the concept of an "opportunity cost," which describes the benefit derived from the best alternative use of a particular resource (9). For example, the value of the best alternative use of land that is currently used for growing tobacco is defined as the benefit derived from the next most valuable crop that could be produced on that land.

2.4.2 Classification of Costs in Health Economic Evaluations

2.4.2.1 What Type of Costs?

In health economics literature, "direct" costs generally refer to changes in resource use attributable to the intervention or treatment regimen. "Indirect" or "productivity" costs refer to productivity gains or losses related to illness or death.

Direct costs include the value of all the goods, services, and other resources that are consumed in the provision of an intervention or in the management of its consequences. Although direct costs are often thought of as involving a monetary transaction, they are actually defined as the use of the resource rather than a monetary exchange. Direct costs encompass all types of resource use, including the health-care costs of hospitalizations, physician services, medications, home health care, and family, volunteer, or patient time.

Direct costs can be further divided into "direct health-care costs" and "direct nonhealth-care costs." Direct health-care costs include the resources consumed in the health-care process, namely the costs of ambulatory care, drug treatment, hospital care, rehabilitation, and long-term care. Direct nonhealth-care costs include, for example, child care costs for a parent attending a smoking cessation program, the increase in total costs required by a dietary prescription, and the costs of transportation to and from the clinic. The time family members or volunteers spend to provide home care is also considered a direct nonhealth-care cost.

Indirect costs are defined as the costs incurred by productivity losses, such as those due to premature retirement or premature mortality. Indirect costs are generally divided into morbidity costs and mortality costs. Morbidity costs refer to the costs associated with lost or impaired ability to work or engage in leisure activities due to morbidity. Mortality costs refer to lost economic productivity due to death. Use of the term "indirect costs" is becoming less common to avoid confusion with the traditional use of this term by accountants to denote overhead costs. It has been replaced in recent work by the term "productivity costs" (10).

2.4.2.2 Costs to Whom?

Several perspectives may be adopted in health economic evaluations, including that of society, the patient, the employer, and the institution providing the health-care service. An item may represent a cost from one point of view but not from another. For example, the costs of travelling to and from a health-care institution for treatment represents a cost from the patient's point of view

but not necessarily from the health-care provider's point of view (11). The societal perspective considers all gains and losses (all costs) and is thus the most comprehensive.

Because definition and measurement of the costs associated with tobacco use depends on which point of view, or perspective, is assumed in the analysis, the following sections provide an inventory of the various types of tobacco-related costs as they pertain to governments, businesses, individuals and their families, and the environment. There are a number of studies of the costs of smoking; to date, however, no one study has addressed all aspects of tobacco-attributable costs.

2.4.3 An Inventory of Tobacco-Related Health-Care Costs

2.4.3.1 Direct Tobacco-Related Health-Care Costs

Tobacco use results in medical care not only for smokers but also for nonsmokers exposed to tobacco smoke. The treatment of tobacco-related diseases requires a variety of medical services, such as hospitalizations, physician services, other health practitioners' services, prescription drugs, home care, and nursing home care. In many industrialized countries, health care is financed by private insurance or by socialized health-care plans; in many developing countries, however, medical-care expenditures are borne by the patients themselves.

Various methods exist for calculating direct costs. For example, a U.S.-based group studied a representative sample of emergency department visits to determine the incidence of tobacco-related illnesses (12). Seven percent of all visits and 12% of gross billings were found for illnesses associated with tobacco use. After calculating attributable risk, it was determined that 3% of visits and 5% of gross billings were directly attributable to tobacco. When the latter figures are extrapolated to all emergency departments in the United States, the result is nearly 2.5 million visits and $500 million per year.

2.4.3.2 Direct Tobacco-Related Costs (Health-Care and Nonhealth-Care)

Costs to Individuals

Smoking affects smokers and their families in terms of time and cost needed to care for the smoker at home or at the hospital; to launder clothes and clean the air of smoke; to repair and replace articles damaged by cigarette burns; to travel to health-care providers; to quit smoking; and to try to quit smoking (13). In addition, cigarettes cost money, and the need to smoke often results in expenditures that would be more beneficial elsewhere. In developing countries, the cost of buying cigarettes can amount to as much as 25% or more of an individual's disposable income (14).

A report written by PATH Canada and Work for a Better Bangladesh illustrates the costs of diverting income to tobacco from an individual's basic needs, such as food and shelter, thus demonstrating that tobacco use further aggravates poverty (15). If personal tobacco expenditures in Bangladesh were reallocated to basic needs, a typical cigarette smoker could increase her monthly food expenditure by 50% on average and have additional money for education and housing. Smokers who replace current tobacco spending according to established patterns could add 400–800 calories/day to their children's diet, and contribute more money to their education, clothing, housing, and other needs. This increase in calorie intake represents almost 75% of the minimum daily calorie requirement for children aged three and approximately 50% for children aged four to six.

Tobacco use may also reduce an individual's disposable income by increasing health-care and insurance payments. One example is illustrated

in a U.S. study that gathered 1988 data on paid claims from a large U.S. health insurer's indemnity plan (16). Tobacco users had more hospital admissions per 1,000 (124 versus 76) and days per 1,000 (800 versus 381), a longer average length of stay (6.47 versus 5.03 days), higher average outpatient payments ($122 versus $75), and higher average insured payments ($1,145 versus $762). Because insurance plans typically set premiums according to frequency claims and payments, the results suggest that privately insured smokers in the United States may pay more in insurance than nonsmokers with similar health-care plans.

Costs to Governments

The primary costs that governments incur as a result of tobacco use are welfare costs. This is because smoking often strikes down smokers in their prime working years (14). Governments also incur expenditures for medical services, cleaning the debris left by the millions of cigarettes smoked each day, for fire fighting services, and for the replacement of property lost to smoking-related fires (13). In developing countries, the costs of importing food at higher costs due to local land being used for tobacco production are also substantial (13).

A U.S. study (16) estimated that in 1987 total medical-care expenditures attributable to smoking were approximately $22 billion, or 7% of total health-care expenditures. It was found that the publicly funded Medicare and Medicaid programs paid for 43% of the medical-care expenditures attributable to smoking. For persons aged 65 and older, public funding accounted for 61% of smoking-attributable costs, compared with 31% for persons younger than 65. In another 1997 U.S. study, smoking-attributable short-term medical and lost productivity costs were estimated for active-duty Air Force personnel. The results indicate that current smoking costs the U.S. Air Force approximately $107 million per year, consisting of $20 million from medical-care expenditures and $87 million from lost workdays (17).

Although tobacco use results in costs for government, it also creates benefits through tax revenues. Because tobacco sales account for important portions of government revenues, such benefits are often heavily weighed in health-care policy decision-making. The Chinese Academy of Preventive Medicine estimated the health-related economic costs of tobacco in China to be $5 billion in 1989, which is similar to the amount earned from tobacco taxes (18). Tobacco taxes account for 10% of all tax revenue in China, and this raises a major concern for policy-makers (18). However, studies have shown that while consumption levels will fall as a result of increased taxes, government revenues will not decline. It is suggested as well that should smokers quit their habit, the money that might have been spent on cigarettes will most probably be spent on something else (19). Consequently, there is no need to expect a net change in business generated by consumer spending; it is simply switched from cigarettes to something else.

Costs to Businesses

All else being equal, businesses lose money from workers who smoke compared with their nonsmoking counterparts (14). Evidence shows that workers who smoke are absent more often than their nonsmoking colleagues, which results in a loss of output (20). Time is also lost as workers smoke on the job or take "smoke breaks," thereby making smokers less productive and less efficient than nonsmokers. Smokers are more likely to become ill or die earlier than nonsmokers, therefore imposing upon businesses the additional costs of training new employees. Smokers are also responsible for more accidents and fires in the workplace resulting in higher rates for insurance premiums for businesses. Tobacco smoke may also result in damage to machinery and equipment.

A study estimated the 1997 costs incurred by employers in Scotland due to smoking in the workplace (20). It was estimated that the annual costs of employee smoking were between $478 million and $747 million due to lost productivity,

$66 million due to higher rates of absenteeism, and $6.6 million due to fire damage. The results indicate that helping employees to stop smoking can lead to significant cost savings to employers, resulting in productivity gains that may outweigh the cost of any workplace smoking cessation program.

Costs to the Environment

Deforestation is one of the largest environmental tobacco-related costs. Cigarette wrapping and packaging involves the heavy use of paper. In developing countries, tobacco is cured mostly by wood smoke, and Malawi has already cut down one-third of its trees for this purpose (14). Deforestation caused by tobacco curing contributes to soil erosion, desertification, flooding, the greenhouse effect, and global warming (14). Tobacco cultivation requires the application of large quantities of fertilizers, herbicides and pesticides, whose use may be largely unmonitored in developing countries (14). Additionally, passive smoking is one of the largest sources of indoor air pollution.

2.4.3.3 Indirect (Productivity) Costs

Compared with nonsmokers, smokers incur indirect costs because of lost wages from absenteeism due to smoking-related illnesses (14). Because smoking often kills smokers in their prime working years, the smoker's family is deprived of many years of future income (14).

Table 2.1 Examples of Direct and Indirect Tobacco-Attributable Costs According to Chosen Perspective.

Perspective	Costs
Government	• Costs of medical care to smokers and their families (D-M) • Welfare costs due to lost income (D-NM) • Cleaning, fire fighting, and property replacement costs (D-NM)
Smokers and their families	• Costs of buying cigarettes (D-NM) • Costs of medical care (D-M) • Lost wages from illness and premature death (I) • Time associated with caring for ill smokers (D-NM)
Businesses	• Costs incurred due to less productive smoking workers (I) • Costs of high insurance due to smoking-related accidents (D-NM) • Costs of training new workers (D-NM)
Environment	• Deforestation for cigarette wrapping and packaging (D-NM) • Soil erosion, desertification, flooding, global warming (D-NM) • Use of fertilizers, herbicides, and pesticides (D-NM)

D-M = Direct Medical Costs; D-NM = Direct Nonmedical Costs; I = Indirect Costs

In developing countries, where educated, middle-class citizens tend to be the heaviest smokers, premature death from smoking reduces some of the country's leadership potential (13).

2.5 Measuring the Burden of Tobacco-Related Disease

Two principle approaches have been developed to measure the burden of tobacco-related disease: the cost-of-illness (COI) methodology; and the methods for calculation of disability-adjusted life-years (DALYs), as used in the Global Burden of Disease study (21). These approaches provide data to substantiate the magnitude of the tobacco epidemic and to quantify its impact. This section briefly outlines the methods, strengths and weaknesses of each approach.

2.5.1 Cost-of-Illness Studies

Studies on the economic costs of smoking have been conducted in several countries. However, the methods of estimation and cost items estimated vary across studies, making comparison difficult. In an attempt to provide a common framework, the 1995 International Symposium on the Economic and Social Costs of Substance Abuse developed a set of international guidelines. These guidelines recommend that studies on the economic costs of substance abuse should use the COI approach (22).

COI studies aim to measure all the costs associated with a specific disease, including direct, indirect and intangible dimensions (e.g., a cleaner household environment due to the absence of secondhand smoke). The general objective of a COI study is to enhance the understanding of the nature and extent of illness and its consequences for society. Determining the total cost of an illness can provide useful information, including how much society is spending on a particular disease and, by implication, the amount that would be saved should the disease be eliminated. Also, determining the total cost of an illness can help identify the specific cost components and the size of the contribution of each sector in society. Most studies of the economic impact of tobacco use to date have focused exclusively on providing such cost descriptions.

2.5.1.1 Framework of Cost-of-Illness Studies

There are three broad steps in performing a COI study for tobacco use:

1. Identifying the adverse outcomes associated with tobacco use;
2. Documenting and quantifying the degree of causality between tobacco use and the associated adverse outcomes; and
3. Assigning economic values to the adverse outcomes of tobacco use (8).

Step 1: Outcome Identification

The initial step in designing a tobacco use COI study is to identify the negative tangible outcomes that are believed to result from tobacco use in the area under study. Outcome identification presents the researcher with three basic decisions: the types of costs to be estimated (tangible versus intangible costs); the timing of the consequences under study (prevalence- versus incidence-based analysis); and the inclusion of consequences attenuating the economic impact of smoking (gross versus net costs). The factors involved in each choice are explained below in greater detail.

- **Tangible versus Intangible Costs**

The morbidity and mortality attributable to cigarette smoking generate significant financial costs, including direct costs of health care, indirect costs of lost productivity, and intangible costs of discomfort, pain, and suffering for smokers, their

families, and others (23). The latter group of costs — the most difficult to measure — are intangible or "psychosocial" effects of illness. As the following Australian study shows, however, these costs may be significant.

The Australian case study used both tangible and intangible costs to estimate the total annual cost of tobacco use in Australia in 1992 (24). Total costs amounted to $8,788 million. Tangible costs were estimated at $4,511 million and included costs related to health care, productivity loss, workers' absenteeism, welfare, legislation and litigation, and tobacco-related fires and accidents. Intangible costs, such as the suffering of the sick and the loss of life to the deceased, were estimated at $4,277 million for the same year. Avoidable costs of tobacco use were estimated to be $3,981 million. Avoidable costs were defined as the benefits that would accrue to the community if the most efficient health policies were implemented and maintained over an extended period of time.

- **Prevalence- versus Incidence-Based Studies**

An important distinction among COI studies relates to the period in which consequences occur, whether costs or benefits (8). With respect to the timing of consequences, two methods are generally used to calculate costs in COI studies: the prevalence and incidence approaches (13).

"Prevalence-based" COI studies measure the direct and indirect costs for a specific period of time, usually one year, that occur due to the prevalence of smoking-induced disease during that period. This method estimates the costs of illness-related morbidity and mortality regardless of the time of disease onset (22). Anticipated changes in the prevalence of tobacco use can be used to assess policies. For example, one prevalence-based study examined the relationship between a change in cigarette sales and a change in medical-care costs and in years of life expectancy (25). Changes in sales of tobacco result from changes in excise tax policy, agricultural policy, cigarette design, smoking behaviour, or tobacco control laws. The analysis took into account the medical costs incurred by quitters over their extra years of life, the asymmetry of impacts for increases and decreases in sales, and the delayed medical effects for ages not yet subject to the health risks of smoking. At current smoking levels, it was found that a 1% decrease in U.S. cigarette sales at this moment will increase life expectancy in the United States by 1.45 million years and increases medical-care costs by $405 million for people aged 25 to 79. This amounts to only $280 in added medical costs for each extra year of life.

On the other hand, "incidence-based" cost studies are the lifetime costs expected to occur as a result of smoking-related disease (13). Incidence-based studies involve calculating the lifetime costs of cases first diagnosed in a particular year, thus providing a baseline for evaluating new interventions (8). In the case of tobacco-related studies, the incidence-based economic costs of smoking are the average additional lifetime costs per smoker that would be incurred due to tobacco consumption, were the smoker to continue to smoke throughout life at the same level.

The majority of COI studies have been prevalence-based analyses of direct and indirect tangible costs, as this method has less extensive data requirements (26). Incidence-based costing requires a considerable amount of data, including disease incidence, survival rates, the impact of the disease on lifetime employment, and the natural course of the disease and associated consequences. In addition, estimating costs using the incidence-based approach requires the calculation of net present value (NPV), which is the discounted total cost of disease between a certain time zero (e.g., the year when a study is being conducted; the year when a program is being evaluated) and a final outcome (e.g., death of diseased patients). NPV is calculated by first costing all illness-related events over the lifetime of each individual with the disease in question. Also, costs that occur in the future, (i.e., after time zero), are discounted

to their present value and then added together to obtain the NPV.[†] Although the incidence-based method requires a considerable amount of data, it is preferred to the prevalence-based method when evaluating the impact of prevention programs (26).

- **Gross versus Net Costs**

Although smoking primarily results in health and economic costs to society, some perceive it to create benefits for society as well. Most economic evaluations of tobacco use focus on gross costs rather than net costs. Whereas net costs take into account the costs and benefits of smoking, gross costs consider only the costs. Although the health and economic costs of tobacco have been well documented, the use of tobacco is associated with several economic benefits to society that result from consumer expenditures on smoking-related products. These benefits include creating jobs for farmers, cigarette company employees and truck drivers, and transfer payments collected as tax from tobacco sales. As benefits are not included within the COI framework, they are not taken into account in most published COI studies on the economic impact of tobacco use.

Although benefits are not typically included in the COI framework, several COI studies have included reductions in costs in their analyses. In 1991, for example, smoking-attributable costs in Canada amounted to $14.3 billion, including $2.2 billion in direct medical-care costs, $1.4 billion for residential care costs, $1.8 billion from workers' absenteeism, and $9.2 billion in lost future earnings (21). Had there been a tobacco-free society, however, smokers who died in 1991 would have lived longer on average. Ultimately, these individuals would have accrued costs to society for such services as pensions, medical care, and residential care. Except for pensions, these "avoided" costs were estimated to be about $1.3 billion, thus reducing overall smoking-attributable costs to approximately $13 billion in 1991.

Step 2: Quantifying Causality

A fundamental issue in COI studies concerns the distinction between association and causality. Upon determining the plausible consequences of tobacco use, the analyst must assess and quantify the extent to which tobacco may have played a causal role in producing the consequences in question.

The problem is illustrated in the following U.S. study, which calculated tobacco-attributable direct medical costs for birth complications and miscarriages (27). The estimated expenditure for a complicated birth in 1987 was significantly higher for smokers than for nonsmokers ($10,894 versus $6,544 respectively). It was estimated in this study that medical-care expenditures attributable to smokers accounted for $791 million in 1987 dollars due to complicated births. The analysis failed, however, to establish a positive relation between smoking during pregnancy and the probability of miscarriage or complicated birth.

In general, the proportion of cases of disease or deaths that can be regarded as causally linked to cigarette smoking is quantified by the smoking-attributable fraction (SAF). For each smoking-related disease, the SAF represents the proportion by which the mortality would be reduced if exposure to cigarette smoking were eliminated. Once the population is divided into smokers and nonsmokers, the SAF of a disease can be estimated by applying the formula presented in Box 2.3.

[†] Discounting concerns the time value of money, which is that a dollar available for spending today is worth more than a dollar that will only be available sometime in the future. Interest charged on loans or paid on certain types of investment reflects the time value of money — the lender or investor is paid interest as compensation for not being able to immediately spend the money that is loaned or invested. In this sense, the interest rate can be considered as the discount rate.

Box 2.3 Calculation of Smoking-Attributable Fractions (SAFs).

$$P(RR-1)1 + P(RR-1)$$

Where: P = Prevalence of smokers (percentage of smokers in the group under study)

RR = Risk Ratio for particular outcome (relative risk of outcome for smokers vs. nonsmokers)

Kaiserman, M.J.
The cost of smoking in Canada, 1991.
Chronic Diseases in Canada 1997; 18:13–19.

Step 3: Assigning Economic Values

Harmful consequences of smoking must be estimated for the group of individuals under study, so that economic values may be assigned to the outcomes of interest. In general, economic cost estimates of smoking-related harm are based on the estimated amounts of smoking-related illness, injury, and premature death produced, and information on the cost of resources used or foregone. In some cases (e.g., goods and services provided by institutions), the valuation is relatively straightforward. In others, such as lost productivity resulting from illness or premature death, the estimation of costs involves more complicated theoretical reasoning and data. Key issues, including the share of smokers' health-care costs that can be attributed to smoking, and the valuation of direct and indirect costs, are explained below.

- **Smoking-Attributable Fractions and Smoking-Attributable Costs**

To measure the economic impact of tobacco use, the proportion of the outcome of interest (e.g., cases of cancer) related to tobacco use is first estimated in the form of SAFs (28). Subsequently, the total cost of an activity (e.g., cancer treatment) is multiplied by the SAF of that activity to determine its smoking-attributable cost (e.g., hospitalization costs). Because smokers generally use health-care services more than nonsmokers, the difference is attributed to the effects of smoking.

- **Valuation of Direct Medical Costs**

Assigning values to goods and services simply requires that the analyst know the average costs involved (8). The most appropriate measures for this purpose are prices that represent the unit cost of purchasing, producing, or replacing the resource flow that has been measured. Average or typical charges for services may be substituted when actual costs are not available, under the premise that in the long run, charges will equal costs. Expenditures for health and nonhealth goods and services are generally straightforward to value, particularly where resources and services are exchanged in a market. Average charge or cost data are usually available for health-care services, such as a day of hospital care or a visit to a physician.

- **Valuation of Indirect (Productivity) Costs**

Two approaches are often used in COI and cost-benefit studies to calculate productivity costs: the human capital approach and the willingness-to-pay (WTP) approach.

2.5.1.2 Human Capital versus Willingness-to-Pay Approach

The human capital approach is the more commonly used method in COI studies of the economic impact of tobacco use. Using this approach, a dollar value is assigned to foregone income that is lost due to illness related to tobacco use, impaired functioning in the workplace, and premature death. Dollar values of foregone income are typically based on data regarding actual earnings for smokers and earnings of comparison nonsmoking populations using age- and gender-adjusted national data.

The WTP approach attempts to reflect both expected loss of productivity, which is the essence of the human capital approach, and the value of pain and suffering (8). This approach uses survey methods to establish the value that a person, typically a smoker or a smoker's family, would place on not experiencing impairment or death from tobacco use. The WTP approach, however, has not been directly adapted and applied to economic evaluations of tobacco use.

2.5.1.3 Discount Rate

To estimate indirect costs related to mortality, a discount rate must be chosen when computing the NPV of future earnings. An extensive debate exists concerning the selection of an appropriate discount rate for costs and health consequences. The aim is to reflect the social decision-maker's time value of money (8). In current practice, it is common to use rates of 3% or 5%, and several additional values are usually chosen for sensitivity analysis.

2.5.1.4 Limitations of Cost-of-Illness Studies

Due in part to the relative availability of the necessary data, COI studies are the most frequently performed economic assessments of tobacco disease burden. As guides to policy, however, the results of COI studies must be interpreted with caution. A COI assessment does not include consideration of alternatives, therefore, conclusions regarding efficiency can't be drawn. For example, knowing that there is a substantial cost associated with tobacco use is insufficient justification for any particular tobacco control policy, unless the potential effectiveness and cost of the proposed policy intervention is also known. The results of COI studies can, however, assist analysts and decision-makers to identify major health problems and their magnitude, recognize patterns of health problems and search for explanations of those patterns, and prioritize health research investments (8) (Box 2.4). COI studies can, therefore, represent important intermediate stages for understanding the costs and consequences of tobacco use. Nonetheless, COI studies alone cannot help to establish resource allocation priorities. This must be done through full economic evaluations considering both costs and outcomes, as these permit assessment of efficiency.

2.5.2 Global Burden of Disease Assessment

Initiated by the World Bank and supported by the WHO, DALYs were designed to quantify the burden of diseases, injuries and risk factors on human populations. The creation of the DALY measure was designed to address several problems, two of which are particularly salient. The first problem concerns the paucity of relevant data in many developing countries. Even the most basic mortality data — the number of deaths from particular causes each year — are

Box 2.4 Questions Addressed in Tobacco-Related Cost-of-Illness (COI) Studies.

- What types of health-care services are required to treat tobacco-related diseases, and at what cost?
- What is the economic impact of tobacco use on home and workplace productivity?
- What is the economic impact of premature deaths due to tobacco use?
- How much reliance on the social welfare system is caused by tobacco use, and at what cost?
- What are the economic dimensions of other effects of tobacco use?

often not available. Moreover, even when such data are available, they fail to capture the impact on population health of nonfatal outcomes of disease and injury, such as dementia or blindness. The second problem concerns the need to develop measures that can guide policies toward more cost-effective and equitable health care. Traditional health statistics do not allow policy-makers to compare the relative cost-effectiveness of different interventions, for example, the treatment of ischemic heart disease versus a smoking cessation program. This shortcoming, which is also a weakness of the COI approach, is a serious drawback, especially when funds are tightly constrained but the range of medical possibilities that exist, and public expectations of health services, are growing (21).

Because the DALY measurement unit was designed to respond to these problems, it serves a dual function. Its first role is to act as a measure of the magnitude of premature death and nonfatal health outcomes attributable to proximal biological causes, including diseases and injuries, or to more distal causes, such as poor water supply, tobacco use or socioeconomic inequality (21, 29). This first function is similar in aim to a COI study, although more sophisticated in output. In terms of measuring the global burden of disease, the DALY offers an assessment of the relative magnitude of diseases and injuries and the fraction of each disease and injury attributable to major risk factors or socioeconomic determinants disaggregated by age, sex, and region. This information is therefore more detailed than most COI studies, and standardized for global comparability. The second function of the DALY measure is to serve as an outcome measure for cost-effectiveness analyses of interventions to reduce the burden of proximal causes or distal risk factors and socioeconomic determinants. This second role goes beyond what can be accomplished through the COI approach, and is actually analogous to the cost-utility approach based on what is termed quality-adjusted life-years (QALYs).

The construction of the measure is intuitively simple. DALYs, like quality-adjusted life-years, combine information about morbidity and mortality. But, where QALYs represent years of healthy life lived, DALYs reflect years of healthy life lost. Specifically, the DALY is calculated as the present value of the future years of disability-free life that are lost as the result of the premature deaths or cases of disability occurring in a particular year (21). In the DALY approach, each state of health is assigned a disability weighting on a scale from zero (perfect health) to one (death). To calculate the burden of a given disease, the disability weighting is multiplied by the number of years lived in that health state and added to the number of years lost due to that disease. Future burdens are discounted at a rate of 3% per year, and the value of the lifetime is weighted so that years of life in childhood and old age are counted less (21, 30).

By defining a DALY as a lost healthy life-year, it can be used to measure the gap between a population's current health status and some reference ideal, namely the burden of disease. Reductions in expected DALYs can be used to measure the benefits of interventions for cost-effectiveness analysis: the relevant quantity would be the number of DALYs estimated to occur in the absence of any interventions, minus the number that would be expected in the presence of interventions (29). In sum, the DALY can be defined as a unit used for measuring both the global burden of disease and the effectiveness of health interventions, as indicated by reductions in the disease burden (21).

Global burden of disease projections using DALYs suggest that by 2020, the burden of disease attributable to tobacco will outweigh that caused by any single disease, even HIV. From its 1990 level of 2.6% of the global disease burden, tobacco is expected to increase its share to just under 9% of the total burden in 2020, compared with less than 6% for ischemic heart disease, the leading projected disease (21).†

† See also **http://www.who.int/msa/mnh/ems/dalys/intro.htm**. Global burden of disease tables can be found in the World Health Report Appendices.

2.6 Cost-Effectiveness of Tobacco Control Strategies

Information on the cost-effectiveness of health-care programs is designed to improve the allocation of resources across different health interventions to maximize health. The goal of this research is to identify relatively low-cost preventive or smoking cessation measures that yield relatively large health benefits, and to inform discussions considering expanding provision of such interventions. In fact, multiple studies have suggested that tobacco control strategies are cost-effective in comparison to other health-care interventions in low- and middle-income countries. Tax increases have been shown to be cost-effective for each year of healthy life saved in these countries, with the additional cost per year saved ranging from $5 to $17. This compares favorably to other health-care programs commonly funded by governments (e.g., child immunization) (2). Evidence also suggests that nonprice strategies may be cost-effective in many countries (2).

Many countries, however, lack information on the cost-effectiveness of common tobacco control interventions, such as community-based interventions to prevent smoking, and tobacco cessation programs. The next section provides a detailed overview of the methods commonly used to assess the cost-effectiveness of health-care programs. Chapter 5 synthesizes information on the methods and conclusions of tobacco-related cost-effectiveness studies performed to date.

Economic evaluation can be defined as the comparative analysis of alternative courses of action in terms of both their costs and consequences (31). Such evaluations aim to facilitate comparison of alternative health-care interventions in terms of efficiency-related criteria, to contribute to improved policy-making.

It is customary to distinguish four types of economic evaluation methods: cost-minimization analysis (CMA), cost-effectiveness analysis (CEA), cost-utility analysis (CUA), and cost-benefit analysis (CBA). Unlike COI, which measures only costs, all four of these techniques are considered to be "full" economic evaluation methods, in that costs and effects are being compared between two or more alternative programs (32). Such approaches can be used to evaluate the cost-effectiveness of tobacco-related prevention and cessation strategies.

Although each approaches costs in a common format, methods differ in their manner of assessing benefits. CMA avoids specifying a measure of benefit, suggesting instead that if two treatments have the same outcome, the lowest cost treatment should be favoured. The conditions under which CMA is the most appropriate analytic design are relatively stringent, and this method is hence decreasing in frequency of use. The remainder of this section will describe the other three economic evaluation methods in more detail.

2.6.1 Cost-Effectiveness Analysis (CEA)

CEA can be defined as a comparison of interventions or programs that have a common health outcome (e.g., reduction of blood pressure; life-years saved). This type of analysis can be used to assess the efficiency of spending relative to program effectiveness in a situation where, for a given level of resources, the decision-maker wishes to maximize the health benefits conferred to the population of concern. A major limitation of this approach, however, is its inability to compare interventions with differing clinical outcomes or effects. Consequently, CEA is considered of limited applicability, or limited generalizability, and is not an ideal input for priority setting (31).

Tobacco-related cost-effectiveness studies have generally focused on smoking cessation programs such as the nicotine transdermal patch demonstrated to be an effective aid to quitting smoking. One U.S. study examined the cost-effectiveness of the nicotine patch as an adjunct to brief physician counseling during routine office visits (33). Benefits were measured in terms of years of life gained by those who quit.

Costs included physician time and patch prescriptions. The incremental cost-effectiveness was quantified as cost per additional year of life saved. Depending on age, the average costs per year of life saved range from $965 to $1,585 for men and from $1,634 to $2,360 for women. Incremental costs per year of life saved range from $1,796 to $2,949 for men and from $3,040 to $4,391 for women.

2.6.2 Cost-Utility Analysis (CUA)

CUA is an adaptation of CEA and aims to provide information on costs per health effect gained. Health effect gained is measured through a standardized outcome measure, such as a QALY or a DALY. The QALY, for example, measures the outcome of a treatment or intervention in terms of the number of years of life saved, adjusted for quality. The use of a standardized outcome measure has generated considerable interest because it allows in theory for computation of a ratio of productivity per unit of expenditure (e.g., cost per QALY, or cost per DALY) for comparison between programs across the continuum of health-related interventions (31). Considerable effort has recently been made to ensure that the results of different CUAs can be meaningfully compared to one another. A critical question, however, is whether the recommended approach provides unbiased estimates of cost-effectiveness across types of interventions and social groups. As a terminological note, it is important to bear in mind that CUAs and CEAs are often referred to more loosely as CEAs. This is particularly true in the United States.

In 1996, the Agency for Health-Care Policy and Research (AHCPR) in the United States published the *Smoking Cessation: Clinical Practice Guideline*. The guideline identifies efficacious interventions for primary care clinicians and smoking cessation specialty providers based on the results of meta-analyses and expert opinion. In order to determine the cost-effectiveness of clinical recommendations in AHCPR's guideline, its 15 recommended smoking cessation interventions were analyzed to determine their relative cost-effectiveness (34). The interventions were then combined into a global model of the guideline's overall cost-effectiveness (using CUA). The analysis assumes that primary care clinicians screen all presenting adults for smoking status and advise and motivate all smokers to quit during the course of a routine office visit or hospitalization. It was found that the guideline would cost $6.3 billion to implement in its first year, at an average cost of $3,779 per quitter, $2,587 per life-year saved, and $1,915 for every QALY saved. Costs per QALY saved ranged from $1,108 to $4,542, with more intensive interventions being more cost-effective. This suggests that greater spending on interventions yields more net benefit.

2.6.3 Cost-Benefit Analysis (CBA)

CBA measures costs and benefits in commensurate terms, usually monetary. By valuing all costs and benefits in the same units, CBA has the potential to compare diverse interventions using the net benefit criterion, which favours increased use of interventions with the greatest net gain. Practical measurement difficulties, however, and objections to valuing health benefits in monetary terms, have limited the use of CBA. It is worth noting that monetary measurement of benefits through the human capital approach, which assesses the value of health gains based on employment earnings, may misrepresent the value of benefits for those who are not economically productive. Other CBA approaches such as willingness-to-pay are in relatively early stages of development.

Although CEA, CUA, CBA, and CMA are designed to help draw conclusions about which of several policy alternatives is more efficient, relatively few tobacco-related studies to date have followed these methods.

Table 2.2 Basic Types of Health Economic Evaluations.

Type of Analysis	Measures/Units	Example
Cost-effectiveness	Incremental cost ($)/Health benefits (natural units)	$100,000/life-year
Cost-utility	Incremental cost ($)/Health improvement (adjusted natural units)	$2,000/quality-adjusted life-year
Cost-benefit	Incremental cost ($)/Health consequences ($)	0.75
Cost-of-illness	Burden of disease ($)	Burden of tobacco-attributable illness = $10 billion

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Chapter 3:
Synopsis: Economic Assessments of the Burden of Tobacco Use on Societies

"The costs of tobacco go far beyond the tragic health consequences. Tobacco is devastating to the economic health of the world."

Nakajima H. *An Appeal from the Director-General of the World Health Organization for World No-Tobacco Day*. Geneva, World Health Organization, 1995.

3.1 Introduction

Smoking impacts economies in at least two ways.

First, it is widely acknowledged that cigarette smoking is strongly associated with increased morbidity and mortality due to a number of diseases, the most recognized of which is lung cancer (7). In addition, the various substances contained in cigarette smoke are partly responsible for malignant tumours of the oral cavity and the pharynx, and are a main risk factor for myocardial infarction, cerebral thrombosis, arteriosclerosis, and chronic obstructive pulmonary diseases such as bronchitis and emphysema (8–10). Smoking therefore increases the risk of incurring a wide variety of diseases, resulting in increased health expenditures.

Second, smoking-related morbidity may also lead to lost productivity or premature death, resulting in costs to the smoker, the employer, and society at large.

A growing literature exists on the economic impact of smoking on societies throughout the world. The majority of published studies have been undertaken in developed countries, using data from North America, Europe, as well as Japan, Australia and New Zealand. Relatively few studies have examined the economic impact of smoking in developing countries. For the most part, published data on the economic impact of tobacco use consists of large-scale studies attempting to estimate country-level or population-level direct and indirect tobacco-related costs.

This chapter provides a synopsis of the most recent and important findings on the medical and nonmedical costs of tobacco use in different societies. It presents findings from ten countries, and summarizes relevant data in accompanying tables. Of the many available techniques examining the burden of tobacco use on societies (Chapter 2, Sections 2.4 and 2.5), the most popular research design is a prevalence-based COI study, described in Chapter 2 (Section 2.5.1).

3.2 Economic Impact of Smoking on Societies

A presentation by the World Bank at the 9th World Conference on Tobacco or Health (Paris, France, October 10–14, 1994) used cost-benefit analysis to estimate that the global net loss resulting from 1,000 additional tons of tobacco consumption would be $27.2 million. The estimated benefits to consumers and producers in the form of immediate pleasure and profits would be $2.6 million (in 1990 prices). The corresponding cost, however, of treating tobacco-induced diseases such as cancer, cardiovascular, cerebrovascular and chronic obstructive pulmonary diseases, was estimated to be $5.6 million. Additionally, indirect costs, in this case the economic value of the years of life lost to morbidity and premature mortality, were estimated to be $11 million and $13.2 million respectively. With extrapolation, the world tobacco market was estimated to produce an annual global loss of $200 billion, with about one-third of the loss occurring in developing countries. The full presentation is available at http://www1.worldbank.org/tobacco.

By 2020, tobacco will become the largest single health problem, causing an estimated 8.4 million deaths annually. This increase will be shared disproportionately by the developing world. While deaths in developed regions are expected to rise by 50%, from 1.6 to 2.4 million, those in developing countries are expected to grow by approximately 400%, from 1.5 to 6 million (6).

The following sections describe the situation in some of the countries where data is available.

3.2.1 Canada

A study based on 1992 data estimated that tobacco use accounted for approximately $7.5 billion in costs to Canadian society, including $2.1 billion in direct medical-care costs and $5.4 billion in lost productivity (1) (Table 3.1), which was due mainly to the premature death of smokers. Direct medical-care costs included $1.4 billion for treatment of tobacco-attributable disorders in general hospitals, $360 million for prescription drugs, and $268 million for physician fees. When the analysis was repeated using extreme assumptions, total smoking-attributable costs in 1992 ranged from $6.1 billion to $8.7 billion.

Table 3.1 Findings of Selected Studies Examining Tobacco-Attributable Costs in Canada.

- Authors and Reference No. - Title of Publication	Measured Costs	Estimated Costs
Single, Robson, Xie, Rehm (1) The Economic Costs of Alcohol, Tobacco, and Illicit Drugs in Canada, 1992	Direct Medical Care	$ 2.1 B
	Hospital Care	$ 1.4 B
	Prescription Drugs	$ 0.4 B
	Physician Fees	$ 0.3 B
	Productivity Loss	$ 5.4 B
	Total	$ 7.5 B
		In 1993 U.S. $
		B = Billion

3.2.2 *United States*

Several studies have estimated medical-care expenditures due to smoking in the United States. One such study (2) estimated smoking-attributable costs for medical care in the United States in 1993 to be $50 billion (Table 3.2). Of these costs, $26.9 billion were used for hospital expenditures, $15.5 billion for physician expenditures, $4.9 billion for nursing-home expenditures, $1.8 billion for prescription drugs, and $900 million for home health-care expenditures. In a complementary study by Miller et al. (3), also examining 1993 data, total medical expenditures attributable to smoking amounted to an estimated $72.2 billion, or 11.8% of total medical expenditures (Table 3.2). Of this total, $18.5 billion were used for ambulatory care, $7.7 billion for prescription drugs, $35.9 billion for hospital care, $1.7 billion for home health care, and $8.9 billion for nursing home care.

Estimates of state-specific expenditures attributable to smoking ranged from approximately $80 million to $9 billion, and state-specific proportions of total expenditures ranged from approximately 7% to 14%. The disparity in total smoking-attributable costs between the estimates of the Miller et al. study (3) and those reported in *Morbidity and Mortality Weekly Report* (2) are due to methodological differences between the two analyses. Updated estimates of the study by Miller et al. were recently published in a study estimating the economic costs of substance abuse in 1995 (4). According to this update, total smoking-attributable costs in the United States for 1995 were approximately $138 billion and consisted of $80 billion in direct medical costs and $58 billion in lost productivity costs. A systematic review of six peer-reviewed articles on the medical costs of smoking in the United States indicated at least 6–8% of yearly individual medical expenditures were earmarked for treating

Table 3.2 Findings of Selected Studies Examining Tobacco-Attributable Costs in the United States.

- Authors and Reference No. - Title of Publication	Measured Costs	Estimated Costs
Anonymous (2) Medical-Care Expenditures Attributable to Cigarette Smoking – United States, 1993	• Hospital expenses	$ 26.9 B
	• Ambulatory physician care	$ 15.5 B
	• Nursing home care	$ 4.9 B
	• Home health care	$ 0.9 B
	• Prescription drugs	$ 1.8 B
	Total	$ 50.0 B
		In 1993 U.S. $
Miller, Zhang, Rice, Max (3) State Estimates of Total Medical Expenditures Attributable to Cigarette Smoking, 1993	• Ambulatory care	$ 18.5 B
	• Prescription drugs	$ 7.7 B
	• Hospital care	$ 35.9 B
	• Home health care	$ 1.7 B
	• Nursing home care	$ 8.9 B
	Total	$ 72.2 B
		In 1993 U.S. $

B = Billion

smoking-related diseases (5). This estimate was based on data for the three leading causes of smoking-related deaths: lung cancer, heart disease, and chronic obstructive pulmonary disease.

3.2.3 The Netherlands

A study carried out in the Netherlands by Barengdt et al. (6) using 1988 data found that health-care costs for smokers at any age were as much as 40% higher than those for nonsmokers (Table 3.3). The authors found that if all smokers were to quit, health-care costs would at first be lower, but after 15 years they would become higher than at present. Lifetime costs for smokers were estimated to be $72,000 per person among men and $94,700 per person among women, and lifetime costs among nonsmokers were $83,400 and $111,000 respectively. This difference amounts to lifetime costs for nonsmokers that are 15% higher among men and 18% higher among women.

3.2.4 Germany

A recent study in Germany (11) estimated the 1996 smoking-attributable direct health-care costs and indirect costs for seven diseases, including chronic obstructive pulmonary disease, lung cancer, stroke, coronary artery disease, cancer of the mouth and larynx, and atherosclerotic occlusive disease (Table 3.3). Overall smoking-attributable costs for these diseases were $20.8 billion, with 51% in direct health-care costs and 49% in indirect costs. Treatment in acute hospitals accounted for 27% of the direct costs, whereas indirect costs attributable to smoking were primarily due to working days lost (28%), premature retirement (33%), and premature death (39%).

Another study used 1993 data to estimate the smoking-attributable costs of health damage and productivity losses for neoplasms, cardiovascular diseases, respiratory diseases, perinatal diseases, and burn deaths (12). Direct costs were calculated with utilization and expenditure data for acute hospitalizations, inpatient rehabilitation, ambulatory care, and prescribed drugs. Indirect costs were calculated using the human capital approach (Section 2.5.1.2). Smoking attributable costs for 1993 were: direct costs – $5.4 billion; mortality – $4.8 billion; lost work days and early retirement – $9.6 billion (using a 3% discount rate).[†] Total costs per capita were $243, and $935 per current smoker.

3.2.5 Switzerland

In Switzerland, one study estimated the percentage of both physician visits and days spent in hospital for smoking-related diseases (13). Smoking-attributable risk was highest for lung cancer (83.3%), second highest for bronchitis and/or emphysema (67%), and lowest for coronary heart disease (20%). These percentages represent weighted averages over all age classes and vary considerably with age. For instance, the calculated smoking-attributable risk was more than 50% at ages 35–39 but only 4% at ages 80–84 for coronary heart disease. Using these results, it was estimated that approximately 2% of all physician visits by men and 4.5% of all male hospital days at all ages were attributable to smoking. On average, smokers had 8% more physician visits and 10% more hospital days per year compared to nonsmokers.

3.2.6 Spain

No study identified by our literature search has estimated smoking-attributable costs in Spain. One study, however, examined the relationship between tobacco consumption and the use of health-care services in 1993 (14). The results of the study indicate that male smokers are hospitalized more frequently and have a statistically significant increased use of hospital

[†] Guidelines for health economic analyses recommend a rate of 3% as one acceptable standard for discounting costs and benefits (16).

emergency services, compared to male nonsmokers. Female smokers were more often hospitalized and had increased medical visits compared to nonsmoking females. In addition, compared to never-smokers, ex-smokers of both sexes generally made greater use of health-care services. These results were reasonably consistent across all age groups and continued to be observed after adjusting for confounding. It was therefore concluded that control of smoking could reduce both the use of health-care services and the related economic costs in Spain.

3.2.7 *United Kingdom*

A recent study in the United Kingdom estimated the health and economic outcomes associated with smoking and the benefits of smoking cessation in 1999 (15) (Table 3.3). The results indicate that smoking-related diseases in the United Kingdom account for over 5 million cases of morbidity at 20 years and 2.4 million deaths over the same period. For this period of time, the cumulative cost of smoking-related morbidity is approximately $45.8 billion. A smoking cessation strategy has a total cost of $168 million, approximately $1,944 per life-year saved and $35,640 per death averted.

Table 3.3 Findings of Selected Studies Examining Tobacco-Attributable Costs in European Countries.

- Authors and Reference No. - Country - Title of Publication	Measured Costs	Estimated Costs
Barendregt, Bonneux, Van der Maas (6) Netherlands The Health-Care Costs Of Smoking	Lifetime Costs for • Male smokers • Female smokers • Male nonsmokers • Female nonsmokers	$ 72,000 $ 94,700 $ 83,400 $ 111,000 In 1988 U.S. $
Ruff, Volmer, Nowak, Meyer (11) Germany The Economic Impact of Smoking in Germany	• Health-Care Costs • Indirect Costs Premature death Premature retirement Productivity Loss Total	$ 5.46 B $ 5.24 B $ 2.04 B $ 1.73 B $ 1.47 B $ 10.7 B In 1996 U.S. $
Orme, Hogue, Kennedy, et al. (15) United Kingdom Development of the Health and Economic Consequences of Smoking Interactive Model	• Morbidity • Cessation Strategy • Cessation Strategy Per life-year saved Per death averted	$ 45.8 B $ 167.7 M $ 1,944 $ 35,640 In 1999 U.S. $

B = Billion; M = Million

3.2.8 Australia

A recent study compared the costs and benefits of cigarette smoking in Australia from the perspective of the government in fiscal year 1989/1990 (17) (Table 3.4). It was estimated that direct and indirect costs to government totaled $553.4 million. Health-care costs totaled $346.9 million and included hospital care (56%), medical care (11%), pharmaceutical care (15%), allied professional care, and nursing home care (18%). Additional costs to the government included direct expenditures related to tobacco control campaigns ($8 million) and assistance to industry ($5.9 million). Indirect costs to government totaled $192.6 million and included losses due to foregone earnings ($124 million) and workers' absenteeism ($68.6 million). It was also estimated that the benefits to government totaled $1,687 million in tobacco-related revenues.

3.2.9 New Zealand

Gray et al. (18) applied attributable risks of mortality and morbidity for current or past cigarette smoking to mortality and hospital morbidity data in New Zealand. Using 1981 and 1984 national census data, it was found that 22% of all male deaths and 10% of all female deaths were attributable to smoking. During the same year, 5.9% of male hospitalizations and 1.7% of female hospitalizations were attributed to cigarette smoking. It was found that if all New Zealanders were nonsmokers, the savings in costs of hospital resources to taxpayers would be $41.3 million.

In a separate study by Phillips et al. (19), cost figures for hospital resources by Gray et al. (18) were refined and updated, and various aspects of primary health care (e.g., general practitioner consultations) were costed (Table 3.4). The total cost of health services use due to cigarette smoking was estimated at $109.4 million. Excess hospital costs attributable to smoking totaled $75.7 million, and a further $22.3 million was consumed in excess prescription medicine use and $11.4 million in general practitioner consultations. It was also noted that the figure of $109.4 million contrasts with the $4.4 million of sponsorship support that the tobacco industry is estimated to provide for New Zealand sports.

3.2.10 China

A 1995 study by Chen et al. (20), was undertaken to identify the smoking-attributable direct medical costs in China in 1988. Medical costs in this study were defined as hospital resource consumption. Indirect costs were not included in the analysis. The study focused on inpatient and outpatient costs of seven diseases caused by smoking. The results of the study indicate that total smoking-attributable medical costs were $620 million in 1988, including $460 million for outpatient costs and $160 million in inpatient costs.

A related study evaluated the 1988–1989 smoking-induced health costs in China (21). Compared to the study by Chen and colleagues, this study examined direct and indirect medical costs. Total smoking-attributable economic costs to health sectors in China were $6.5 billion, consisting of $1.7 billion in direct medical costs and $4.8 billion in indirect costs. Indirect medical costs included indirect morbidity costs and indirect mortality costs. It was found that diseases of the circulatory system and respiratory system brought the heaviest health burden. The costs due to these two categories accounted for more than 60% of total smoking-attributable health-related economic costs.

3.2.11 Japan

A 2001 study examined the impact of smoking on medical resource utilization in a large population-based cohort in Japan (22). Data on medical resource utilization and costs were collected for 1995–1997 in the prospective study.

The results of the study indicate that mean per capita per month tobacco-attributable medical costs were $1,868 for deceased smokers, $203 for those who had withdrawn from the study, and $214 for survivors. In males, per capita per month medical costs were $282 for smokers, which was 11% higher than never-smokers; in females, however, it was $234 for smokers, almost the same as that of female never-smokers. Differences in medical-care costs were mainly attributable to differences in costs for inpatient care. Per capita per month inpatient costs were higher for smokers of both sexes, 33% higher in males and 8% higher in females. Per capita per month outpatient costs were slightly lower for smokers in both sexes.

3.3 Global Trends

At the global level, some important disability-adjusted life-year (DALY)-based estimates of global trends exist. DALYs attributable to tobacco use in 2020 could be over three times higher in developing regions versus developed regions (94,537 versus 29,141 – Table 3.6). For developing regions, this would be more than a fivefold increase from the DALYs attributable to tobacco use in 1990 (to 94,537 from 16,772 – Tables 3.5 and 3.6). Comparatively, this would be only a 1.5 times increase for the developed world (to 29,141 from 19,410 – Tables 3.5 and 3.6). These estimates highlight the growing problem that tobacco dependency poses for developing nations.

Table 3.4 Findings of Selected Studies Examining Tobacco-Attributable Costs in Australia and New-Zealand.

- Authors and Reference No. - Country - Title of Publication	Measured Costs	Estimated Costs
Doran, Sanson-Fisher, Gordon (17) Australia A Cost-Benefit Analysis of the Average Smoker: A Government Perspective	• Health-care costs • Antismoking campaigns • Assistance to industry • Indirect costs Productivity loss Absenteeism Total	$ 346.9 M $ 8.0 M $ 5.9 M $ 192.6 M $ 124.0 M $ 68.6 M $ 553.4 M In 1989–90 U.S. $
Phillips, Kawachi, Tilyard (19) New Zealand The Costs of Smoking Revisited	Excess Smoking-Related Costs: Hospitalization Prescription medicine Physician consultations Total	 $ 75.7 M $ 22.3 M $ 11.4 M $ 109.4 M In 1989 U.S. $

3.4 Conclusions

The studies reviewed in this chapter (summarized in Table 3.7) were situated in different contexts, used a variety of methodologies, and varied in quality. All of them, however, clearly pointed to one common finding: tobacco use exacts a severe economic toll on health-care resources, and competes with other social priorities.

At the global level, DALY-based studies confirmed the substantial and increasing toll that tobacco use exerts on the economies and societies of the developing world. At the national level, COI studies were the design of choice to assess tobacco disease burden, in part because of the relative availability of data. Prevalence-based COI studies were more common than incidence-based COI studies, probably largely due to the latter's demanding data requirements. In fact, of the 16 studies in this chapter that contain cost data, 11 (69%) are prevalence-based COI. Note, though, that incidence-based COI studies are more advantageous with respect to evaluating the impact of interventions (e.g., prevention programs) to reduce tobacco use.

Table 3.5 Deaths and Disability-Adjusted Life-Years (DALYs) Attributable to Tobacco Use for 1990.

Region	Deaths ('000s)	Percentage of Total	DALYs ('000s)	Percentage of total
Former Socialist Economies of Europe	515	13.6	7,803	12.5
India	129	1.4	1,719	0.6
China	820	9.2	8,078	3.9
Other Asia and Islands	223	4.0	2,638	1.5
Sub-Saharan Africa	78	0.9	1,217	0.4
Latin America and the Caribbean	99	3.3	1,340	1.4
Middle Eastern Crescent	111	2.4	1,779	1.2
World	3,038	6.0	36,182	2.6
Developed Regions	1,577	14.5	19,410	12.1
Developing Regions	1,460	3.7	16,772	1.4

Source: Murray, C.J.L; Lopez, A.D. Assessing the burden of disease that can be attributed to specific risk factors. *In:* Ad Hoc Committee on Health Research Relating to Future Intervention Options. *Investing in Health Research and Development*. World Health Organization (WHO), Geneva, 1996. Table A2.2. Table reproduced from WHO Tobacco Free Initiative Website: http://tobacco.who.int/page.cfm?sid=47#1990 Accessed March 8, 2002.

Despite the fact that the DALY approach is designed to help establish both burden of disease and resource allocation priorities, none of the country-level studies reviewed in this chapter used the DALYs to assess the burden of disease. To date, only the WHO appears to have employed the DALY-based approach in tobacco-related studies (23).

Based on the availability of studies, this review focused on the developed world. Little information exists on the economic impact of tobacco use in developing countries, despite the fact these countries are expected to experience the largest growth in tobacco consumption, disease, and death over the coming two decades. Future research should focus on monitoring the burden of disease in developing countries, to set the stage for comprehensive tobacco control efforts.

Table 3.6 Deaths and Disability-Adjusted Life-Years (DALYs) Attributable to Tobacco Use for 2020.

Region	Deaths ('000s)	Percentage of Total	DALYs ('000s)	Percentage of total
Established Market Economies	1,286	14.9	16,499	17.0
Former Socialist Economies of Europe	1,101	22.7	12,643	19.9
India	1,523	13.3	24,024	10.2
China	2,229	16.0	35,415	16.1
Other Asia and Islands	681	8.8	10,061	6.1
Sub-Saharan Africa	298	2.9	5,457	1.7
Latin America and the Caribbean	447	9.4	7,280	6.8
Middle Eastern Crescent	817	9.5	12,299	7.3
World	8,383	12.3	123,678	8.9
Developed Regions	2,387	17.7	29,141	18.2
Developing Regions	5,996	10.9	94,537	7.7

Source: Murray, C.J.L.; Lopez, A.D. Assessing the burden of disease that can be attributed to specific risk factors. *In*: Ad Hoc Committee on Health Research Relating to Future Intervention Options. *Investing in Health Research and Development*. World Health Organization (WHO), Geneva, 1996. Table A2.2. Table reproduced from WHO Tobacco Free Initiative Website: http://tobacco.who.int/page.cfm?sid=47#2020 Accessed March 8, 2002.

Table 3.7 Studies of the Economic Impact of Tobacco Use on Societies (Studies Containing Cost Data Only).

Authors and Reference No.	Country	Type of Study
Single et al. (1)	Canada	COI - Prevalence
Anonymous (2)	United States	COI - Prevalence
Miller et al. (3)	United States	COI - Prevalence
Rice (4)	United States	COI - Prevalence
Warner et al. (5)	United States	Systematic Review
Barendregt et al. (6)	Netherlands	COI - Incidence
Ruff et al. (11)	Germany	COI - Prevalence
Welte et al. (12)	Germany	COI - Prevalence
Leu and Schaub (13)	Switzerland	COI - Prevalence
Orme et al. (15)	United Kingdom	CEA
Doran et al. (17)	Australia	COI - Prevalence
Gray et al. (18)	New Zealand	COI - Incidence
Phillips et al. (19)	New Zealand	COI - Prevalence
Chen et al. (20)	China	COI - Prevalence
Jin et al. (21)	China	COI - Prevalence
Izumi et al. (22)	Japan	COI - Incidence

COI = Cost-of-illness; CEA = Cost-effectiveness analysis

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Chapter 4:
Synopsis: Economic Assessments of the Burden of Tobacco Use in Population Subgroups

4.1 Introduction

Recent studies have focused increasingly on the economic impact of tobacco use in specific age-, gender-, and disease-affected populations. This chapter provides a synopsis of the findings and methodologies of studies examining the economic impact of tobacco use in specific population subgroups. Section 4.2 presents selected studies examining the economic impact of tobacco use across different levels of income and education. Sections 4.3 and 4.4 look at the economic effects of tobacco consumption on women and children respectively.

4.2 Smoking, Income and Education

4.2.1 Income

Historically, the number of smokers rose as incomes rose within populations (1). In the early decades of the smoking epidemic, smokers in high-income countries were more likely to be affluent than poor. This pattern appears to have reversed among men in the past three or four decades (1). Affluent men in high-income countries have increasingly quit smoking, whereas poorer men have not. In Norway, for example, the percentage of men with high incomes who smoked fell from 75% in 1955 to 28% in 1990 (1). Over the same period, the proportion of smoking men with low incomes declined much less steeply, from 60% in 1955 to 48% in 1990 (1).

Today, in most high-income countries, there are significant differences in the prevalence of smoking between different socioeconomic groups. In the United Kingdom, only 10% of women and 12% of men in the highest socioeconomic group are smokers (1). In the lowest socioeconomic groups the corresponding figures are 35% and 40% respectively. Over the years, there has also been a slower decline in

smoking among manual occupation groups, so that smoking has become increasingly concentrated in these groups. In 1999, 33% of British men and 34% of British women in manual occupations smoked, compared to 21% and 22%, respectively, in nonmanual occupations (2).

An econometric analysis in the United Kingdom examined the effects of price, income, and health publicity on cigarette smoking by age, sex, and socioeconomic group (3). The results suggest that men and women in lower socioeconomic groups are more responsive to changes in the price of cigarettes than are those in higher groups. Women of all ages, including teenagers, appear to be more responsive to price. It was therefore suggested that price increases in cigarettes could narrow differences between socioeconomic groups in smoking, and that steadily increasing cigarette taxes could help achieve government targets for smoking and smoking-related diseases. These suggestions have been confirmed in a wide variety of contexts (1).

4.2.2 Education

A similar inverse relationship to income and smoking is found between education levels and smoking. In general, individuals who have received little or no education are more likely to smoke than those who are more educated. Studies in Brazil, China, India, South Africa, Vietnam, and several Central American nations confirm this pattern (1).

In the general U.S. population, 26–28% of Americans continue to smoke, but variations exist among groups with different educational levels (4). Demographic factors associated with higher smoking prevalence include lower socioeconomic status and lower educational level. Those with less than high school education are more likely to be current, ever, and heavy smokers, and also the least likely to quit. In contrast, an increased number of years of education is associated with never smoking and higher cessation rates (4).

While little research currently exists on the distribution of smoking prevalence among population subgroups in the developing world, there is reason to believe that the inverse relationships identified in high-income countries between income and smoking, and education and smoking, do not necessarily hold. For example, a survey in Khartoum, Sudan, showed that 64% of doctors and university lecturers, and 34% of medical students, were smokers, and similar results have been shown in other major urban centres of the developing world, such as Nairobi, Kenya, and Shanghai, China (5).

4.3 Effects of Smoking on Women

4.3.1 Smoking Prevalence

Smoking kills over half a million women worldwide each year and this number is increasing rapidly (7). It is estimated that between 1950 and 2000, 10 million women died from smoking. In developed countries, such as the United States and the United Kingdom, cigarette smoking is now the single most important preventable cause of premature death in women, accounting for at least a third of all deaths in women aged 35 to 69. Despite these figures, smoking is still regarded in many countries as mainly a male problem, primarily because cigarette smoking prevalence among women, particularly in developing countries, is still low compared to men (7). In addition, no country has yet experienced the full impact of smoking on women's health because of the time lag between smoking becoming a widespread habit and the emergence of tobacco-related health problems.

In 1960, 40% of women and 60% of men in Britain smoked cigarettes. By the mid-1990s, the rate for men had dropped by nearly half to 32%, while the rate for women had dropped by just one quarter to 30% (8). Australia, the United States, and some European countries show similar trends: forty years after evidence of the

link between smoking and lung cancer, the rate of female smoking has almost caught up to male rates (9). China is a particularly interesting case as the smoking prevalence among women in that country is among the lowest in the world (10).

The following table, based on burden of disease projections using the disability-adjusted life-year (DALY) methodology, demonstrates that the number of deaths and DALYs lost due to smoking

Table 4.1 Tobacco: Magnitude of the Problem by Sex and WHO Region, Estimates for 1998.

	Deaths (000)			DALYs (000)		
	Both sexes	Males	Females	Both sexes	Males	Females
All Member States	4,023	3,241	782	49,288	40,037	9,251
Africa	125	112	13	1,900	1,763	137
The Americas	772	472	300	8,867	5,529	3,338
High income	604	342	262	6,603	3,752	2,851
Low and middle income	168	130	38	2,264	1,777	487
Eastern Mediterranean	182	160	22	2,976	2,547	429
Europe	1,273	1,066	207	17,084	14,396	2,687
High income	538	425	113	5,887	4,654	1,233
Low and middle income	735	641	94	11,196	9,742	1,454
South-East Asia	580	505	75	7,439	6,456	983
India	383	332	51	5,098	4,415	683
Other low and middle income	197	173	24	2,341	2,041	300
Western Pacific	1,093	927	166	11,022	9,354	1,677
High income	116	88	28	1,274	970	304
China	913	783	130	8,991	7,716	1,275
Other low and middle income	64	56	8	757	659	98

Source: *World Health Report 1999. Making a Difference*. Geneva: World Health Organization (WHO), 1999. Table reproduced from WHO Tobacco Free Initiative Website: http://tobacco.who.int/page.cfm?sid=47#1998 accessed March 8, 2002.

among women is still relatively small in low- and middle-income countries. This is, however, likely to change in the very near future.

In developed countries, smoking rates among women are declining despite increasing rates among some groups of teenage girls. A recent WHO study of 10 European countries indicated that over a third of girls have tried smoking by the age of 13, and this increased to about 60% among 15-year-olds (11). In developing countries, where 80% of the world's population lives, the smoking rate among women is quickly rising (9). The WHO estimates that the overall smoking rate for women in developing countries is about 7%, compared with 48% for men (9). The current uptake of smoking by women could raise the rate of smoking from 7% to 20% by 2024 and double their death rate by that year (9).

Women are beginning to smoke at younger ages and are therefore increasing their risks of developing smoking-related diseases and dying prematurely (12). The smoking rate among teenage girls is rising fastest, and in some countries teenage girls are now smoking more than their male counterparts (9). In the United States, smoking rates among female high school seniors have increased from 18% in 1991 to 24% in 1997 (12). Smoking rates among women 18 years and older vary considerably according to ethnic groups: 35% among American Indians, 24% among Caucasians and African Americans, 15% among Hispanics, and 4% among Asians and Pacific Islanders (12).

Smoking rates among women also vary according to education. The more formal education a woman receives, the less likely she is to be a smoker. Among U.S. women between the ages of 25 and 44, proportions of smokers in 1995 were 40% among those not finishing high school, 34% among high school graduates, 24% among those with some college education, and 14% among women who graduated from college (12).

4.3.2 Gender Differences in Direct Medical Costs

Many economic studies examining country-specific costs of tobacco use have reported on gender differences. The Canadian study undertaken by Kaiserman (13), for example, examined direct and indirect 1991 smoking-attributable costs and found that hospitalization costs for males were almost twice as high as the costs for females. When analyzed according to age group, the data revealed that the bulk of smoking-attributable costs of female ever-smokers accumulate between the age groups of 15–34 and 65–74. For men, however, costs accumulate between the 55–64 age group. The peak expenditures in the early age group among women are possibly explained by the increase in the number of female smokers and by complications during childbirth.

Tobacco smoke does not discriminate between men and women. The main tobacco-related killers in both sexes are cancers — especially lung cancer — heart disease, and chronic bronchitis. There are, however, a number of tobacco-related adverse health effects that are specific to women (9). Smoking has a damaging effect on women's reproductive health and is associated with reduced fertility and early menopause (12). It is estimated that 29% of deaths from cervical cancer are caused by smoking (14). It was also found that smoking combined with taking contraceptive pills can increase the risk of heart disease tenfold (15).

Smoking by women also has adverse effects on the fetus during pregnancy. Research has shown that pregnant women who smoke cigarettes increase their risk of having low birth weight (LBW) infants. Randomized trials indicate that women who quit smoking early in pregnancy reduce their risk of delivering a LBW infant (16). Recent U.S. figures suggest that smoking is responsible for 15% of all pre-term births and 20%–30% of infants with LBW who require neonatal intensive care unit (NICU) admission (17). It is estimated that smoking during pregnancy is responsible for 14,000 to 26,000 admissions to NICUs (17).

Costs of NICU cases are particularly high, with the cost per NICU admission in the United States estimated at $5,213 to $10,306 (17). It is therefore evident that smoking during pregnancy is responsible for an important proportion of infant hospitalization costs.

A U.S. study estimated the cost-effectiveness of a smoking cessation program for preventing LBW and perinatal mortality (16). The analysis assumed that the smoking cessation program would cost $30 per participant and that 15% of the participants would quit smoking. It was determined that a program offered to all pregnant smokers would shift 5,876 LBW infants to normal birth weight and would cost about $4,000 for each LBW infant prevented. Since infants born to smokers are at greater risk of perinatal death, a smoking cessation program could prevent 338 deaths at a cost of $69,542 for each perinatal death averted. Compared with the costs of caring for these LBW infants in a NICU, smoking cessation programs would save $77.8 million, or $3.31 per $1 spent. If reducing long-term care for infants with disabilities secondary to LBW is included in the benefits derived from smoking cessation programs, the ratio of savings to costs increases to more than six to one. The results of this study argue for routinely including smoking cessation programs in prenatal care for smokers.

Box 4.1

"Reduced quality of life for not only the smoker and those affected by secondhand smoke, but also the suffering that is brought upon those people whose lives are torn apart due to the loss or illness of a loved one."

McBride, C.M.; Lozano, P.; Curry, S.J.; Rosner, D., et al. (18)

4.4 Effects of Smoking on Children

4.4.1 Exposure to Secondhand Smoke

Children are innocent victims of tobacco smoke pollution, the harmful effects of which start at the youngest ages. There is consistent evidence that nonsmokers, particularly young children, experience negative health effects from exposure to environmental tobacco smoke (18). Parental smoking is therefore a major, but entirely preventable, cause of morbidity, mortality, and economic costs among children (19).

Women who smoke during pregnancy subject themselves and their fetus or newborn to special risks, including pregnancy complications, premature birth, and LBW (12). In addition, research suggests that intrauterine exposure and passive exposure to secondhand smoke after pregnancy are associated with an increased risk of sudden infant death syndrome (12).

Compared to children of nonsmokers, infants and primary school-aged children who live in households with smokers are at a significantly greater risk for a variety of illnesses such as upper and lower respiratory tract infections (18). In the United States, the condition of 400,000 to 1 million asthmatic children has been worsened by exposure to secondhand smoke, and the odds of developing asthma are twice as high among children whose mothers smoke at least 10 cigarettes a day (12). These conditions represent a significant proportion of all childhood morbidity and may therefore increase the demand for pediatric health services and direct medical costs among children living in households with smokers.

The WHO noted that the greatest costs of tobacco industry products may lie in the human potential foregone as families cope with the illnesses and premature deaths of smokers (19). The loss of a parent may leave a lifetime of negative effects on the surviving children, taxpayers, and society. The death of a parent is a traumatic experience for a child, and up to 40% of children facing the death

of a parent show emotional disturbance a year later (19). Over the long-term, there may be up to a fivefold increase in childhood psychiatric disorders in these children. Even adults and the elderly who have lost a parent during childhood seem to be more vulnerable to depression, anxiety, and attempted suicide (20).

4.4.2 Use of Health-Care Services

A U.S. study sought to assess whether exposure to environmental tobacco smoke results in greater use of health services among children of smokers (18). Health-care utilization was compared between children of smokers and nonsmokers who were enrolled in a health maintenance organization. There were no differences between children of smokers and children of nonsmokers in the use of primary care visits, emergency room visits, asthma-related prescriptions, and inpatient stays. Among children with preventive care visits, however, children of smokers had significantly fewer visits than those of nonsmokers. It was therefore concluded that further studies were needed to elucidate whether (a) parents who smoke underutilize or use health services differently for their children and (b) whether these differences have cost implications.

4.4.3 Direct and Indirect Costs

In one study, techniques of literature synthesis were used to determine the economic influence of pediatric disease attributable to parental smoking (19). Published data on relative risk, incidence, and costs were used to calculate the direct medical expenditures and costs for loss of life in children due to parental smoking. Illnesses attributable to parental smoking included LBW, sudden infant death syndrome, respiratory disorders, otitis media, and asthma. It was found that parental smoking results in more than 5.4 million excess cases of disease and 6,200 excess childhood deaths in the United States. Tobacco-related morbidity in children results in annual direct medical expenditures of $4.6 billion and loss of life costs of $8.2 billion.

Another study sought to assess the association between environmental tobacco smoke exposure from maternal smoking and health-care expenditures for respiratory conditions among U.S. children (21). To determine such expenditures, family-level data contained in the 1987 *National Medical Expenditure Survey* were used. Respiratory-related health-care expenditures among children whose mothers smoke were found to be significantly higher than the expenditures for children of nonsmoking mothers. Maternal smoking was associated with increased health-care expenditures, in 1995 dollars, averaging $120 per year for children aged 5 and under and $175 per year for children aged 2 and under. The analysis indicates that passive smoking was associated with $661 million in annual medical expenditures in 1987, representing 19% of all expenditures for childhood respiratory conditions.

It has been shown that exposure to environmental tobacco smoke in children is associated with respiratory complaints, a reduction in lung function, and asthma (22). For this reason, the objective of one study in Hong Kong was to examine the financial cost of doctor consultations for cough, phlegm, and wheeze in children exposed to tobacco smoke at home compared with those not exposed to environmental tobacco smoke in the home. The rate of $2 per doctor consultation was used in the analysis. Compared to children not exposed to environmental tobacco smoke, the expected direct cost of doctor consultations per year per child was 14% higher for children living in a home with one smoker, and 25% for those living in a home with more than one smoker. These values translate into avoidable direct costs in children from birth to 12 years of age ranging from approximately $51,613 to $129,032 in 1992.

Another child-related economic evaluation of tobacco use was undertaken to estimate the excess direct medical costs of LBW from maternal smoking and short-term cost savings from smoking cessation programs before or during the first trimester of pregnancy in the United States (23). Total direct medical costs in 1995 were estimated at $263 million, and mean excess direct medical cost per live birth for each pregnant smoker was $511. It was also estimated that an annual drop of one percentage point in smoking prevalence would prevent 1,300 LBW live births in the United States and save $21 million in direct medical costs in the first year of the program. Over a 7-year period, the reduction in smoking would prevent 57,200 LBW infants and save $572 million in direct medical costs.

4.4.4 Direct Nonmedical Costs

Smoking causes large numbers of deaths in people of child-rearing age. In the United States, these deaths result in higher government expenditures on insurance taxes for social security survivors. One study estimated the 1994 smoking-attributable deaths of men and women at child-rearing ages in the United States (20). It was found that smoking caused an estimated 44,000 male and 19,000 female deaths at ages 15–54, leaving 31,000 fatherless and 12,000 motherless youths. The resulting expenditure for the U.S. federal government-funded social security survivors' insurance tax was approximately $1.4 billion in 1994.

Table 4.2 Typology of Studies of the Economic Impact of Tobacco on Population Subgroups (Studies Containing Cost Data Only).

Authors and Reference No.	Country	Type of Study
Kaiserman et al. (13)	Canada	COI-Prevalence
Marks et al. (16)	United States	CBA/CEA
Cohen and Barton (17)	United States	COI-Prevalence
Aligne et al. (19)	United States	Literature Synthesis
Leistikow et al. (20)	United States	COI-Prevalence
Stoddart and Gray (21)	United States	COI-Prevalence
Peters et al. (22)	Hong Kong	COI-Prevalence
Lightwood et al. (23)	United States	CEA

COI = Cost-of-illness; CBA = Cost–benefit analysis; CEA = Cost-effectiveness analysis

4.5 Conclusions

Tobacco use has a disproportionate impact on vulnerable population subgroups. In affluent countries, inverse relationships are found between income and smoking, and between education level and smoking. However, these patterns do not always hold in developing countries, where tobacco use has been observed to be increasing in all segments of the overall population. Given the dearth of research on the distribution of smoking prevalence among population subgroups in the developing world, future research into this area should be prioritized.

Smoking rates are slowly declining among women in developed countries, yet the smoking rate for teenage girls in these countries continues to rise, and large differentials are seen within women when they are grouped by income and education levels. Smoking prevalence among women in developing countries is still low compared to men, but it is quickly rising, making it a matter of particular policy concern.

Children also suffer from the harmful effects of tobacco use. They may be exposed during pregnancy by mothers who smoke and/or they may experience morbidity and mortality through exposure to secondhand smoke in the home.

As in the assessments of tobacco use on societies (Chapter 3), COI studies are the most frequently performed assessment of tobacco disease burden. The most popular research design for examining the economic impact of tobacco use on population subgroups is again a prevalence-based COI study. Of the eight studies in this chapter that contain cost data, five (63%) are prevalence-based COI. Table 4.2 lists the eight studies and identifies the type of study design.

DALY comparisons between males and females indicate the burden resulting from tobacco use is greater for men in all areas of the world. This reflects the fact that men in general have higher smoking prevalence rates than women. The relative differences between DALYs for males and females is smaller in developed regions because smoking prevalence among women in the developed world has tended to be greater than the prevalence in developing countries. This may change over time due to the increasing prevalence of smokers, especially females, in the developing world. Again, the need for research into tobacco use in the developing world is underscored by the implications of these current trends.

4.6 References

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Chapter 5:
Synopsis: Economic Assessments of Interventions to Reduce the Demand for Tobacco

5.1 Introduction

As discussed in Chapter 2 (Section 2.3), governments may consider pursuing a variety of intervention strategies to reduce the demand for tobacco. These strategies range from prevention measures such as tax increases to cessation measures such as the provision of NRT.

This chapter provides a synopsis of the economic aspects of various smoking prevention and cessation strategies. Since governments devoting scarce resources to these strategies will have fewer resources to assign to other publicly delivered goods and services, decisions to implement or continue these programs should not be made without considering their potential economic costs and benefits. Economic evaluations are thus a necessary ingredient of any comprehensive policy examination.

5.2 Search Results

A literature search was conducted using several different databases to identify studies concerned with the economic aspects of the interventions in Box 5.1. The databases were: MEDLINE (1966–present), HealthSTAR (1975–present), EconLit (1969–present), and the Cochrane Database of Systematic Reviews (1st Quarter 2002). The timeframes covered by the search, shown in brackets, were dictated by content availability on the McGill University Libraries' online search catalogue (Ovid Online). Published, peer-reviewed academic articles were the focus of the literature search. Material such as conference proceedings, systematic reviews, and abstracts were included in the synopsis if an economic evaluation was reported. Bibliographies of retrieved articles were searched manually for government reports or peer-reviewed publications appearing in journals not indexed by any of the aforementioned databases. As it is more up to date than the four databases, the World Health Organization Tobacco Free Initiative

Table 5.1 Literature Search Strategy for the Synopsis of Economic Evaluations of Smoking Prevention and Cessation Strategies.

Tobacco OR Cigarette OR Smoking OR Smoker	AND	Cost OR Expenditure OR Economic Evaluation OR Economic Impact	AND	Taxation OR Restriction OR Advertising OR Behaviour OR Counseling OR Pharmacotherapy OR Nicotine Gum OR Nicotine Patch OR Nicotine Nasal Spray OR Nicotine Inhaler OR Bupropion

Notes: Each word (e.g., "tobacco") was treated as a keyword for the search. The above combination of keywords was used to conduct a separate search of each database (MEDLINE, HealthSTAR, EconLit, Cochrane Database of Systematic Reviews). The keywords "taxation", "restriction", and "advertising" were used to obtain articles on prevention strategies. The keywords "behaviour", "counseling", "pharmacotherapy", "nicotine gum", "nicotine patch", "nicotine nasal spray", "nicotine inhaler", and "bupropion" were used to obtain articles on cessation strategies.

website was also searched periodically for breaking news, articles, and press releases. It is available online at http://tobacco.who.int/.

The search strategy is described in Table 5.1. The abstracts of publications retrieved by the search were examined to identify the publications that would be reviewed for the synopsis. For an article to be retained, it had to specifically evaluate at least one prevention or cessation strategy. Publications with general commentaries on the economic benefits of these strategies were not included. The search was limited to articles reporting human data and published in English.

5.3 Methods

A total of 20 articles on prevention strategies and 21 on cessation strategies were obtained from the search and reviewed for the synopsis. Table 5.2 provides a breakdown according to type of strategy.

The following sections contain reviews and tabular summaries of the articles found for each prevention or cessation strategy.

5.4 Taxation

The retrieved articles evaluating taxation policy for preventing tobacco use utilized economic models (e.g., multiple regression equations) to estimate the elasticity of demand for tobacco products and/or the impact that changes in taxation levels would have on product pricing and consumption. All but two studies were U.S.-based, and conclusions were favourable to taxation policy.

Sung et al. (1) evaluated the effect of taxation on cigarette consumption using a model containing both a retail price equation and a dynamic demand equation. The dependent variables were per capita cigarette sales and the retail price per

Box 5.1 Interventions to Reduce the Demand for Tobacco.

Prevention Strategies:

- Tobacco taxation
- Restrictions on selling tobacco products
- Restriction on areas where tobacco can be consumed
- Provision of health information
- Advertising against tobacco (counter-advertising)
- Bans on tobacco advertising and tobacco-sponsored promotions

Cessation Strategies:

- Behaviour therapy
- Community interventions
- Physician counseling
- Pharmacotherapy (e.g., bupropion, nicotine replacement therapy)

Table 5.2 Number of Articles Obtained from the Literature Search and Reviewed for the Synopsis — Breakdown by Type of Smoking Prevention or Cessation Strategy.

Strategy	Number of Articles
Taxation	9
Restriction (sales and locations)	0
Advertising	11
Behaviour and Counseling	14
Bupropion	2
Nicotine Patch	3
Nicotine Gum	2
Nicotine Nasal Spray	0
Nicotine Inhaler	0

cigarette pack. Independent variables were the level of state cigarette taxes, per capita income, cost to manufacture cigarettes, demographics (i.e., age, sex, race), religious affiliation, regulation, and "bootlegging" (a variable to account for the impact of cigarette smuggling into California after a $0.25 per-pack increase in the state's cigarette tax). Data from 11 western US states, encompassing the years 1967–1990, were obtained for these variables. The authors concluded cigarette consumption was price sensitive after calculating demand elasticity to be -0.40 over the short-term and -0.48 over the long-term. They estimated California's tax increase of $0.25 per pack could lower cigarette consumption by 11.2% over the short-term and 13.4% over the long-term.

Keeler et al. (2) found similar results in their analysis of the effect of prices, taxes, income, and antismoking regulations on cigarette consumption in California after the $0.25 per-pack tax increase. They used a demand equation built with inputs from the California Board of Equalization, U.S. Bureau of Census, U.S. Bureau of Labor Statistics Consumer Price Index survey, Tobacco Institute, and state and federal income data. Long-run demand elasticity for cigarette consumption was estimated to range from -0.5 to -0.6. The California tax increase could therefore be expected to reduce long-term cigarette consumption by 10% to 12%.

Hu et al. (3) further examined the tax increase by comparing it to an antismoking media campaign targeted at specific California residents (i.e., adult smokers, pregnant women, ethnic minorities, and children). The campaign consisted of paid television advertisements designed to change the target groups' behaviours and attitudes toward smoking. Quarterly cigarette sales reported by the California State Board of Equalization between 1980 and 1992 were employed to develop a time-series model with per capita cigarette sales as the dependent variable. Independent variables were time trend, state cigarette tax in real cents, federal cigarette tax in real cents, average retail price of cigarettes without state or federal taxes, and media expenditures. The tax increase alone was predicted to reduce the number of packs sold by 514 million (17.1 per capita) between January 1989 and February 1990. After the launch of the media program in March 1990, the authors estimated the tax increase alone would be responsible for reducing pack sales by 819 million (27.3 per capita) through April 1992. The media program alone would lead to a 232 million (7.7 per capita) reduction in packs sold during the same period. Although the tax increase was estimated to be more effective than the antismoking media campaign, the authors pointed out that the relative size of the programs could have an impact on their effectiveness. For example, a larger and more expensive antismoking media campaign could potentially have been more effective than the campaign that was actually launched.

The theme of combining tobacco taxation policies with a second strategy was also explored by Goel and Morey (4), who studied whether tobacco and alcohol tax rates should be established jointly to maximize tax revenues. Data on 43 states, pertaining to the period from 1959 to 1982, were obtained to build a demand equation. Eight hundred observations formed the dataset, with cigarette price and consumption data provided by the Tobacco Institute. An index of alcohol prices was constructed for nine leading liquor brands. The authors calculated that a cigarette tax increase of $1 to $2 per pack would boost the price of a pack of cigarettes by 50% to 100%. This in turn would reduce cigarette demand by 15% to 30%. The authors, however, pointed out the existence of a "cross effect" between cigarettes and liquor. When demand for one product is lowered through a method such as taxation, demand for the "crossed" product could rise. Goel and Morey predicted the $1 to $2 cigarette tax increase would lead to a 20% to 40% jump in the demand for liquor.

Even within the rubric of cigarette taxes, different tax regimes (i.e., federal, state, and local) can have a varying impact on demand. Barnett et al. (5) estimated a cost function to study the impact of cigarette excise taxes on price and consumption. Data covering the years 1955 to 1990 were acquired from several U.S. government sources (e.g., Department of Commerce, U.S. Surgeon General), print media, and published scientific literature. The authors found that an increase in the federal cigarette excise tax was associated with a greater increase in price, and a greater decrease in consumption, than the same tax increase at the state or local level (controlling for population). After a simulated one cent federal excise tax increase, the price per pack was predicted to increase by 1.016 cents, and consumption to decrease by 159.6 million packs. The same tax increase at the state or local level would boost prices by 0.897 cents and lower consumption by 141 million packs.

Most research on tobacco taxation pertains specifically to cigarettes. However, Ohsfeldt et al. (6) studied the use of smokeless tobacco in addition to cigarettes among American males to determine how this usage might be affected by tobacco excise laws and state laws restricting smoking in public places. The authors specified a demand equation with the dependent variable being tobacco use. Independent variables included price, income, smoking regulation, and demographic characteristics (e.g., age, sex, educational attainment). Elasticities of demand were calculated to be -0.05 for cigarettes, -0.27 for snuff tobacco, and -0.13 for chewing tobacco. Increases in excise taxes for smokeless tobacco were associated with diminished use of this form of tobacco; however, higher cigarette excise taxes were associated with a greater use of smokeless tobacco.

A non-US study by Jones and Mazzi (7) used quarterly time-series data to estimate tobacco demand in Italy. Household consumption data for the period 1970 to 1990 came from the Italian Institute of Statistics. The authors also analyzed the distributional effects of taxation with 1991 data from the same institute. The study was largely concerned with applying economic theory on welfare inequality to tobacco demand, and consequently its conclusions assume a theoretical quality. When interest in welfare inequality is low and the most important goal is to increase economic efficiency, tobacco tax hikes are not optimal. If the concern is for redistribution, then tobacco tax increases are more advisable.

A press release (8) discusses another non-U.S. study, carried out by the WHO, which focusses on the usefulness of taxation as a tobacco control policy tool in the developing world. Quoting a World Bank estimate, the WHO press release states that a tax increase of 10% worldwide would cause 42 million people to quit smoking and avert at least 10 million tobacco-related deaths. The WHO recommends assigning a portion of tobacco taxation revenue to cessation programs, antitobacco advertising, or cancer research. Also, the WHO suggests harmonizing tobacco prices across political jurisdictions to reduce the incentive to smuggle, government adjustment of cigarette prices to keep pace with inflation, and a focus on price and tax policies in negotiations for the Framework Convention on Tobacco Control (45).

The evidence from these studies suggests tobacco taxation policies are an effective means of lowering cigarette consumption. Their effectiveness rests with the inverse relationship between tobacco price and consumption (9). Tax increases should not, however, be pursued without considering their potential impact on the demand for other "sin" products. Some evidence suggests higher tobacco taxes could lead to increased demand for liquor, or to higher consumption of smokeless tobacco.

Table 5.3 Articles on Taxation – Quantitative Results.

Article – Type of Study Design	Findings
Sung et al. (1) – Econometric modeling	Demand elasticity for cigarette consumption: -0.40 (short-term), -0.48 (long-term) 25¢ tax increase could lower consumption by 11.2% (short-term) and 13.4% (long-term)
Keeler et al. (2) – Econometric modeling	Long-term demand elasticity for cigarette consumption: -0.5 to -0.6 25¢ tax increase could lower long-term consumption by 10% to 12%
Hu et al. (3) – Econometric modeling	25¢ tax increase would reduce pack sales by 819 million between 3/1990-4/1992 Media program would reduce pack sales by 232 million between 3/1990-4/1992
Goel and Morey (4) – Econometric modeling	$1–$2 increase in price of pack of cigarettes would reduce cigarette demand by 15%–30%, but increase liquor demand by 20%–40%
Barnett et al. (5) – Econometric modeling	1¢ increase in federal excise tax would increase price of a pack by 1.016¢ and decrease consumption by 159.6 million packs 1¢ increase in state or local tax would boost prices by 0.897¢ and lower consumption by 141 million packs
Ohsfeldt et al. (6) – Econometric modeling	Demand elasticities: cigarettes (-0.05), snuff tobacco (-0.27), chewing tobacco (-0.13)
Jones and Mazzi (7) – Econometric modeling	N/A
World Health Organization (8) – N/A	Ample room to increase tobacco prices through taxation, thereby increasing government revenue and improving health through reduced consumption resulting from higher prices. (Tobacco Control 11:1, 2002)
Harris (9) – Econometric modeling	N/A

N/A = not applicable; Note = all studies with monetary figures report results in U.S. currency

5.5 Advertising

This section summarizes economic studies on the effect of tobacco advertising on cigarette sales and consumption, as well as the effect of tobacco advertising restrictions and antismoking media campaigns as policy instruments for reducing tobacco consumption. In general, there is less consensus on the efficacy of these policy instruments for reducing consumption as opposed to other tobacco control policy instruments. Nine of the 11 studies reviewed in this section use econometric and regression analysis to reach their conclusions.

Tobacco Advertising and Advertising Restrictions

Yamanaka et al. (10) studied government-sponsored smoking control measures and eight health, social, and economic variables in 93 countries. Smoking control measures included health warnings on cigarette packages, chemical level indicators on cigarette packages, a ban on tobacco advertising on television and radio, and a prohibition on sales to minors. The eight economic variables were: annual rate of population increase, infant mortality rate, population per hospital bed, number of television sets per 1,000 people, per capita daily protein supply, military expenditures as a percentage of gross national product (GNP), GNP, and percentage of children enrolled in primary school. Multiple linear regression analysis showed that 49% of the variance in smoking controls was explained by the eight variables taken together as a group (r2=0.49). Smoking controls were more likely to be present in countries with higher GNP. GNP alone explained 42% of the variance in smoking controls (r2=0.42).

Another multi-country analysis was performed by Saffer and Chaloupka (11), who constructed a dataset for 22 OECD countries to study the effectiveness of limited versus comprehensive advertising bans. Data were collected for the period between 1970 and 1992, with dependent variables being per capita annual cigarette consumption and per capita tobacco consumption in grams. Independent variables were created from tobacco advertising ban data in the following seven areas: television, radio, print, movie, outdoors (e.g., billboards), point of purchase (e.g., tobacco product displays in convenience stores), and sponsorships. Also included in the regression model were variables for product price, income, unemployment, and the percentage of tobacco products with a filter. The authors found that limited advertising bans (i.e., bans in 4 of the aforementioned 7 areas) would not reduce total tobacco advertising expenditure or affect tobacco consumption because advertising would simply be shifted to the areas unaffected by the ban. However, if all 22 OECD countries had comprehensive advertising bans in place (i.e., bans in at least 5 of the 7 areas), the regression analysis indicated tobacco use in general could be reduced by 5.4%, and cigarette use could be reduced by 7.4%. Saffer and Chaloupka used their model to predict that the European Commission's (EC) directive to ban tobacco advertising entirely by 2006 could reduce tobacco consumption by 6.3% and cigarette consumption by 7.9% in the 11 EC countries for which data were included in the wider 22-nation analysis. In summary, the authors concluded that tobacco advertising increases tobacco consumption, however, a comprehensive tobacco advertising ban is an effective tool for reducing tobacco consumption. On the other hand, a limited advertising ban would have only limited or no effect on reducing consumption.

Two studies explored the influence of tobacco advertising on cigarette sales. Yucelt and Kaynak (17) collected U.S. data for the period 1955 to 1979. Data sources were Statistical Abstracts of the United States, Historical Statistics of the United States, and Vital Statistics. A multiple linear regression model, with the dependent variable "cigarette consumption," was employed in the analysis. Independent variables included

disposable income, death rate for respiratory cancer, newspaper and television advertising, cigarette production, number of sales outlets, average price of cigarettes, restrictions on advertising, and product loyalty. Regression coefficients for newspaper and television advertising were positive, thereby indicating an association between higher advertising expenditures and greater cigarette consumption. However, these associations were not statistically significant ($p>0.05$). A dummy variable with a coded value of 1 to represent the pre-1968 time period when tobacco advertising was permitted on U.S. television, and a value of 0 to represent the 1968 and beyond period when no such advertising was permitted, achieved significance when it was placed into the model ($t=1.88$; $p\leq0.05$). This represents limited evidence of a positive association between advertising and cigarette consumption. Implicit in this finding is the notion that advertising restrictions could lead to decreased consumption.

In another study of the relationship between tobacco advertising and cigarette demand, Reekie (18) failed to find statistically significant results in a study in South Africa during the 1970 to 1989 time period. A regression model was employed to analyze data that included total annual consumption of cigarettes (South African Department of Excise and Statistics), average monthly retail price of a pack of cigarettes (tobacco industry), and annual per capita disposable income (South African Reserve Bank, etc.). Advertising alone was not found to be a statistically significant predictor of per capita cigarette consumption. However, price and per capita disposable income were statistically significant predictors of per capita consumption.

Descriptive, rather than regression, analysis was employed by Joossens (19) to examine advertising bans and changes in the aggregate demand for tobacco products. Drawing on tobacco consumption data from four countries (Norway, Finland, New Zealand, France), which were chosen because they were able to effectively enforce advertising bans, Joossens compares pre- and post-ban consumption data to show that large drops in smoking in each country were preceded by the bans. The percentage drop in per capita cigarette consumption from the date of the ban in each country until 1999 is as follows: Norway (July 1, 1975) = -31%, Finland (March 1, 1978) = -34%, New Zealand (December 17, 1990) = -33%, France (January 1, 1993) = -15%. Joossens concludes that advertising bans do work if properly implemented as part of a comprehensive tobacco control strategy.

Farr et al. (16) estimated the economic impact of cigarette advertising restrictions on social welfare in the United States. The restrictions evaluated were the U.S. Broadcast Advertising Ban, which abolished all cigarette advertising (both pro and con) from television and radio in 1971, and its predecessor, the Fairness Doctrine Act. Data came from the U.S. cigarette industry and covered the period 1955 to 1994. The authors concluded that the implementation of advertising restrictions is a double-edged sword. While such restrictions are an effective tool for reducing smoking, Farr et al. suggest that they accomplish this goal by violating the promotion of competition in the marketplace. For both equity and efficiency considerations, the authors suggest tax policy as a more effective tool for reducing smoking and find that clean indoor air laws are successful policy instruments for reducing demand.

A New Zealand study by Laugesen and Meads (14) focussed on the influence of tobacco advertising in newspapers on cigarette sales in supermarkets in New Zealand. The authors monitored total weekly cigarette sales at 60 supermarkets for a 42-week period and input the data into a regression model. The dependent variable was the total number of cigarettes sold during the time period, and independent variables included the number of shopping days during the week, the average retail cigarette price, real household disposable income, prices for different types of cigarettes (i.e., upmarket, regular, downmarket), and the number of news

items on smoking-related issues. The study showed that aggregate cigarette sales were positively influenced by advertising for new downmarket brands, while aggregate cigarette sales were inversely related for regular and upmarket brands. These findings raise concerns that the advertising of new downmarket cigarettes may have an additional effect of recruiting young smokers and increasing market size.

Antismoking Media Campaigns

Leu (12) investigated the effects of two policy instruments on per capita cigarette consumption in Switzerland: an antismoking publicity campaign and taxation. Time-series cigarette sales data from the period 1954 to 1981 was used to develop a demand equation. The dependent variable was annual per capita cigarette consumption for adults over 15 years of age. Independent variables included disposable income, price indices (for cigarettes, cigars, and pipes), sex ratio of the population, time trend, media publicity, and relapse rate. Leu found that antismoking publicity in the mass media is a powerful tool for reducing cigarette consumption. He suggested that publicity campaigns (in this case, the 1964 U.S. Surgeon General's report, publicity in 1966 that accompanied a tax increase, and publicity in 1979 that preceded a vote on a tobacco advertising ban) are effective deterrents for cigarette demand and cost-efficient. Furthermore, the available evidence implies that the joint impact of antismoking publicity, tax increases, and other smoking control measures is likely to exceed their partial effects.

Using a time-series model, Hu et al. (13) also found positive benefits for reducing cigarette consumption through an antismoking media campaign in California. The campaign was delivered via television, radio, and billboards. Cigarette consumption data came from the California State Board of Equalization (monthly sales data from 1980 to 1993). Retail cigarette prices were supplied by the Tobacco Institute and the Tobacco Control Section – California Department of Health Services. California's media campaign was found to have a negative impact on cigarette consumption ($p=0.01$). While the study showed that antismoking media campaigns are effective for reducing demand, the authors noted that they may not always be

Table 5.4 Articles on Advertising – Quantitative Results.

Article – Type of Study Design	Findings
Yamanaka et al. (10) – Econometric modeling	49% of variance in smoking controls explained by 8 health, social, and economic variables 42% of the variance in smoking controls explained by Gross National Product variable
Saffer and Chaloupka (11) – Econometric modeling	Comprehensive advertising bans could reduce tobacco use by 5.4% and cigarette use by 7.4% in 22 OECD countries European Commission (EC) directive to ban tobacco advertising by 2006 could reduce tobacco use by 6.3% and cigarette use by 7.9% in 11 EC countries

† Date of ban in brackets.

Table 5.4 Articles on Advertising – Quantitative Results. (continued)

Article – Type of Study Design	Findings
Leu (12) – Econometric modeling	Antismoking message, plus various tax increases, permanently reduced cigarette consumption by 11%
Hu et al. (13) – Econometric modeling	California media campaign has statistically significant (p=0.01) negative impact on cigarette consumption
Laugesen and Meads (14) – Econometric modelling	100% decrease in press stories about smoking could lead to a 4%–96% reduction of cigarette sales in supermarkets
Doroodian and Seldon (15) – Econometric modeling	Advertising elasticity is 0
Farr et al. (16) – Econometric modeling	If external cost of smoking is 0.51¢/pack, then tobacco industry profits could decrease by up to 18.86%
Yucelt and Kaynack (17) – Econometric modeling	Dichotomous dummy variable representing pre- and post- U.S. television cigarette advertising ban is significant (t=1.88; p≤0.05), indicating a positive association between advertising and consumption
Reekie (18) – Econometric modeling	N/A
Joossens (19) – Descriptive analysis	Percentage drop in per capita cigarette consumption from the start date of a tobacco advertising ban (given in brackets) until 1999: Norway (July 1, 1975) = -31%, Finland (March 1, 1978) = -34%, New Zealand (December 17, 1990) = -33%, France (January 1, 1993) = -15%
Goldman and Glantz (20) – CEA (a)	California media campaign: 50¢ annual per capita cost reduced annual per capita cigarette consumption by 3.9 packs Massachusetts media campaign: $2.42 annual per capita cost reduced annual per capita cigarette consumption by 0.5 packs

Econometric modeling = use of regression analysis to explain and/or predict economic phenomena; N/A = not applicable; CEA = cost-effectiveness analysis; (a) = analysis uses average cost-effectiveness ratio

the most cost-effective strategy. The cost-effectiveness of these campaigns remains to be analyzed as a public health measure for reducing demand for tobacco.

Using time-series data covering the period 1952–1984, Doroodian and Seldon (15) examined the response of aggregate demand for cigarettes as well as consumer reaction to government health warnings and media policy in the United States. Their results support the hypothesis that cigarette advertising increases aggregate demand. Government health warnings implemented in 1964 and 1979 as well as the 1968 and 1971 media policies were all found to reduce aggregate demand for cigarettes.

In their evaluation of antismoking media campaigns in California and Massachusetts, Goldman and Glantz (20) found that the type and target of antismoking messages matter. For California, the researchers found that per capita cigarette consumption between 1989 and 1996 decreased by 1.93 (standard error: ±0.21) packs per year faster than in the rest of the United States. During this time period, the cost of California's media campaign worked out to $0.50 per capita per year, and each per capita dollar spent on the campaign was estimated to reduce annual per capita cigarette consumption by 3.9 packs. The Massachusetts program, on the other hand, was not as cost-effective as California's campaign. Per capita consumption in Massachusetts between 1993 and 1996 decreased by 1.28 (standard error: ±0.90) packs per year faster than in the rest of the United States (excluding California). Massachusetts spent $2.42 annually per capita on the media program, and each per capita dollar spent was estimated to reduce yearly per capita cigarette consumption by 0.5 pack. The authors found that industry denormalization and secondhand smoke messages were the most effective for reaching all audiences. Addiction and cessation messages can also be effective but work best when used in combination or rotated with more powerful messages on industry denormalization and secondhand smoke. Messages related to youth access, short-term effects, long-term health effects, and romantic rejection were all found to have limited effectiveness.

In conclusion, economic studies suggest that tobacco advertising can increase demand for tobacco products, and that tobacco control policies such as antismoking media campaigns and restrictions on tobacco advertising can reduce demand. However, the evidence on the effectiveness of advertising bans as a sole policy instrument is equivocal, and suggests they are more effective when implemented as part of a comprehensive tobacco control strategy. To date, most of the economic studies on the effectiveness of tobacco advertising and advertising bans have been conducted in developed countries. As the tobacco industry continues its aggressive marketing of tobacco products in developing countries, research on the impact of both tobacco advertising and advertising bans would shed light on their effectiveness within the developing country context. In particular, countries where smoking among women is still low but advertising by the tobacco industry is rising, present researchers with an opportunity to study the effects of the industry's marketing strategies and how advertising bans might effectively counter the growth of the tobacco epidemic among women in these countries.

5.6 Cessation

There are a variety of programs for smoking cessation, such as behaviour modification and counseling delivered through the workplace or the health-care system, and pharmacotherapies like bupropion or NRT. Many of these programs, however, are available to only a limited segment of the global population. For example, pharmacotherapies are more widely available in developed countries because a larger proportion

of the population living there can afford to purchase them relative to people in the developing world.

Several economic evaluations of smoking cessation programs have been undertaken, often using the techniques for health-care program evaluation that are outlined in Chapter 2 (Section 2.6). The general conclusion of these studies is that cessation strategies are cost-effective. The studies themselves will be summarized in the following sections.

5.6.1 Behaviour and Counseling Cessation Strategies

Cromwell et al. (21) examined the cost-effectiveness, from the societal perspective, of the recommendations contained in the Agency for Health Care Policy and Research (AHCPR) Smoking Cessation: Clinical Practice Guideline (1996) (22). The guideline recommended an intervention where a primary care physician would, during a routine office visit, screen patients for smoking status and motivate and advise all smokers to quit. The intervention also consisted of three counseling interviews per patient with a primary care physician, two counseling sessions with a smoking cessation specialist, and the possibility of using nicotine patch or gum to supplement the sessions. Assuming 75% of all U.S. smokers were given the intervention, the estimated implementation cost would be $6.3 billion in the first year, and society would gain 1.7 million quitters at an average cost of $3,779 per quitter, $2,587 per life-year saved, and $1,915 per quality-adjusted life-year (QALY) saved.

Cummings et al. (23) also estimated the cost-effectiveness of physician counseling to quit smoking. Costs were calculated corresponding to that portion of a routine office visit devoted to counseling, for a self-help booklet, and for a follow-up visit. Cessation rates after physician advice were estimated from the literature. Effectiveness data included American Cancer Society estimates of the increases in life expectancy for men and women between 35 and 69 years of age at the time of quitting. Costs were found to be between $705 and $988 per life-year for men, and $1,204 to $2,058 per life-year for women.

Other health care professionals (e.g., nurses) can play a role in counselling strategies. Krumholz et al. (24) evaluated the cost-effectiveness of a cessation program after acute myocardial infarction. The program begins in hospital after the patient is stabilized. A trained nurse visits the patient to review the risks of continuing to smoke, and the benefits of stopping. The patient is then given a manual that explains how to identify high risk smoking situations and provides tips on how to resist the urge to smoke. The nurse calls the patient weekly after discharge for three weeks, and then monthly for four months, to provide support. Cost-effectiveness was calculated using a decision-tree, with probabilities coming from the literature. Resources included in the analysis were nursing time and the manual. Baseline cost-effectiveness was calculated to be $220 per life-year saved. If as many as five life-years could be saved, then the ratio would be $80 per life-year saved.

Crealey et al. (25) looked at a pharmacy-based cessation program from Northern Ireland. They adopted a payer perspective to evaluate the Pharmacists' Action on Smoking (PAS) model, where community pharmacists were asked to provide advice and motivation to help smokers quit. Data were drawn from two local pharmacies over a two-year period, and three groups of subjects were studied: 52 people who received the PAS program, 48 who were given nicotine gum, and 60 controls who expressed a desire to stop smoking. Controls were matched to PAS participants on age, sex, socioeconomic status, and disease status. The cost per life-year saved with PAS (in 1997) was between $326.62 and $583.41 for men and $301.04 to $1,281.72 for women.

Many cessation programs are workplace-based and paid for by the employer. Weiss et al. (26) examined one such program that consisted of two weekly meetings of one-and-a-half hours duration each for a period of four weeks. Program objectives were to make employees aware of why they smoked, to conduct behaviour modification to help them stop smoking, and to teach techniques to help them maintain the nonsmoking behaviour. Data were based on 33 subjects who completed the program and responded to a questionnaire. Benefits from the point-of-view of the firm included savings in health-care costs and absenteeism, and reductions in workplace inefficiencies (e.g., reduced smoke breaks for employees). Costs to the firm were estimated at $600 for 20 people, with 12 hours of time-off for attendees. The net present value of net benefits was estimated to fall between $2,702 and $27,989.

Another workplace cessation strategy was evaluated by Warner et al. (27), using a Monte Carlo simulation to study the strategy from the firm's perspective. The program involved multiple sessions of behavioural counseling, and a hypothetical cohort of 10,000 blue-collar manufacturing workers was run through the simulation until all were deceased. Data came from the 1990 National Health Interview Survey, which was used to assign smoking status to the members of the cohort. Benefits were defined as reductions in all of the following: health-care costs, absenteeism, productivity losses, and life insurance costs. Costs per life-year saved decreased over time: $99,703 (year 3), $43,670 (year 10), $2,920 (year 25), $894 (year 85). Net benefits increased until year 25 and dropped off slightly through year 50: -$92,744 (year 1), -$11,018 (year 3), $438,206 (year 5), $2,443,664 (year 10), $4,703,888 (year 25), $4,619,285 (year 50).

Some behaviour and counseling cessation strategies are of the self-help variety, where individuals pursue help on their own initiative without being encouraged by a health-care worker or employer. Davis et al. (28) investigated the cost-effectiveness of four such programs: stop-smoking pamphlets, the pamphlets and a quit maintenance manual, a cessation manual, and both manuals. Resources costed for the analysis included the pamphlets and manuals, postage, handling, recruiting, training, and follow-up. The latter three resource components related to the costs of having trained specialists explain the reading material and provide follow-up support to participants. Effectiveness outcomes were initial quit rates, nonsmoking prevalence rates for 30 days, and continuous nonsmoking prevalence rates for one year. The authors did not conduct a modeled analysis, but instead drew upon a sample of 1,237 smokers who responded to an announcement by the American Lung Association. The costs per quitter were calculated as follows (at 30 days and one year, respectively): pamphlets ($135/$921), pamphlets plus maintenance manual ($105/$497), cessation manual ($126/$669), and both manuals ($116/$396). The "pamphlets plus maintenance manual" and "both manuals" strategies were judged to be roughly equivalent in terms of cost-effectiveness. Davis et al. felt these two strategies had the advantage of focusing on the maintenance of abstinence, rather than just on providing initial help to quit.

Altman et al. (29) studied three cessation strategies: a cessation class, an incentive-based quit smoking contest (i.e., a grand prize trip to Hawaii, plus 21 other donated prizes), and a self-help quit smoking kit. Resources for which costs were estimated included staff salaries and benefits, overhead, rent, supplies and materials, travel, data analysis, and the time participants devoted to the programs. Effectiveness was measured as complete abstinence at the time of assessment, which was four to six weeks minimum, or eight to eleven weeks maximum, after the date when participants were expected to stop smoking. The stop smoking date was generally two-thirds to three-quarters of the way through any of the programs. The costs

per quitter were (at one year and five years respectively): class ($399/$276), contest ($236/$151), and self-help ($144/$50).

Another incentive-based program, again involving a vacation prize, was examined by Tillgren et al. (30) in Sweden. The "Quit and Win" contest run in 1988 was open to smokers and smokeless tobacco users who had been using tobacco for at least a year. Participants had to refrain from all tobacco use for four weeks and NRT was not allowed. Participant data (e.g., the percentage that remained smoke free after one year) were collected with a survey. Resources costed for the purpose of the economic analysis were personnel, printing and distribution of campaign literature, prizes, and overhead (e.g., rent, administration) for the groups involved in the project. Costs per life-year gained ranged from $188 to $1,222.

An innovative cessation strategy was tried in Los Angeles, where a television program on the ills of smoking invited viewers to write in for more stop-smoking information. Danaher et al. (31) estimated that approximately 300,000 smokers were exposed to the broadcast, and 3,500 wrote for more information. Random telephone surveys were used to estimate one-year quit rates of 2.4% for the viewers and 6.2% for those who wrote in. Resource inputs were the production and promotion of the television program. The cost of the strategy, per smoker who quit for at least one year, was $27. The cost per quitter who wrote in was $75.68, compared to $25.68 for those who did not write in.

Several behaviour and counseling cessation programs have been developed to specifically target pregnant smokers. Windsor et al. (32) reported a cost-benefit ratio for an intervention versus control strategy in this population. The intervention was a mix of group counseling sessions, individual use of a cessation guide, clinic reinforcement (e.g., chart reminders), a buddy system, and pamphlets. The control program involved providing information, at the first clinic visit, on the dangers of smoking while pregnant. The cost-benefit analysis was based on a clinical trial that compared the two strategies between 1986 and 1991. A total of 400 subjects received the intervention, and 414 received the control strategy. Resources included program personnel time and materials. The researchers measured benefits as the number of low birth weight (LBW) infants prevented by smoking cessation. This was quantified using data from the U.S. Office of Technology Assessment. For each dollar in program costs, the monetized benefits of the intervention strategy were estimated to be between $17.93 (lower bound) and $45.83 (upper bound).

Another study using LBW as a measure of effectiveness was undertaken by Marks et al. (33), who wanted to estimate the costs and outcomes of having all pregnant female smokers participate in a cessation program during pregnancy. The program would involve a 15-minute counseling session, the distribution of instructional material, and two follow-up telephone calls. Resources included staff time, material, and training. Data on smoking and quit rates came from the 1985–1986 Behavioral Risk Factor Surveillance System and the published literature. Pregnancy outcomes data also came from the literature. Costs averted by a pregnant woman who quit smoking were assumed to be the costs of hospitalizing a LBW baby minus the costs of hospitalizing a normal birth weight infant. Marks et al. estimated that the program would prevent 5,876 LBW births at a cost of $4,000 per LBW birth prevented. Furthermore, the program would cost $69,542 for each perinatal death averted; for every $1 spent, the program would save $3.31 in the cost of caring for LBW infants in a neonatal intensive care unit.

Given the proliferation of health maintenance organizations (HMOs) in the United States, it is important to investigate the economics of a smoking cessation strategy for pregnant women from the perspective of this type of insurance payer. Ershoff et al. (34) based their analysis on a clinical trial that recruited patients

from a HMO between mid-1985 and mid-1987. One-hundred and sixty-five pregnant smokers were randomized to an experimental group, and 158 to a control group. Subjects in both groups received a 2-page pamphlet detailing the dangers of smoking during pregnancy, and a 2-minute discussion. Subjects in the experimental group were enrolled in a program specifically designed for pregnant smokers, wherein behavioural strategies were taught to help them quit and avoid relapse. Teaching materials included a 3-minute introduction to the program, plus booklets mailed weekly for eight weeks. Resource inputs were overhead, personnel time, self-help materials, and postage. Benefits included savings to the HMO in the following areas: expenditures (e.g., laboratory fees, X-rays), charges from hospital-based providers such as

Table 5.5 Articles on Cessation: Behaviour and Counseling – Quantitative Results.

Article – Type of Study Design	Findings
Cromwell et al. (21) – CEA/CUA	Clinical practice guideline: $2,587 per life-year saved, $1,915 per QALY saved
Cummings et al. (23) – CEA	Physician counseling (ages 35–69): women = $1,204–$2,058 per life-year saved; men = $705–$988 per life-year saved Incremental follow-up visit: women = $772–$9,259; men = $421–$5,051
Krumholz et al. (24) – CEA	Cessation program after acute myocardial infarction: $220 per life-year saved ($80 per life-year saved if as many as five life-years can be saved)
Crealey et al. (25) – CEA	Pharmacy-based program: women = $326.62–$583.41 per life-year saved; men = $301.04–$1,281.72 per life-year saved
Weiss et al. (26) – CBA	Workplace-based behaviour modification: cost to firm $600 for 20 employees; net present value of net benefits $2,702–$27,989
Warner et al. (27) – CEA/CBA	Workplace-based behaviour modification: costs per life-year saved from $99,703 (year 3) to $894 (year 85); net benefits from -$11,018 (year 3) to $4,619,285 (year 50)
Davis et al. (28) – CEA (a)	Four self-help programs: cost per quitter at 30 days from $105–$135; cost per quitter at 1 year from $396–$921

Table 5.5 Articles on Cessation: Behaviour and Counseling – Quantitative Results (continued).

Article – Type of Study Design	Findings
Altman et al. (29) – CEA (a)	Miscellaneous strategies (cessation class, contest, self-help kit): cost per quitter at 1 year = $399, $236, $144 respectively; cost per quitter at 5 years = $276, $151, $50 respectively
Tillgren et al. (30) – CEA	Quit and Win contest: cost per life year gained $188–$1,222
Danaher et al. (31) – CEA (a)	Television program and follow-up write-in for information: cost per smoker who quit for 1 year = $27; cost per quitter who wrote for more information = $75.68; cost per quitter who did not write in = $25.68
Windsor et al. (32) – CBA	Mix of counseling, booklets, reinforcement, buddy system versus provision of information at first clinic visit – target = pregnant smokers: net benefit of intervention strategy per dollar spent from $17.93 to $45.83
Marks et al. (33) – CBA	Mix of counseling, booklets, and follow-up phone calls for pregnant smokers: cost per LBW birth avoided = $4,000; $69,542 for each perinatal death avoided; $3.31 saved per dollar spent with respect to caring for a LBW infant in a neonatal intensive care unit
Ershoff et al. (34) – CBA	Behavioural counseling for pregnant smokers: net benefit $2.80 for every additional dollar spent on the program versus money spent on a control strategy (2-page pamphlet and 2-minute discussion)
Windsor et al. (35) – CEA (a)	Three strategies provided to pregnant smokers by maternity clinics (standard package of information and quitting advice, standard package plus American Lung Association manual, standard package plus a pregnancy-specific smoking cessation manual): cost per percentage who quit = $104 (standard package), $118.83 (standard plus ALA manual), $50.93 (standard plus pregnancy-specific manual)

CEA = cost-effectiveness ratio; CUA = cost-utility ratio; (a) = analysis uses average cost-effectiveness ratios; QALY = quality-adjusted life-year; CBA = cost-benefit analysis

physicians, and charges for other professional services (e.g., medical examinations). Net benefit was $2.80 saved for every additional $1 spent on the experimental program.

The Windsor et al. study (35) focuses on another institution-based cessation program for pregnant smokers. In this case, public health maternity clinics were asked to provide one of three interventions: standard clinic information and advice to quit ("standard package"), the standard package and a manual from the American Lung Association, and the standard package plus a pregnancy-specific manual designed by a stop-smoking association. A total of 309 patients from three prenatal clinics were randomly assigned to receive one of the three strategies. Resources included personnel and the manuals. Average cost-effectiveness ratios per strategy were calculated by dividing the average cost per patient for each strategy by the percentage who quit. Results were as follows (cost per patient, percentage who quit, cost-effectiveness ratio, respectively): standard package – $2.08/2%/$104.00; standard package plus American Lung Association manual – $7.13/6%/$118.83; standard package plus pregnancy-specific manual – $7.13/14%/$50.93.

5.6.2 Pharmacotherapeutic Cessation Strategies

Economic evaluations of pharmacotherapeutic cessation strategies have considered bupropion and nicotine replacement therapies, often in combination with one another or as part of a behavioural or counseling program. The latter is the focus of a study by Halpern et al. (36), who assessed the costs and benefits of using sustained release bupropion as part of a workplace smoking cessation strategy. The authors assembled a hypothetical population cohort from the 1997 Current Population Survey and the 1994 National Health Interview Survey. Population size totaled 100,000 employees and 60,000 adult dependents covered by the employees' workplace health insurance benefits. A model was developed to obtain data from this cohort at three time points: time zero (start of the model), retirement (age 65 years), and death (age 85 years). For every dollar spent on workplace smoking cessation programs that include private health insurance coverage of bupropion, $5.04 to $6.48 in smoking-related health-care costs are saved. This compares favorably to savings of between $4.10 and $4.69 for every dollar spent on workplace programs without bupropion coverage.

Nielsen and Fiore (37) also employed modeling to study bupropion in the workplace. In this case, a decision-tree was utilized to compare the costs and benefits of employer provision of bupropion, nicotine patch, or both. Probabilities for the model were obtained from the literature, and cost data were based on the average wholesale price for each alternative. Benefits to employers (in 1998 dollars) were assumed to be $1,654 per successful quitter in the first year of the program. Net benefits per employee for bupropion alone were higher than the net benefits for the other strategies: bupropion ($338), bupropion and nicotine patch ($178), nicotine patch ($26).

The nicotine patch is generally evaluated as part of some larger cessation strategy. For example, McGhan and Smith (38) examined eight cessation programs from the employer perspective, including five with nicotine patch: self-care, 5-day behavioural program, group withdrawal clinic, nicotine patch and weekly group counseling, nicotine patch and weekly individual counseling, nicotine patch and no or minimal counseling, nicotine patch and a pharmacist's consultation, and nicotine patch with both pharmacist's consultation and a comprehensive behavioural program. A decision-tree was used to estimate the costs and benefits of these interventions. Probabilities for the model were obtained from the literature, as were estimates of the monetary benefits of not smoking. Other data included the total costs of smoking in the workforce and the costs of the interventions, with the former coming from the published literature and the latter coming from telephone interviews with profit and nonprofit organizations offering

Table 5.6 Articles on Cessation: Pharmacotherapy – Quantitative Results.

Article – Type of Study Design	Findings
Halpern et al. (36) – CBA	Bupropion as part of workplace cessation strategy: $5.04–$6.48 saved for every dollar spent on workplace cessation strategies that include bupropion; $4.10–$4.69 saved per dollar spent on workplace programs without bupropion
Nielson and Fiore (37) – CBA	Employer provision of bupropion, nicotine patch, or both: net benefit per employee = $338 (bupropion), $178 (bupropion and patch), $26 (patch)
McGhan and Smith (38) – CBA	Eight programs (self-care, clinic, counseling, etc.), five of which include nicotine patch: program involving nicotine patch, a pharmacist's consultation, and a comprehensive behavioural program had the highest net benefit = $302 (year 1) and $1,483 (each year thereafter)
Fiscella and Franks (39) – CUA	Nicotine patch as adjunct to physician counseling: 35–39 year old male = $4,390 cost per QALY saved; 45-year old male = $4,671 per QALY saved; 65–69 year old male = $10,943
Wasley et al. (40) – CEA	Nicotine patch as adjunct to physician counseling: incremental cost per life-year saved when the patch is used as an adjunct, versus when it is not, $1,796–$2,949 (men) and $3,040–$4,391 (women)
Oster et al. (41) – CEA	Nicotine gum as adjunct to physician counseling: cost per life-year saved using the gum is $4,113–$6,465 (men) and $6,880–$9,473 (women)
Hughes et al. (42) – Prospective cohort	Use of nicotine gum and association with cost: after six months, 75% who received the gum for free were using it regularly, 58% who paid $6 per box were regular users, and 47% who paid $20 per box were regular users

CBA = cost-benefit analysis; CUA = cost-utility analysis; QALY = quality-adjusted life-year; CEA = cost-effectiveness analysis

smoking cessation programs. The "nicotine patch-pharmacist's consult-comprehensive behavioural program" had the highest net benefit, which was $302 for the first year and $1,483 for each year thereafter.

Fiscella and Franks (39) utilized a decision-tree to investigate the cost-effectiveness of nicotine patch as an adjunct to a physician-led smoking cessation counseling session. Decision-tree probabilities were obtained from the literature, and cost information for the patch was based on the published wholesale price for a 1-month supply in 1995 dollars. Also, six pharmacies were surveyed to estimate the retail price. Physician time allocated to the counseling session was also costed. Adding a nicotine patch to physician counseling produced one additional lifetime quitter for $7,332. In terms of the base case, which was a 45-year-old male smoker, one QALY was saved at a cost of $4,671. For a 35 to 39 year-old male, the cost per QALY was $4,390; for a 65 to 69 year-old male, the cost per QALY was $10,943.

Wasley et al. (40) also studied the use of the nicotine patch in addition to physician counseling. This strategy was compared to physician counseling alone. Cost data (in 1995 dollars) included physician time and patch prescriptions. Effectiveness estimates for both options were taken from the literature. The average cost per life-year saved from the payer perspective when the patch was used along with physician counseling was between $965 and $1,585 (men) and $1,634 to $2,360 (women). Incremental costs per life-year saved were $1,796 to $2,949 (men) and $3,040 to $4,391 (women).

The patch was not the only NRT evaluated as an adjunct to physician counseling. Oster et al. (41) looked at nicotine gum in this context by constructing a hypothetical sample of 250 smokers who would be seen in an office setting. Resources costed (in 1984 U.S. dollars) included physician time to prescribe the gum and the cost to patients of purchasing the gum. The cost per life-year saved by using nicotine gum as an adjunct to physician counseling ranged from $4,113 to $6,465 (men) and $6,880 to $9,473 (women).

Nicotine gum alone was evaluated by Hughes et al. (42), who sought to study the association between the cost of the gum and its use among smokers. Subjects were 106 smokers recruited from two rural family practices in Vermont. Resources included physician time for scheduled visits, patient time, and the costs of both the gum and quit smoking booklets. Benefits included the avoidance of lung cancer, coronary heart disease, and chronic obstructive pulmonary disease. Lower prices for the gum were found to be associated with increased use. Over six months, 75% of subjects (24/32) who received free gum used it regularly, 58% (21/36) who paid $6 per box used the gum regularly, and 47% (18/38) who paid $20 per box used the gum regularly.

5.6.3 Conclusion – Smoking Cessation Strategies

Many economic evaluations describe smoking cessation strategies as cost-effective, even if the cost per life-year saved, or cost per QALY, seems large. For example, Oster et al. (41) found the cost per life-year saved by using nicotine gum as an adjunct to physician counseling to be as high as $6,465 for men. The authors concluded this was cost-effective, but the unanswered question is "cost-effective compared to what?" Ultimately, the determination of whether a program can be considered cost-effective requires agreement on an appropriate benchmark for purposes of comparison. This task cannot be left to the economist alone, but rather to all those who have a stake in health care (e.g., patients, physicians, and policy-makers).

The reported cost-effectiveness of a health care programme depends on the programme or programmes to which it is compared (43). The vast majority of the economic evaluations in Tables 5.5 and 5.6 approached the evaluation task by comparing one intervention strategy to the status

quo, which was presumed to cost nothing and to accrue no benefits. This approach has at least two shortcomings. First, from a policymaking perspective, the relevant comparison programme is usually the status quo; however, this may not be well-represented as a no-cost "do nothing" strategy. This choice may distort reported cost-effectiveness results. Second, rather than considering a single smoking cessation strategy as compared to the status quo, it is often more relevant for policymakers to consider an ensemble of policy options in relation to one another. For meaningful comparisons between interventions, it is necessary to examine the additional costs that one cessation strategy or program imposes over another, compared with the additional benefits it delivers (again, over and above the other). This is known as the incremental approach to analysis (43). Relatively few of the studies were designed to provide this sort of comprehensive, policy-relevant information.

In fact, 4 (19%) of the 21 economic evaluations of smoking cessation strategies reported average costs and benefits per strategy analyzed. This can be misleading with respect to identifying the most efficient program. Future economic evaluations of tobacco cessation strategies should use incremental cost-effectiveness ratios as recommended by the health economics literature, rather than average ratios (43, 44).

Many economic evaluations of smoking cessation strategies were conducted from the payer (e.g., employer) perspective. Given the benefits to society as a whole that accompany reduced tobacco consumption (e.g., a healthier population, additional health resources made available to use in other areas of patient care), policy-makers may wish to encourage employers to consider implementing cessation strategies. Government subsidies could be a way of encouraging sceptical employers to begin a program. Of course, no subsidy should be provided without an evaluation of its potential costs and benefits. Future economic evaluations of tobacco cessation strategies should expand the analytical perspective to include more than just a single payer if the study objective is to highlight the merits of a program that requires more than one actor to facilitate design and implementation.

5.7 Conclusion

This chapter has provided a synopsis of economic evaluations of smoking prevention and cessation programs. The evidence suggests tobacco taxation policies are an effective means of lowering cigarette consumption due to the inverse relationship between tobacco price and consumption, and that considerable scope exists for expanding these policies in developing countries. Some evidence, however, suggests that higher tobacco taxes could lead to increased demand for liquor, or to higher consumption of smokeless tobacco. This chapter also summarized economic studies that have explored the effect of tobacco advertising on cigarette sales and consumption, as well as the effect of tobacco advertising restrictions and antismoking media campaigns as policy instruments for reducing tobacco consumption. Economic studies suggest that tobacco advertising can increase demand for tobacco products, while tobacco control policies such as antismoking media campaigns and advertising bans can reduce demand. In general, however, the evidence on the effectiveness of advertising bans or antismoking media campaigns as sole policy instruments is equivocal, and suggests they are more effective when implemented as part of a comprehensive tobacco control strategy. Finally, smoking cessation strategies have been shown to have a positive impact on reducing consumption. Most of the cost-effectiveness analyses in this chapter have evaluated cessation strategies, and typically there is an additional cost per life-year or QALY saved attached to the strategy in question. Decisions about whether such a strategy is cost-effective should be made by stakeholders in the health-care system.

5.8 References

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Chapter 6:
Conclusions and Recommendations

6.1 Conclusions

The importance of tobacco use as a global public health problem is indisputable. Moreover, the studies reviewed in this report confirm that cigarette smoking and other tobacco consumption also exact a severe *economic* toll on developed and developing countries. Tobacco use leads to poor health for those affected, to loss of productivity due to poor health, and to increased consumption of societal resources, especially in the health-care sector.

Tobacco use has a particularly severe economic impact on the developing world. Resources are relatively scarce in developing country contexts, and expenditures on tobacco consumption and tobacco-related illnesses compete in clear and often poignant ways with other social priorities. Moreover, the magnitude of the problem is increasing. Projected global trends show that developing nations are likely to experience by far the largest growth in tobacco consumption, disease and death over the coming two decades. The economic toll associated with this growth is likely to be significant, and can impede country development objectives.

Yet, as this review demonstrates, many tobacco control policies and interventions have been shown to be both effective and cost-effective. To recap, the evidence suggests that macroeconomic interventions such as tobacco taxation policies are an effective means of lowering cigarette consumption due to the inverse relationship between tobacco price and consumption. Considerable scope exists for expanding these policies in developing countries. It should be noted, however, that some evidence suggests that higher tobacco taxes could lead to increased demand for liquor, or to higher consumption of smokeless tobacco.

Another effective measure in reducing the demand for tobacco products is the banning of tobacco advertising. However, compared to taxation strategies, the evidence on the effectiveness of advertising bans as a sole policy instrument is equivocal, and suggests that bans are more effective when implemented as part of a comprehensive tobacco control strategy.

Smoking cessation strategies have also been shown to have a positive impact on reducing tobacco consumption in high-income countries.

Despite these facts, global funding for tobacco control research is inadequate, and overwhelmingly concentrated in high-income countries. The only two major underlying causes of premature death that are increasing dramatically are HIV infection and tobacco use, yet this fact is not reflected in public spending on tobacco control research. A working paper for the 2001 WHO Commission on Macroeconomics and Health reported that for every death due to tobacco use, governments and public agencies spent approximately $50 on tobacco research, versus $3,000 for every HIV death in the same year, based on 1990 estimates. This resulted in a global total for 1990 of $148–164 million for tobacco research, compared to $919–985 million for research into HIV/AIDS (1).

As the results of this review suggest, economic studies have a critical role to play in measuring the real costs of tobacco use to developing countries, and in informing tobacco control policy development. Conclusions are summarized in Box 6.1.

6.2 Recommendations

This section offers recommendations for future policy-oriented research into the economics of tobacco control. As this report and others have shown, the majority of research into the economics of tobacco control has taken place in developed countries (1). This situation should be redressed. Little information exists on the impact of tobacco use in developing countries, despite the fact these countries are expected to experience the largest growth in tobacco consumption, disease, and death over the coming two decades (Chapter 3).

Box 6.1 Conclusions

- Tobacco consumption exacts a significant economic toll on developed and developing countries.
- Tobacco use has a particularly severe economic impact in the developing world, where tobacco-related expenditures compete with other social priorities for relatively scarce resources.
- The situation in the developing world is worsening, as the epidemic is growing rapidly and disproportionately in low- and middle-income countries.
- Tobacco control interventions are demonstrably effective in reducing tobacco consumption.
- Tobacco control research is underfunded relative to the importance of the problem, and its potential to positively impact policy development.
- Economic studies have a critical role to play in measuring the real costs of tobacco use to developing countries, and in informing tobacco control policy development.

Future research should focus on monitoring the burden of disease in developing countries, to set the stage for comprehensive tobacco control efforts. This information should aid governments in terms of health planning, which is particularly important in view of the time lag between tobacco consumption and disease onset.

Tobacco use has a disproportionate impact on vulnerable population subgroups (Chapter 4). In affluent countries, inverse relationships are found between income and smoking, and between educational level and smoking. These patterns, however, do not always hold in developing countries, where tobacco use has been observed to be increasing in all segments of the overall population. Given the dearth of research on the distribution of smoking prevalence among vulnerable population subgroups in the developing world, future research into this area should be prioritized.

With respect to methodology, studies assessing national tobacco disease burden or examining the economic impact of tobacco use on population subgroups predominantly employed the cost-of-illness (COI) design. Prevalence-based COI studies were more common than incidence-based COI studies, probably largely due to the latter's more demanding data requirements. Incidence-based COI studies, however, are advantageous with respect to evaluating the impact of interventions

Box 6.2 Recommendations for Future Research on the Economics of Tobacco Control.

Economic tobacco control studies should:

- Focus on developing countries; and
- Focus on vulnerable population subgroups (e.g., women, children, and the poor).

Developing country studies monitoring the burden of disease and its associated economic impact should be encouraged. Where feasible, studies should:

- Take advantage of existing data sources; and
- Explore alternative methods.

Developing country research tailored to assessing tobacco control policies and interventions in local contexts should be encouraged.

Economic evaluations of prevention and cessation interventions should be done in developing country contexts, as costs and effectiveness are likely to vary. Studies should improve their methods to:

- Expand analytical perspective to the societal perspective; and
- Report incremental rather than average cost-effectiveness ratios.

(e.g., prevention programs) to reduce tobacco use. The disability-adjusted life-year (DALY) approach is designed to help establish resource allocation priorities; yet, to date, only the WHO appears to have employed the DALY-based methodology in tobacco-related studies.

Studies monitoring the burden of disease and its associated economic impact in developing countries should be encouraged. Where feasible, studies should take advantage of existing data sources (Appendix B), and explore alternatives to the prevalence-based COI method.

Studies assessing the effectiveness of interventions to reduce the demand for tobacco (Chapter 5) have been predominantly performed in high-income countries. Part of the problem in designing and implementing tobacco control policies in developing countries concerns a lack of knowledge with respect to the effectiveness of various policies. Moreover, policies effective in high-income settings may need to be tailored to local contexts in low- and middle-income countries. In addition, evidence suggests that academic analyses geared to local needs may increase the likelihood of tobacco control measures being adopted (1). With respect to economic evaluations of prevention and cessation interventions, studies conducted in developing country contexts should be encouraged, as costs and effectiveness are likely to vary across settings. Study methods should be aligned with standard practice. Specifically, the analytical perspective of the studies should use the societal analytical perspective, and future economic evaluations of tobacco cessation strategies should use incremental cost-effectiveness ratios as recommended by health economics literature, rather than average ratios.

Recommendations for future research into the economics of tobacco control are summarized in Box 6.2.

6.3 References

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appendix A

Description of Databases Searched in Literature Review

1. MEDLINE

Produced by the U.S. National Library of Medicine, the MEDLINE database is widely recognized as the premier source for bibliographic and abstract coverage of biomedical literature. MEDLINE encompasses information from Index Medicus, Index to Dental Literature, and International Nursing, and other sources of coverage in the areas of allied health, biological and physical sciences, humanities and information science as they relate to medicine and health care, communication disorders, population biology, and reproductive biology. More than 9.5 million records from more than 3,900 journals are indexed, plus selected monographs of congresses and symposia (1976–1981). Abstracts are included for about 67% of the records.

2. HealthSTAR

HealthSTAR contains citations to the published literature on health services, technology, administration, and research. It focuses on both the clinical and nonclinical aspects of health-care delivery. The following topics are included: evaluation of patient outcomes; effectiveness of procedures, programs, products, services and processes; administration and planning of health facilities, services and manpower; health insurance; health policy; health services research; health economics and financial management; laws and regulation; personnel administration; quality assurance; licensure; and accreditation.

HealthSTAR is produced cooperatively by the U.S. National Library of Medicine (NLM) and the American Hospital Association. The database contains citations and abstracts (when available) to journal articles, monographs, technical reports, meeting abstracts and papers, book chapters, government documents, and newspaper articles from 1975 to the present. Citations are indexed with the National Library of Medicine's Medical Subject Headings in order to ensure compatibility

with other NLM databases. Information in HealthSTAR is derived from MEDLINE, CATLINE, the Hospital Literature Index, and selected journals. Additional records specially indexed for this database do not appear in any other NLM database. HealthSTAR replaces the former Health Planning and Administration database.

3. EconLit

Produced by the American Economic Association, EconLit indexes and abstracts more than 550 international economic journals. EconLit source material includes journal articles, essays, research papers, books, dissertations, book reviews, and working papers. The database contains more than 350,000 records and covers subjects from accounting, consumer economics, monetary policy, labour, marketing, demographics, modeling, economic theory, planning, and more. Years of coverage are 1969–present with approximately 26,000 records added annually.

4. Cochrane Database of Systematic Reviews

The Cochrane Database of Systematic Reviews (COCH) includes the full text of the regularly updated systematic reviews of the effects of health care prepared by The Cochrane Collaboration. The reviews are presented in two types: 1) complete reviews, and 2) protocols. Protocols are the background, objectives and methods of reviews in preparation. COCH is produced by the Cochrane Collaboration — an international network of individuals and institutions committed to preparing, maintaining, and disseminating systematic reviews of the effects of health care. The Cochrane Collaboration is guided by six principles: collaboration, building on people's existing enthusiasm and interests, minimizing duplication of effort, avoiding bias, keeping up to date, and ensuring access. Each issue of COCH contains new and updated reviews and protocols. COCH is unlike other "journal" or "serial" publications in that once a review is published it will appear in every issue thereafter. Consequently, each Review or Protocol includes a section about how to cite that document if needed.

appendix B

Inventory of Data Sources

Due to the time and expense of primary data collection, data availability is of primary concern to tobacco control researchers. Many economic studies are therefore based on the use of published epidemiological data. Accurate and up-to-date national statistics are available in most industrialized nations. For instance, nationally representative surveys of disease and mortality statistics are compiled regularly by the U.S. National Center for Health Statistics, with deaths classified by their primary cause and appending data on age and gender of the deceased. Many published cost-of-illness (COI) studies on the economic impact of tobacco use in industrialized countries have used epidemiological data in conjunction with the Smoking-Attributable Mortality, Morbidity, and Economic Costs Software, Release II (SAMMEC II) program.

National statistics and information sources in developing countries are fewer and less accurate. Although its use to date in tobacco control research is not well established, researchers should consider using the Living Standards Measurement Study (LSMS) of the World Bank. The LSMS provides information on, among other things, tobacco-related expenditures, health expenditures and socioeconomic status in over 30 developing countries. Moreover, the WHO provides tobacco country profiles that unite economic, epidemiological and policy information for 197 countries in all income categories and geographical regions. These data sources are described in greater detail below.

SAMMEC II

The SAMMEC II software program consists of a spreadsheet that operates within LOTUS 1-2-3 and contains diagnosis-specific relative risks for smoking-related diseases obtained from major prospective studies in the United States. In its design, SAMMEC II adapts national epidemiologic methods for use by U.S. states and local health departments. SAMMEC II permits rapid calculation of deaths, years of potential life lost (YPLL), direct health-care costs, indirect mortality costs, and disability costs associated with cigarette smoking.

The primary purpose of SAMMEC II is to provide state data on the health consequences of smoking to policy makers and public health professionals.

SAMMEC II performs a prevalence-based analysis of smoking-attributable mortality and costs of illness. The program generates "disease impact estimations", a multiple-measure approach examining attributable mortality and economic costs to quantify a health problem. The pivotal epidemiological measure in these calculations is the smoking-attributable fraction (SAF). Calculation of each of the principal disease impact measures relies on the prior calculation of the SAF. The software uses a calculation formula that is derived from the basic SAF formula but that can accommodate three levels of smoking status: current, former, and never-smokers.

To calculate SAF values, estimates of current and former smoking prevalence and diagnosis-specific relative risk estimates for smoking-related diseases must be available. Smoking prevalence rates for the group under study are entered by the user. SAMMEC II provides diagnosis- and sex-specific relative risks for current and former smokers (relative to never-smokers) according to the International Classification of Diseases, Ninth Revision (ICD-9-CM). For instance, the relative risk for male smokers of contracting cancer of the larynx (ICD-9 161) is 10.48 for current smokers and 5.24 for former smokers. Similarly, the relative risk for female smokers of contracting bronchitis or emphysema (ICD-9 490-492) is 10.47 for current smokers and 7.04 for former smokers.

Using the SAF values, SAMMEC II calculates three mortality-related measures of disease impact: smoking-attributable mortality, YPLL, and indirect mortality costs. In addition, SAMMEC II calculates smoking-attributable direct health-care costs and indirect morbidity costs according to disease category. For the group under study, the user supplies total health expenditures and five component costs, including hospitalization, physician services, medication costs, nursing home costs, and other professional services.

Box B.1 SAMMEC II Calculation of Smoking-Attributable Fraction.

$$SAF = \frac{\{ [\, p0 + p1(RR1) + p2(RR2) \,] - 1\}}{p0 + p1(RR1) + p2(RR2)}$$

Where SAF = Smoking-attributable fraction

Where p = Percentage of individuals in the group under study:
- p0: Never-Smokers
- p1: Current Smokers
- p2: Former Smokers

Where RR1 = Relative Risk for current smokers relative to never-smokers

Where RR2 = Relative Risk for former smokers relative to never-smokers

SAMMEC II is therefore an important tool in the study of the impact of tobacco use. Disease impact estimation provides a useful tool in developing public health strategies to confront the tobacco epidemic. Although SAMMEC II delivers this tool to public health officials in industrialized countries, similar information is lacking for developing countries.

Living Standards Measurement Study (LSMS)

The World Bank established the LSMS in 1980, in order to explore ways of improving the type and quality of household data collected by government statistical offices in developing countries. LSMS surveys are multitopic questionnaires designed to study multiple aspects of household welfare and behaviour and are subject to extensive quality control.

The main objective of LSMS surveys is to collect household data that can be used to assess household welfare, to understand household behaviour, and to evaluate the effect of various government policies on the living conditions of the population. Accordingly, LSMS surveys collect data on many dimensions of household well being, including consumption, income, savings, employment, health, education, fertility, nutrition, housing and migration (Box B.2). Three different kinds of questionnaires are normally used in the LSMS. The first is the household questionnaire, which collects detailed information on the household members. The second is the community characteristics questionnaire in which key community leaders and groups are asked about community infrastructure. The third is the price questionnaire, which asks market vendors about prices.

Of special interest to research on the economic impact of tobacco use is the household questionnaire, which collects detailed information on the household members, including information on personal tobacco expenditures. Section 4 of the questionnaire, Nonfood Spending, instructs the interviewer to ask, “In the past month, about how much, if anything, was spent on cigarettes or tobacco?” The LSMS also offers information relevant to the assessment of socioeconomic status (e.g., educational attainment, employment status and sector of employment, social assistance payments such as disability pension, housing type, indicators of wealth and public health such as toilet facilities and water source), and information on health status and health spending (e.g., chronic illness type, type and location of treatment, workdays lost, and monthly cost; acute illness type, provider consulted, sector and site of consultation, cost of treatment, tests and drugs prescribed). To date, the LSMS has been undertaken in more than 30 developing countries worldwide (Box B.3). The LSMS can be accessed through the World Bank website at http://www.worldbank.org/lsms/.

Box B.2 Modules in Living Standards Measurement Study (LSMS) Questionnaires

Household Composition

Household roster, demographic data, information on parents of all household members

Consumption Modules

Food Expenditures
Food expenditures in the past 14 days and past 12 months; consumption of home production in past 12 months

Nonfood Expenditures
Expenditures in the past 14 days and past 12 months; remittances to other households

Housing
Type of dwelling; housing and utilities expenditures

Durable Goods
Inventory of durable goods and their characteristics

Income-related Modules

Nonfarm self-employment
Income, expenditures, and assets for three most important household businesses

Agro-pastoral activities
Land, crops, income, and expenditure from raising crops and animals; livestock and farm equipment inventory

Economic Activities
Employment, income, and time data for the main and secondary jobs in the last 7 days and the last 12 months; employment history; unemployment spells in the last 12 months; time use in the home

Other income
Income from other sources, including remittances from other households

Savings and credit
Savings and net debt the day of the interview; characteristics of outstanding loans to and from household members

Sectoral Modules

Education
Completed schooling and schooling expenditures for all household members aged five or older; schooling and other information of all nonmember children under 30

Box B.2 Modules in Living Standards Measurement Study (LSMS) Questionnaires (continued)

Health
Utilization of health services and medical expenditures for any illness in the last four weeks; utilization of and expenditures for preventive services in the last 12 months

Migration
Place of birth, time and current place of residence, and reasons for first and last moves

Fertility
Birth history; use of maternity services and duration of breast feeding for last live birth

Anthropometrics
Height and weight measurements of all household members

Community Questionnaire

Demographics
Size, growth, ethnic mix

Economy and Infrastructure
Economic activities, access to roads, electricity, water, public services such as public transport, mail service, etc.

Education
Location and characteristics of schools serving community

Health
Location and characteristics of health facilities serving community

Agriculture
Location and characteristics of health facilities serving community

Price Questionnaire

Market, shops
Prices on frequently purchased items

Source: Grosh, M.; Glewwe, P. A Guide to Living Standards Surveys and Their Data Sets. LSMS Working Paper #120, The World Bank, 1995 (updated on March 1, 1996).

Tobacco Control Country Profiles and NATIONS

Anticipating the demand for an information system to support new tobacco control efforts, the WHO and the Centers for Disease Control and Prevention (CDC) initiated development of the National Tobacco Information Online System (NATIONS) in December 1998. NATIONS is an electronic system that tracks country-specific information across a variety of indicators: smoking prevalence and tobacco consumption, laws and regulations, morbidity and mortality, industrial organizations, tobacco economics, and programmatic interventions against tobacco use. NATIONS reports time-trend data for some of these topics, and the data is updated periodically and made available on the Internet. NATIONS helps monitor the global tobacco epidemic by standardizing data collection and distribution methods, providing the permanent electronic framework necessary to update the data, and making information easily accessible to the public.

Tobacco Control Country Profiles (Profiles) provided preliminary data for NATIONS. Profiles and NATIONS report on the current tobacco situation in 197 countries and territories around the world: 191 WHO Member States, 2 WHO associate Member States (Puerto Rico and Tokelau), Hong Kong (special administrative region of China), Taiwan (province of China), the West Bank and Gaza Strip (presented together). The data are organized into six categories: socio-demographic situation, smoking prevalence, smoking-related disease impact, tobacco economy, infrastructure for tobacco control, and available pharmaceutical treatments for tobacco dependence.

NATIONS data is now available at http://www1.worldbank.org/tobacco/, http://apps.nccd.cdc.gov/nations/, and http://tobacco.who.int/.

Tobacco Control Country Profiles is available at http://tobacco.who.int/page.cfm?sid=57.

Box B.3 Countries Surveyed in the Living Standards Measurement Study (LSMS)

- Albania
- Armenia
- Azerbaijan
- Brazil
- Bulgaria
- Côte d'Ivoire
- Ecuador
- Federal Republic of Yugosolvia Kosovo
- Ghana
- Guyana
- India - Uttar - Pradesh and Bihar
- Kazakhstan
- Kyrgyz Republic
- Morocco
- Nepal
- Nicaragua
- Pakistan
- Panama
- Papua New Guinea
- Peru
- Romania
- Russia
- South Africa
- Tajikistan
- Tanzania
- Venezuela
- Viet Nam

Research for International Tobacco Control (RITC) is a multi-donor Secretariat established in 1994 and housed at the International Development Research Centre (IDRC) in Ottawa, Canada. RITC's mission is to create a strong research, funding and knowledge base for the development of effective tobacco control policies and programs that will minimize the threat of tobacco production and consumption to health and human development in developing countries. RITC was initially funded by IDRC and Health Canada, and was later joined by the Canadian International Development Agency (CIDA) and the Swedish International Development Cooperation Agency (Sida).

RITC works in 4 strategic areas:

Research – providing technical and financial support for multi-disciplinary, policy-relevant international tobacco control research.

Dissemination – supporting broad dissemination of research results in formats that are appropriate for differing audiences.

Strengthening Capacity – strengthening individual and institutional capacity for tobacco control research in developing countries in order to provide credible evidence for the development of tobacco control policies and programs.

Coordination – working with other partners to coordinate global tobacco control research to ensure optimal use of scarce research funds, to avoid duplication of effort and to make better use of the knowledge emerging from tobacco control research as global public good.

The Monograph Series is a part of RITC's commitment to contribute to the production, synthesis and dissemination of research data on tobacco control.

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