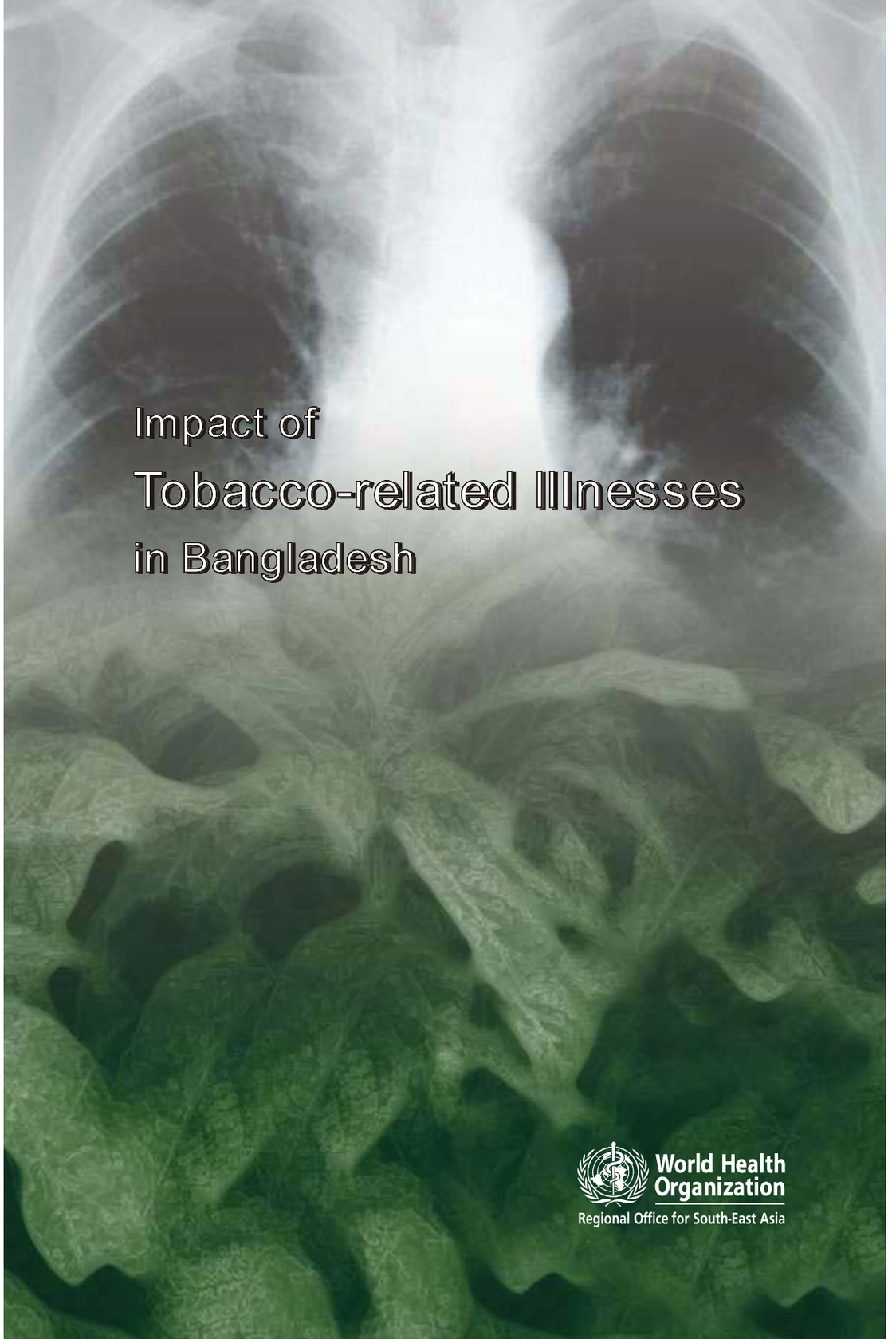

Impact of Tobacco-related Illnesses in Bangladesh

World Health Organization
Regional Office for South-East Asia

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Foreword

The economics of tobacco is a critical element in tobacco control activities. The tobacco industry has long claimed that increased taxes on tobacco products would lead to a decrease in government revenues, an increase in illicit trade in tobacco and massive job losses. These largely unfounded arguments have made many governments reluctant to formulate and implement stringent tobacco control policies such as increased pricing and taxes. Scientific research has produced evidence to show that tobacco control actually brings significant health benefits without harming the economy. What has been lacking to date was the real cost of tobacco use; not just the cost of tobacco use on health, but the full cost of its impact on the economy of a nation.

The study entitled "Impact of Tobacco-related Illnesses in Bangladesh" is one of those most pertinent fact-finding assessments of the health costs of tobacco use. The results of the study show that the health and economic costs of tobacco use significantly outweigh the revenues from tobacco. The findings also support increased taxes on all tobacco products as one of the most effective and cost-effective ways to reduce tobacco consumption.

Bangladesh is in epidemiological transition. Disease patterns have changed from predominantly communicable diseases to noncommunicable diseases such as heart conditions, chronic respiratory infections and cancers. Many of these killer diseases can be prevented through more appropriate lifestyles. Tobacco use is a major lifestyle risk factor. Additional data gathered during implementation of the study and a further analysis of costs have been incorporated into the findings. The revised study provides comprehensive, evidence-based data on tobacco-related illnesses and their impact on the economy in Bangladesh.

The findings of the study were used by the Government of Bangladesh to get its National Tobacco Control Legislation adopted by the Parliament. They have also been used in the South-East Asia Region and elsewhere as strong advocacy for tobacco control programmes. I am confident that this updated study will serve as a valuable tool to understand the overall costs involved in tobacco use, not only in Bangladesh, but in all developing and transitional economies. It should encourage countries to establish tobacco control legislation, implement tobacco control activities, and re-examine the tax structures of tobacco products in order to formulate appropriate policies in this regard.

Samlee Plianbangchang

Samlee Plianbangchang, M.D., Dr.P.H.
Regional Director

Executive summary

Data regarding the impact of tobacco usage on the economy in developing countries are insufficient. This study examines the costs of tobacco-related illnesses in Bangladesh as of 2004 by determining: (i) the prevalence of tobacco-related diseases; (ii) disabilities and deaths that are attributable to tobacco; and (iii) direct (out-of-pocket and health system) and indirect (premature deaths and disabilities) costs, for a cost benefit analysis.

The study is based on the data collected through a sample survey of 11 985 persons from 2467 households; hospital costs; patient surveys in four medical college hospitals; an expert survey that determined the survival rate and quality of life after occurrence of the tobacco-related disease; and a supplementary survey of four specialized institutes to identify the additional cost of specialized treatment.

Given that tobacco-related diseases develop mostly after the age of 30 years, the study reports findings for this age group (n=4394). Smoking prevalence was found to be 50% among men and 3% among women. In addition, 22% of men and 39% of women use smokeless tobacco in chewable form. Altogether, 62% of men and 41% of women (52% for sexes combined) either smoked or chewed tobacco products.

Nine percent of the participants examined at households had at least one of eight selected tobacco-related diseases (ischemic heart disease, lung cancer, stroke, oral cancer, cancer of the larynx, chronic obstructive pulmonary disease, pulmonary tuberculosis, or Buerger's disease). Forty one percent of them were attributable to tobacco. Hospital data indicated that 29% of inpatients (of the same age group) were hospitalized due to these diseases. It was also estimated that they were responsible for 16% of all deaths in the country and 9% of them were attributable to tobacco.

The annual cost of tobacco-related illnesses in Bangladesh attributable to tobacco usage was estimated at 50.9 billion taka, including 5.8 billion taka for second-hand smoking. The calculation was based on current health-seeking behaviour; thus only a quarter of patients were assumed to seek inpatient care. On the other hand, the total annual benefit from the tobacco sector was estimated at 24.8 billion taka from tax revenue and wages in tobacco production. The cost of tobacco usage to the country thus exceeds its benefits by 26.1 billion taka per annum (equivalent to US$ 442 million).

Tobacco consumption and burden of related disease were found to be inversely related to the socioeconomic status of the participants. The study concluded that the whole nation, especially the poor, would benefit from tobacco control.

Chapter 1

Introduction

Tobacco usage accounted for 4.1% of the global burden of ill-health in 2000. Much of this burden was due to an increase over the previous decade of tobacco-related illnesses in developing countries. Almost 4.9 million deaths in 2000 were attributed to tobacco usage (Ezzati et al., 2002). According to a recent study on smokers, the average loss of life expectancy per tobacco-related illness in India was estimated at 20 years, with middle-aged smokers having twice the death rates than non-smokers (Gajalakshmi *et al*., 2003). Thus, tobacco usage results in loss of life – and in turn productivity – during the active years of experienced workers.

The study in Bangladesh identifies and compares the economic costs and benefits of tobacco consumption with a view to providing economic data to frame tobacco control policy. More specifically it provides an estimation of opportunity costs (costs necessitated by tobacco usage that could otherwise have yielded greater benefit) incurred because of ill-health attributable to tobacco usage. Accounting includes the costs borne by the health system to treat tobacco-related illnesses, and out-of-pocket costs borne by the household of the person afflicted by these illnesses. These two items make up the direct costs. To this is added the cost to the economy due to premature death and disabilities, or the indirect costs.

The initial task was to identify the types of illnesses that can be attributed to tobacco usage, although the etiology of the illnesses is not exclusive to tobacco.[1] The list of illnesses varies from country to country due to different habits for tobacco usage (Peto *et al*., 1992). In this study, eight illnesses were selected as they are consistent with tobacco usage in all regions of the world. These are: lung cancer, cancers of the mouth and larynx, stroke and ischemic heart diseases (IHD), and chronic obstructive pulmonary disease (COPD) (Murray and Lopez, 1996). Studies in the People's Republic of China and India have shown that tobacco contributes to the incidence of pulmonary tuberculosis (Gajalakshmi *et al*., 2003, Liu et al *et al*., 2001), Buerger's Disease (thromboangiitis obliterans), occurring primarily among heavy smokers who

[1] Here, tobacco-related illnesses are all those that have been associated with tobacco usage. A portion of the prevalence of the illnesses can be attributed to tobacco usage. Thus the main interest of this study is to estimate the opportunity costs imposed by occurrence of illnesses directly caused by tobacco usage.

are poor and work bare feet in wet soil condition, has been shown to be a source of disease burden in Bangladesh and other developing countries (Rahman *et al*., 2000).

Having identified the illnesses, the study compared the total cost of tobacco usage to zero usage. The difference between these costs would represent the magnitude of the problem. The calculation of annual costs followed the cross-sectional, or prevalence-based, approach for cost of illness studies (Cooper and Rice, 1976). This estimates actual costs as a function of all illnesses related to current and past smoking. Costs were calculated using standard guidelines on economic cost"benefit analysis. All costs attributable to tobacco-related illnesses were deemed excess medical costs

Consumption of tobacco is addictive and can therefore be seen as an unwarranted cost. On the other hand, its consumption yields benefits in terms of relaxation and pleasure. A major reason that tobacco consumption has not been considered as a cost has been the concern of policy-makers in poorer countries of losing tax revenues from sales of tobacco products (including surpluses which are normally seen as benefits in welfare economics), as well as wages earned through the production of tobacco. The study therefore adopted a mixed approach: while the tax and wages associated with tobacco consumption and production were seen as benefits, the producer and consumer surpluses from domestic consumption were discounted as they stem solely from addictive consumption and cause damage to health.

Nearly all the comprehensive studies to assess the economic burden of tobacco usage have focused on high-income countries (Jha and Chaloupka, 2000). In the United States of America, the direct costs of treatment of illnesses directly attributed to tobacco usage accounted for 0.46% to 1.15% of gross domestic product (GDP). This is the actual expenditure in a given year. In the United Kingdom, these costs amounted to 0.13% of GDP, while those in Canada ranged from 0.12% to 0.56% of GDP. Similar ranges were found in Australia. The only comprehensive study from any developing country , carried out in China, showed that direct costs amounted to 0.43% of GDP.

Social costs included the indirect costs of morbidity and premature mortality, as well as direct medical costs. While social costs averaged 1.4% to 1.6% of GDP in the USA and Canada, the China study showed a higher figure of 1.7% (Jha and Chaloupka, 2000).

While directly not accounted in the cost calculations in any of the studies mentioned above, the effects of tobacco consumption on poor populations

are significantly higher than for other income groups. Taking education as proxy for income levels, data from both developed and developing countries suggest that poor people consume more tobacco products than people in higher income groups in nearly all regions of the world. In the United Kingdom, the least educated people smoke three times more than the highest educated group, and this rate is up to seven times more in some developing countries. The risk of death from tobacco usage is also related to income (Jha and Chaloupka, 2000). A study in Canada determined the risk of death attributable to smoking to be 5% for high-income earners, rising to 15% for the poorest population group.

The effects of high consumption of tobacco in developing countries is compounded by the opportunity costs of consuming other essential items. Studies in several countries observed that up to 17% of household income was being spent on tobacco products (de Beyer *et al*., 2001). A study in Bangladesh estimated that 10 million people currently malnourished could have an adequate diet if money spent on tobacco were spent on food instead (Effroymson *et al*., 2001).

In developed countries, considerable efforts have resulted in a lower number of smokers, often as a result of banning direct and indirect tobacco advertising, high taxes on tobacco products, the enforcement of laws requiring tobacco-free public and work places, and clear graphic health messages on tobacco packaging. Developing countries, on the other hand, are not only witnessing an increase in tobacco usage; they are also lacking effective legislation, often for the socioeconomic arguments stated above. Based on these arguments, some policy-makers conclude that amount gained as revenue from tobacco exceeds the cost to society due to tobacco use. This study seeks to assess the validity of this view in Bangladesh, a pioneer among countries considering legislation to control tobacco consumption.

Chapter 2

Objectives

The objective of the study was to obtain information on the economic costs of illnesses resulting from tobacco usage in Bangladesh. It entailed calculating the opportunity costs borne by the government attributable to tobacco-related illnesses, and an analysis of the extent to which these may frame tobacco control policy.

The specific objectives were to determine:

(1) the prevalence of tobacco usage;

(2) the prevalence of tobacco-related illnesses;

(3) utilization of health services (in a partial way);

(4) hospital costs borne by the health system due to tobacco-related illnesses;

(5) out-of-pocket expenditure of households, either when people are hospitalized or attend outpatient departments, due to tobacco-related illnesses;

(6) deaths and disabilities due to tobacco-related illnesses;

(7) the impact of second-hand smoking; and

(8) benefit of tobacco consumption for the economy.

Using the above criteria we attempted to test the following hypotheses:

(1) tobacco-related illnesses impose substantial costs to the society;

(2) total expenditure (household out-of-pocket, health system and indirect costs) exceeds total income (public and private) earned from, domestic consumption of tobacco; and

(3) the cost of tobacco usage is disproportionately high for the poor.

The prevalence of tobacco-related diseases and the average private and public costs of treating them were estimated using data collected in 2004 from various sources, including a national household survey, hospital costs and patient surveys (from three public medical college hospitals and one private one), and an expert survey that determined the survival rate and quality of life after occurrence of the diseases attributable to tobacco. These data were supplemented by others from the institutes that provide specialized care for the diseases.

Chapter 3

Methods and analytical framework

This chapter describes the methods used, and the four surveys conducted for the present study.

3.1 Cost of Illness (COI) approach

The opportunity costs of tobacco-related illnesses included:

(1) private expenditures (out-of-pocket or insurance) of patients on medical care, e.g., drugs, medical examination, hospitalization, and transportation to health centres;

(2) cost of the public health care system; and

(3) loss of potential income and investment opportunities due to illness and consequent working disability or termination of working life by premature death.

The first two components are the direct costs to the patients and the health care system. The third component constitutes the indirect cost of illness to individuals and society.

The measurement of the total annual cost of tobacco-related illnesses to the economy involves the estimation of:

(1) the relative risk of the eight selected diseases with respect to tobacco–the proportion of tobacco users having any of the diseases;

(2) the prevalence rates of the eight diseases attributable to tobacco usage–the probability that one of them would befall a tobacco consumer, derived from the ratio of tobacco users having any of the eight illnesses compared to the proportion of tobacco users in the economy;

(3) the average cost of private treatment of individual patients;

(4) the average hospital cost (inpatient and outpatient) of treatment of individual patients;

(5) the average indirect cost from the loss of working days and income of both the patient and the attendant family members due to the treatment;

(6) average indirect cost from the loss of income owing to disability or early demise caused by the illness.

The sum of the average costs (3) to (6), weighted by the rate of prevalence of tobacco-related illness, yields an estimate of the expected average cost of illnesses attributable to tobacco usage. To obtain the expected total cost of illness, the average cost needs to be multiplied by the total population. Thus the following basic economic cost structure for each illness will be calculated for each year:

$$(O_i + H_i) \times N_i + (O_{nh} \times N_{nh}) + \sum_{t=a}^{LE} \frac{TYIC(Death)}{(1+r)^t} + TYIC(Disability),$$

where,

i = {inpatient, outpatient},

nh = {non-hospitalised},

O = average out-of-pocket expenditure,

H = average hospital cost,

N = number of patients with a tobacco-related illness

r = the rate of discount for future monetary values,

TYIC = total yearly indirect cost due to death and disability,

a = average age of onset of illness,

LE = life expectancy conditional on survival up to age a, and

t = time.

The variables that have been generated through the surveys for the purpose of analysis are described in Annex 1.

3.2 Household survey

The household survey allowed us to estimate the prevalence of tobacco usage, construct a population disease profile for the age group of 15 years and above, determine out-of-pocket costs incurred for tobacco-related illnesses, and diagnose associated health-seeking behaviour.

Sampling and cluster selection

The household survey took place from May to July 2004. A representative sample of 2467 households was drawn from six divisions. We made sure that the districts selected had different degrees of accessibility to tertiary health care facilities: districts within a 25 kilometre radius from a tertiary health-care facility were considered *near* and those 25 to 50 kilometres were considered *far*.

Unions or Wards (clusters) were selected randomly from the districts. Table 1 shows the number of clusters and households from each division. A total of 59 clusters were selected from 6 divisions that included 11 985 young and adult individuals.

Table 1: *Regional distribution of sample of households and individuals, 2004*

Division	District	Upazila/ Thana	Union/ Ward[a]	Village/ JLs	Total HHs	Population aged 15 years and above	Population aged 30 years and above	Total population[b]
Dhaka	5	15	17	27	767	2293	1304	3558
Chittagong	2	7	7	9	470	1666	919	2725
Rajshahi	4	9	12	16	606	1572	951	2518
Khulna	3	7	11	12	295	911	556	1355
Barisal	2	6	6	9	164	564	327	839
Sylhet	2	5	6	7	165	589	322	990
Total	18	49	59	80	2467	7595	4394	11985

JL: jurisdiction limit; HH: households.

[a] Total urban clusters in the sample were 23 and total rural clusters were 36.

[b] 30% of the sampled population was urban and 70% was rural.

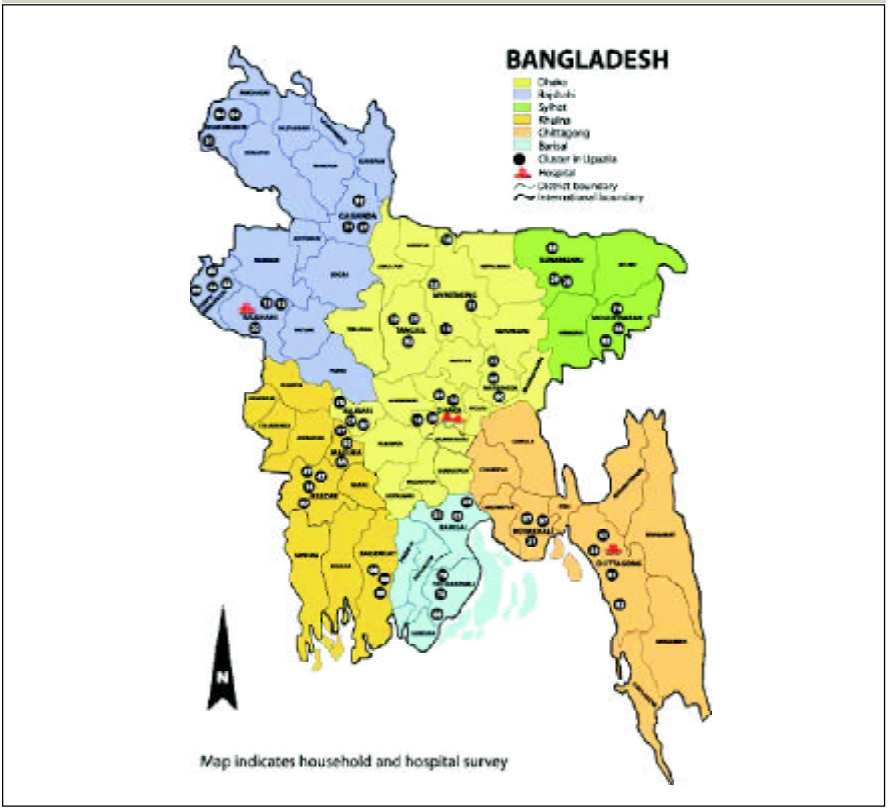
Distribution of the clusters is depicted in the map of Bangladesh in Figure 1. The household sample is representative of the Bangladeshi population in terms of urban–rural composition, distribution of household expenditure, as well as age composition. For example, youth and infants (those aged below 30) accounted for 63% of the total sample, while the national figure is 64%. The distribution of sample population by age group is shown in Annex 2. The present study focused on adults aged 30 years and above, who constituted 37% of the sample, because tobacco-related illnesses are observable primarily among people of this age group. The socioeconomic background of the sample population is presented in Table 2.

Survey tools

(1) *Household questionnaire:* The household questionnaire was designed to obtain information on characteristics such as demographics, household monthly expenditure, assets, tobacco usage per member, occupation and the educational achievement of each member. General information on lifestyle habits, health, and reported morbidity were collected from individuals aged 15 years and above.

(2) *Medical questionnaire:* A structured medical questionnaire was used to obtain information on health-seeking behaviour and the cost of treatment for 15 days' morbidity. Questions were asked to ascertain whether anyone in the household had been diagnosed within the previous six months with any of the eight tobacco-related diseases–

Figure 1: Household and hospital survey locations, 2004



Source: Sample Survey: Impact of Tobacco-related Illness in Bangladesh, 2004

ischemic heart disease (IHD), stroke or transient ischemic attack (TIA), oral cancer, lung cancer, laryngeal carcinoma, chronic obstructive pulmonary disease (COPD), pulmonary tuberculosis and Buerger's disease. An in-depth survey was also carried out to identify the eight tobacco-related illnesses. Standardized WHO questionnaires were used to identify IHD and stroke/TIA. Incidence of the remaining six diseases was measured through questions regarding cardinal symptoms. The medical questionnaire was developed by the research team, pre-tested and finalized on the basis of the opinions of experts.

(3) *X-ray:* A chest X-ray was performed on any suspected case of lung cancer, COPD or tuberculosis.

(4) *Carbon Monoxide Monitor (CO-monitor):* In order to corroborate the use of tobacco, a CO monitor was used to measure the ambient air quality and individual CO level. A conversion table was used to determine the CO level in blood (haemoglobin).

Table 2: *Socioeconomic background of respondent aged 30 years and above, Bangladesh 2004*

	Urban	Rural	Total
Number			
Men	711	1565	2276
Women	644	1474	2118
Both	1355	3039	4394
Individual variable			
Age of men, mean (SD)	45 (12)	47 (14)	46 (13)
Age of women, mean (SD)	44 (12)	46 (13)	45 (13)
Male	53	52	52
Married	87	89	87
Years of schooling, median (IQR)	9 (03-12)	0 (0-05)	4 (0-09)
Alcohol consumption	3	3	3
Vegetable intake, servings[a]/week, median (IQR)	42 (22-56)	30 (21-43)	35 (21-50)
Fruit intake, servings[a]/week, median (IQR)	1 (0-2)	1 (0-2)	1 (0-2)
Medication for high blood pressure	13	7	9
Medication for diabetes	5	2	3
Household variable			
Brick-made floor	65	16	32
Electricity	93	46	60
Radio	55	33	40
Television	76	28	43
Telephone/cell phone	49	6	19
Refrigerator	50	4	18
Solid cooking fuel	35	98	79
Flush toilet	39	2	14
Income in taka, median (IQR)	10 000 (5 000-20 000)	4 000 (2 000-7 000)	5 000 (2 500-10 000)

Source: Sample Survey: Impact of Tobacco-related Illness in Bangladesh, 2004

SD: standard deviation; IQR: inter-quartile range.

[a] Three tablespoons of vegetables, one apple or one medium-sized banana constitutes one serving.

Results are percentages unless otherwise indicated.

(5) *Diagnosis of diseases:* The 6-month morbidity questionnaire allowed the screening of those who were known sufferers from tobacco-related illnesses. Only those who had valid documents (e.g., a prescription from a qualified medical practitioner, or hospital records on any of the eight diseases, as checked by the survey physician) were taken as diagnosed cases. Probable sufferers of a tobacco-related disease detected from the medical questionnaire but without a validation document underwent a medical examination by the survey physician and were referred for X-ray if needed, free of charge. The survey physician finally determined the cases of tobacco-related illnesses based on patient history and medical records, a physical examination and X-ray findings.

Survey team and its activities

For each of the six divisions, a survey team was formed. Each team consisted of two to three pairs (one male and one female) of enumerators, a supervisor and a survey physician. The team received comprehensive training before going to the field, including a one-day practice session in a nearby cluster. In the urban clusters, the survey started at the Ward Commissioner's Office, and in the rural clusters the team started from the office of the Chairman of the Union Council until the desired number of households had been recruited.

Enumerators recorded all information noted in the household questionnaire and diagnosed probable cases of tobacco-related illnesses. They referred suspected cases to the survey physician. The team motivated households to send persons identified as needing an X-ray to a selected facility. The supervisor coordinated the activities of enumerators and administered the CO-monitor to measure the CO reading from each individual of that household and from the main room of that household (as perceived by its occupants).

Enumerators tried to collect any information missing on the households surveyed during their stay in the cluster. Each pair of enumerators exchanged their surveyed questionnaires with the other pair(s) for cross-examination; the supervisor then checked all the questionnaires.

Quality control

Training: The same trainers who developed the questionnaire imparted the training. Every question was discussed. Field condition were simulated in the classroom and mock interviews carried out. After every mock interview, any queries on the questionnaire were clarified for the enumerators by the trainers. One day of field practice took place in Dhaka before the survey began.

Validation of the responses: During the survey, questionnaire responses were cross-checked by the pair of enumerators and were then rechecked by the supervisor. Each supervisor rechecked 10 questions from each pair of enumerators at the household level for consistency. One full day was allocated in each cluster to recheck the whole questionnaire and collect missing information.

Data management

At the central level: Each team double-checked the questionnaires in the presence of the supervisor at the head office before passing them over for coding. Coders worked on the questionnaire under the guidance of the data management supervisor and coordinator of the household survey.

At the entry level: A supervisor was present during the data entry by a trained pool of personnel. Consistency was verified by the data entry supervisor and by the investigators.

3.3 Hospital survey

In Bangladesh, most of the eight tobacco-related illnesses are treated in specialized institutes or medical college hospitals that deliver specialized care. District and sub-district hospitals deliver preliminary care and refer cases of the eight illnesses to specialized facilities. While tuberculosis cases can be treated in medical colleges, they are mostly treated in tuberculosis clinics and hospitals located throughout the country. Buerger's disease is treated primarily in medical college hospitals. For the other six illnesses, either specialized institutes in Dhaka or any of the medical college hospitals in the country are able to deliver care. The care in specialized institutes is generally superior to the care received in medical colleges.

Survey of medical college hospitals

Four medical college hospitals were surveyed to obtain epidemiological and cost data on the eight illnesses. The survey included patient surveys regarding health habits and costs, and examined hospital records of costs and illnesses. We surveyed one public and one private medical college hospital in Dhaka (the capital city, where one in fourteen Bangladeshis live); one public medical college hospital in Chittagong (south-eastern divisional headquarters); and one in Rajshahi (north-western divisional headquarters) to obtain information on tobacco usage, the eight diseases and on system costs (see Figure 1 for the location of hospitals). The hospital survey sample is described in Table 3.

Table 3: *Number of patients in four medical college hospitals in a one-day cross-section, Bangladesh, 2004*[a]

Medical college hospitals	Age groups						
	<=29	30-39	40-49	50-59	60-69	>=70	Total
	Emergency and outpatients[b]						
BMCH	402	156	88	57	39	24	766
CMCH	348	156	126	83	39	20	772
DMCH	381	178	149	86	58	30	882
RMCH	320	122	97	63	39	21	662
Total	**1451**	**612**	**460**	**289**	**175**	**95**	**3082**
	Inpatients						
BMCH	71	34	41	43	27	35	251
CMCH	333	204	180	158	66	54	995
DMCH	245	136	129	121	95	69	795
RMCH	161	71	92	66	75	53	518
Total	**810**	**445**	**442**	**388**	**263**	**211**	**2559**

BMCH: Bangladesh Medical College Hospital; CMCH: Chittagong Medical College Hospital; DMCH: Dhaka Medical College Hospital; RMCH: Rajshahi Medical Hospital.

[a] The paediatric, psychiatric and gynaecology-obstetric patients are excluded from the sample of hospital patients. In these departments, there were 1110 outpatients and 964 inpatients.

[b] The number of patients attending emergency departments was 406.

The hospital survey had two components:

(1) Patient census

A census of outpatients and inpatients was used to collect information on patient composition in order to determine the proportion of cases that could be classified as tobacco-related illnesses. All departments except paediatrics, psychiatry and gynaecology-obstetrics were enumerated. Then, detailed information on outpatients and inpatients admitted due to tobacco-related diseases was collected regarding their socioeconomic status, smoking habits, and relevant risk factors such as alcohol intake, physical activity, fruits and vegetable intake, blood pressure, diabetes mellitus and waist circumference. The collection of this data followed the WHO STEP-wise approach to surveillance of noncommunicable diseases (Step 1 of core variables in WHO STEPS, 2003). Further information was gathered on the patients' exposure to tobacco advertisements, knowledge of the harmful effects of tobacco, as well as out-of-pocket costs. Costs for consultation, investigation, medicines, transportation, meals and other sundries, for both the patient and any accompanying person(s), were included.

(2) Hospital costs

A hospital cost survey was undertaken to determine the total fixed and variable costs incurred by the hospital. The details of this survey are described in section 3.5 below. The survey at the private hospital in Dhaka was used to compare expenditures with those of a public health care facility, and to establish the unit cost of care in the private sector.

Training of enumerators

A total of 16 enumerators were recruited on the basis of their familiarity with the hospital. Two doctors for the outpatient department (OPD) and two for the inpatient department (IPD) from each medical college hospital were trained for three days by the investigators from WHO. The training took place in a single session in order to assure a common understanding of the questionnaires. A field training component in one of the medical colleges was included. Three enumerators from each medical college hospital were trained in how to collect data on the hospital system costs. A medical doctor supervised the team in each hospital. The other two team members had health economics or accounting background. Two of the researchers periodically visited the hospitals during the survey to monitor the enumeration.

Expert survey

Interviews of experts in relevant fields were designed to determine the impact of illness on the quality of daily lives and the average duration of survival. This allowed an estimation of the case fatality rate. A protocol was developed anew to obtain information on quality of life in the aftermath of illness. The quality of life indicator was determined by using the EuroQoL scale (Drummond *et al*., 1997).

The survey was carried out in Dhaka, Chittagong and Rajshahi medical college hospitals. One hundred and twenty experts (5 from each specialty, 40 from each medical college) were interviewed. The quality of life that a patient could expect, according to the stage of illness when diagnosed and assuming full treatment, was determined. The scale takes into account five attributes of physical and mental health, namely: mobility, self-care, usual activity, pain or discomfort, and anxiety or depression. Each attribute had three levels – no problem, some problem and major problem – and each level had a unique coefficient. The final score using these coefficients fell between 1 and 0, where 1 stands for perfect health and 0 for death. The results are provided in Table 4.

Supplementary survey in specialized institutes

This survey was carried out to supplement the data of our main study in four specialized institutes, namely: the National Institute of Cardiovascular

Table 4: *The quality of life scores consequent to tobacco-related diseases*

Tobacco-related disease	Life expectancy (years), when diagnosed at			EuroQol score
	Early stage	Typical stage	Late stage	
Ischaemic heart disease	16.11	10.33	4.33	0.812
Chronic obstructive pulmonary disease	18.13	10.88	6.00	0.689
Lung cancer	4.00	2.12	0.78	0.151
Laryngeal cancer	17.08	8.00	3.58	0.689
Oral cancer	14.75	8.00	3.58	0.689
Pulmonary tuberculosis	23.33	12.86	6.73	0.883
Buerger's disease	20.00	11.67	4.00	0.691
Stroke	18.33	14.64	5.33	0.516

Diseases, the National Institute of Cancer Research and Hospital, the National Institute of Diseases of Chest and Hospital, and the Neuro-medicine department of Bangabandhu Sheikh Mujib Medical University. Although the four medical college hospitals surveyed in the main study can treat tobacco-related and non-tobacco-related diseases, they may not be able to provide the best possible treatment. For example, they cannot offer percutaneous transluminal coronary angioplasty (PTCA) following a heart attack, which is offered by the specialized hospitals. Keeping this in mind, the supplementary survey determined the optimum rather than the actual treatment a patient should receive for a tobacco-related illness. The cost estimates obtained from this survey are presented in Annex 3.

3.4 Secondary data

As the task was to weight the costs imposed on society due to tobacco consumption against its benefits, information on tax revenues and wage income from the production and distribution of tobacco products was needed. The tax revenue and the wage of agricultural and industrial workers in Bangladesh have been routinely documented by various statistical surveys and censuses. This study draws on secondary data from published sources (Bangladesh Bureau of Statistics, 2000, 2002, 2003). Data on the number of hospitals, inpatients and outpatients were obtained from the Yearly Health Situation Report (Institute of Epidemiology, Disease Control & Research, 2000).

3.5 Analysis of data

As in most developing countries, Bangladeshi people do not routinely visit formal health-care facilities to treat their ailments. Disease prevalence and behaviour associated with the occurrence of illnesses have to be determined by examining data beyond records from the health facility. A household level survey was therefore carried out to complement information on the prevalence of illnesses obtained from the hospital-based surveys.

The household survey, as a population-based study, did not identify experimental or control groups. However, it did identify individuals with a tobacco-related illness, who essentially represented the experimental group. Those who did not have these illnesses constituted the control group.

The household survey helped determine population-based risk ratios of tobacco-related illnesses, and identify the determinants of access to different types of health-care services, out-of-pocket expenses and loss of income during care. The risk ratios were also determined through hospital survey data on patient conditions and, where possible, were compared to the risk ratios obtained from the household data.

The hospital cost survey determined the unit cost of common procedures for treatment of the illnesses as well as the outpatient cost. To determine the amount of care that could be attributed to the target illnesses, we imputed the total hospital costs in proportion to the prevalence of tobacco-related illnesses among all types of illnesses observed in the hospital outpatient survey.

Our analysis had three broad components. First, we provide summary sample statistics for the variables of interest from the data. Second, in order to project the extent of out-of-pocket expenditure from the sample to the population we examined the determinants of out-of-pocket expenditure at all levels. Third, from the inferential estimations that relate the key variable of interest, i.e., the costs of illnesses, to determinants, we generalize the results to the population by using population level determinants. These analytical approaches are described in more detail below.

Epidemiological analysis

Prevalence rates of the eight illnesses were determined through the household survey. In order to attribute the prevalence of illnesses directly to tobacco usage, the likelihood of finding one of the eight illnesses among tobacco users was determined using risk ratios (RR). The standard formula for the RR was essentially the proportion tobacco users with one of the eight illnesses compared to the proportion among non-users in a given sample or population, as follows:

$$RR = \frac{a/(a+c)}{b/(b+d)}$$

where *a* and *b* are the number of the diseased people among tobacco users and non-users respectively. The total number of tobacco users is $a+c$, with *c* being smokers who do not have a tobacco-related illness. Similarly $b+d$ represent the number of non-smokers in the sample.

RR is the likelihood of a tobacco user afflicted with a tobacco-related illness compared to a non-user. Given that many other factors could cause these diseases, their attribution to tobacco use needs to be reported (Nakayama *et al*., 1998, Nakayama *et al*., 2000). To obtain the population prevalence of the illness attributable to tobacco usage, one needs to know the proportion of the population exposed to the specific risk of becoming a tobacco user, that is the population attributable risk (PAR) given by the formula:

$$PAR = \frac{(RR-1)P_e}{1+(RR-1)P_e},$$

where *P***e** is the proportion of the population exposed to tobacco usage. In this study the *RR* was calculated by obtaining the figures a,b,c,d from the hospital IPD survey and *Pe* is obtained from the household survey.[2]

Death rates and the impact of intervention were determined from expert opinion on life expectancy at the early stages of illness. For late stages of an illness, it was assumed that the treatment would have no impact (see the expert survey described in Section 3.3 above). The number of deaths came solely from the late stage, where we assumed uniform distribution over the remaining expected life as reported by the experts. The imputation of costs due to death is explained in section 4.7 on indirect costs.

Analysis of direct hospital costs

The cost of treating a patient for a tobacco-related illness was obtained by comparing the available costs of attending a patient in the OPD, a one-day stay in the IPD and specialized costs needed for the cases we examined, with the entire costs of the hospital. These costs were then apportioned to the OPDs and the IPDs. Details of the allocation method are provided below. All costs defined here are consistent with the WHO guideline for cost-effectiveness analysis (Baltussen *et al*., 2004). The line items and cost centres were identified and costs annualized (see also Annex 3).

[2]As expected, the survey from the hospital yielded a 5% lower PAR than that from the household survey. This could be due to lower attendance of tobacco users in hospitals by the poor, who were noted to have higher rates of tobacco use.

Econometric analysis of household survey data

Probability of tobacco-related illness

The probability that an individual will have one of the eight tobacco-related illnesses was found to depend, inter alia, on tobacco usage, prevalence of high blood pressure, age, gender, food habit, and education. We took tobacco user, to mean current smokers and chewers of tobacco and those who have discontinued tobacco use within the previous six months. We anticipated that tobacco users to have a higher probability of falling ill than non-users. Similarly, high blood pressure was expected to be associated with the target illnesses. Good dietary habits enhance healthy life and thus lower the probability of falling ill. As a proxy for food intake, we used information on an individual's weekly intake of leafy and other vegetables measured in spoon servings (WHO STEPS, 2003). Education was used as a proxy for individual earning capability, and health awareness as it lowers the probability of illness.[3]

Average out-of-pocket expenditure of outpatients

The out-of-pocket expenditure of households on health care (except hospital episodes) was determined by different characteristics, such as age distribution, household size, income, wealth, dietary habit, as well as the type of illness. It was assumed that the presence of young children in the household would add to household health expenditure. The number of household members aged below 15 years was therefore considered likely to increase health expenses. In the absence of any accurate measure of household income, we used monthly household expenditure as a proxy.

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[3] Defining a dichotomous variable, Y, that takes a value of 1 if an individual has either of the designated illnesses and 0 otherwise during the survey period, we used a probit model that estimated the effect of each determinant mentioned above by using the maximum likelihood method. Let the vector X represent the set of determinants of the probability of tobacco-related illness. Then,

Probability (Y=1) = $\Phi(\beta'X)$

Probability (Y=0) = 1 - $\Phi(\beta'X)$

The underlying assumption is that the probability of illness variable follows a cumulative standard normal distribution represented by $\Phi(\beta'X) = \int_{-\infty}^{\beta'X} \phi(t)dt$. The set of parameters ß reflect the impact of changes in X on the probability of illness. The estimated probit equation is as follows:

Probability of illness = - 2.4130*** + 0.0183*** (Age) + 0.1715*** (Dummy for men) + 0.0555 (Dummy for urban household location) + 0.0555 (Ambient air quality) - 0.0039** (Weekly intake of vegetables) - 0.0174** (Years of schooling) - 0.0603 (Dummy for the second wealth quartile) + 0.0698 (Dummy for the third wealth quartile) - 0.0491 (Dummy for the fourth wealth quartile)+ 0.4301***(Dummy for tobacco user) + 0.5645***(Dummy for high blood pressure) + error. A positive (negative) sign of a parameter indicates that, other things remaining the same, a higher value of the corresponding determinant will increase (decrease) the likelihood that an individual will have one of the eight tobacco-related diseases. ** and *** indicate significance at 5% and 1% levels respectively.

Household wealth was represented by a wealth index measured as a weighted sum of several indicators, such as source of drinking water, type of housing materials, sanitation, access to electricity and communication, possession of electrical devices and telephone. The weighting of these indicators used a factor analysis to group the sample households into wealth quartiles.

Ascertaining how much health services cost to people in relation to the above determinants is typically limited to those who seek care. In our survey, 60% of the patients diagnosed with a tobacco-related illness did not seek any medical care and, as a result, we only have data on the 40% who actually sought health care.

If we used only the observed costs to estimate the average cost, we would underestimate the true cost to the individual with the disease, the majority of whom did not incur any prohibitive expenses. They may also be unaware of the seriousness of the disease. In any case, they are internalizing this cost by compromising with worse health conditions without any medical care. This type of sample is known as censored sample, which requires Tobit analysis for estimating average health cost.[4]

By using observations with positive health expenditure, this model imputes health expenditure to cases with zero expenditure. The expected value of expenditures predicted this way provides us an estimate closer to the true cost than what we would have obtained by using ordinary least squares estimation.

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[4] Let Yi* be the latent variable determined by a set of characteristics of household i, Xi . Yi* in turn determines whether the household will incur health expenditure (Yi) or not. Formally,

Yi* = β′ Xi + εi,

Yi*~ N [μ , σ2],

Yi = 0 if Y i* ≤ 0,

Yi = Yi* if Yi* > 0.

where Yi* is assumed to be normally distributed with mean m and variance σ2. The set of parameters, b, reflect the impact of changes in X on the household health expenditure and ei is the random error component in the latent variable that is not captured by the observable characteristics of households. The following Tobit equation is estimated by the maximum likelihood method:

Yi* = - 1484.05 *** + 101.16***(Number of household members aged below 30 years) + 44.15 (Number of household members aged above 30 years) + 0.01***(Total monthly household expenditure in taka) + 202.33 (Dummy for the second wealth quartile) + 588.34***(Dummy for the third wealth quartile) + 412.12**(Dummy for the fourth wealth quartile) + 20.70 (Dummy for urban location of the household) - 1.43 **(Weekly intake of vegetables) + 361.35 ***(Dummy for tobacco-related illnesses) + error.

*** and ** stand for significant at 1% and 5% level respectively. The reference group includes rural households at the first wealth quartile, with the prevalence of non-tobacco-related illnesses.

The expected health expenditure for each household is predicted using the conditional censored mean, $E[Y_i \mid X_i] = \Phi\left(\frac{\beta' X_i}{\sigma}\right)\beta' X_i + \sigma\lambda_i$, where σ is the standard deviation of the latent variable Yi, Φ(.) is the cumulative standard normal distribution, and $\lambda_i = \frac{\phi(\beta' X_i / \sigma)}{\Phi(\beta' X_i / \sigma)}$.

The potential health cost per household is estimated by averaging these predicted censored means across all observations.

Average out of pocket cost of inpatients

The average cost of inpatients rises in relation to the duration of stay in the hospital. The duration of stay for lung cancer and for stroke were obtained from the specialized hospital survey through expert opinion. For other illnesses, this was obtained through econometric techniques using inpatient data from the four non-specialized hospital survey. As none of the inpatients had completed the hospital episode, we censored the duration variable at the upper end, which is variant across the patients. We held that the inpatients interviewed within a few days of admission would stay in the hospital longer. Half of the sample reported duration of 3 days or less. So we consider these observations with duration right-censored at 3. If we use this censored variable, the hospital cost would be underestimated. Here we apply the Tobit model again to predict the complete duration of the right-censored observations.[5] The average duration predicted in this way was 7.66 days per patient.

We expected that poor people would spend less on hospital care than those with higher income. The poverty status of the sample of inpatients was determined on the basis of an index of economic well-being. This index was constructed by a factor analysis using a self-assessment on well-being regarding food, housing, health care, education and clothing. The patients at or below the median of the index were grouped as poor and those above the poverty line were grouped as non-poor. This classification by poverty status was consistent with the approach of setting the poverty line at the median income level when income data were available.

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[5] Let Z_i^* be the latent variable determined by a set of characteristics X_i of patient i. Z_i^* determines the duration of hospital stay (Z_i) of a patient. Formally,

$$Z_i^* = \beta' X_i + e_i, \qquad Z_i^* \sim N[\mu, \sigma^2],$$
$$0 \le Z_i \le 3 \text{ if } Z_i^* \le 3,$$
$$Z_i = Z_i^* \text{ if } Z_i^* > 3.$$

where Z_i^* is assumed to be normally distributed with mean μ and variance σ^2. The set of parameters, reflect the impact of changes in X on the hospital episode and ε_i is the random error component in the latent variable that is not captured by the observable characteristics of patients. The estimates of the parameters â are obtained by the maximum likelihood estimation of the above Tobit model. The estimated equation is:

$Z_i^* = 3.12^{***} + 0.11$ (Dummy for men) + 0.00 (Age) - 0.04^{**} (Years of self education) + 0.00 (Years of spouse's education) + 0.13 (Dummy for the poor) + 0.13 (Dummy for Chittagong Medical College Hospital (CMCH) - 0.13 (Dummy for Dhaka Medical College Hospital (DMCH) - 0.91^{***} (Dummy for Rajshahi Medical College Hospital (RMCH) + 0.00 (Duration of illness) + 0.01 (Frequency of hospital visit for the illness) + 0.00 (Additional expenditure willing to pay for treatment)+ error

*** and ** stand for significant at 1% and 5% level respectively. The reference group includes the non-poor patients Bangladesh Medical College Hospital.

Then the expected duration of stay for each patient is predicted using the conditional censored mean, , $E[Y_i \mid X_i] = \Phi\left(\frac{\beta' X_i}{\sigma}\right)(\beta' X_i + \sigma\lambda_i)$ where σ is the standard deviation of the latent variable Z_i^*, $\Phi(.)$ is the cumulative standard normal distribution, and $\lambda_i = \frac{\phi(\beta' X_i/\sigma)}{\Phi(\beta' X_i/\sigma)}$. The duration values less than or equal to 3 are replaced with these predicted values.

Using duration of hospital stay and poverty status along with age, gender, own education, education of spouse, weekly intake of vegetables, cases of tobacco-related illness, indicator for paying bed, and dummies for the four hospitals surveyed, as explanatory variables, we estimated a weighted ordinary least squares regression function of hospital cost.[6]

Assessment of net cost of tobacco usage

There are two steps necessary to calculate the net cost of tobacco usage for the Bangladeshi economy. First we need to calculate the net benefit. The second step consists in the calculation of the direct and the indirect costs. Secondary data from various statistical surveys in Bangladesh have been used to supplement the primary data initially collected through the sample surveys.

The net benefit of domestic usage of tobacco is derived in two ways: tax revenue collected and net wages earned, i.e., wages minus individual consumption. Tax revenue is composed of value added tax (VAT) and supplementary domestic production tax. The wage for a tobacco worker is obtained by dividing the total value added in the tobacco industry, as noted in the Bangladesh Bureau of Statistics reports, by the number of workers in the industry in previous years. This average figure is then adjusted for inflation. Apparently, the tobacco workers earn slightly more than the national average wage.[7] From this figure, average consumption was subtracted to obtain net wages.

Direct costs

The direct costs incurred by the patients, both for hospital and non-hospital care, were derived using the econometric method described above. The

[6] Hospital cost = -21375.72***+ 1686.69 (Dummy for men) + 168.70 (Age) + 1029.95*** (Years of self education) -1.19 (Years of spouse's education) -982.52 (Dummy for the poor) + 134.41 (Weekly intake of vegetables) + 8534.43*** (Dummy for tobacco-related illnesses) + 1078.55 (Predicted duration of hospital stay) + 467.76 (Dummy for CMCH) + 22123.67***(Dummy for DMCH) + 12567.02***(Dummy for RMCH) +17113.87*** (Dummy for Paying Bed) + error

*** and ** stand for significant at 1% and 5% level respectively. The reference group includes rural female population at the first wealth quartile, who are not tobacco users and who do not have high blood pressure. The weights are calculated separately for the cases of tobacco-related illnesses and other type of illnesses. It is given by the ratio of the population proportion to the sample proportion. While the population proportion of tobacco-related illnesses is 0.244 and of other type of illnesses is 0.776, the sample proportion for both types of illnesses is nearly 0.5 by the purposive sample design. The weighting of the regression function makes it representative of the entire population with all types of illnesses. Then we obtain average predicted hospital cost per patient with tobacco-related illnesses.

[7] Overestimation was partly due to the fact that the value added, used for the calculation of the wage rate, included return to capital employed in the tobacco industry, which cannot be isolated given the secondary data. In addition, the number of tobacco workers included both industrial and farm labourers. The industrial wage, on which the wage income in the tobacco sector is based, is higher than an agricultural wage. Thus, the benefit to tobacco workers is overstated.

health system costs were added to patients' out-of-pocket expenses to obtain the total direct cost.

This study was not able to collect the costs of typical care for most of the eight illnesses directly. We could not, therefore, determine the various procedures. Instead, we obtained costs for hospital beds and special procedures.

In order to determine the costs to the health system, we multiplied the average costs of hospital care for inpatients by the number of inpatients suffering from at least one of the eight illnesses of interest. A similar exercise was carried out for outpatients. In this section, we report some intermediate results. The average outpatient cost for the four hospitals was 191 taka for all illnesses. The inpatient bed-day cost differed in the four hospitals, with the private hospital costing the highest.[8] The average cost was 726 taka.

The bed cost in specialized hospitals was similar; however, out-of-pocket expenditure was much higher. For example, the cost of treating lung cancer ranged from 60 000 to 500 000 taka depending on the stage of illness. As much of this was out-of-pocket costs it was difficult to determine the exact cost without a large sample. We did not incorporate the costs from the specialized hospitals into this calculation as these would be much higher and largely borne by the individual (see Annex 4 for estimates of the cost of care provided by specialized hospitals).

Seven per cent of hospital outpatients suffered from one of the study illnesses. We further observed that 29% of all IPD patients in Bangladesh were hospitalized owing to tobacco-related illnesses. This amounts to nearly 14% of all patients in the population afflicted with these illnesses.[9] We believe that an additional 5% of those that should go to hospital do not obtain care. Thus, 19% of the cases we are likely to observe in the population needed IPD care. However, we assumed that some may not attend hospital even if the referral system improved. A conservative estimate of 15% (463 000) of persons suffering from the eight illnesses would attend an IPD ward in the immediate future. The composition of illnesses in the IPD obtained from the hospital survey was maintained to distribute the number of patients among the eight disease categories.

If we accept that the hospitals in the survey were better equipped to deal with the eight illnesses than other hospitals in Bangladesh, the 29% of

[8] Bed-day costs in taka from medical college hospitals: BMCH (1198.43), CMCH (462.14), DMCH (1010.44) and RMCH (704.96).

[9] Some Bangladeshis go abroad for care. The expert survey yielded different estimates for the cost of treatment abroad. For example, lung cancer could cost as much as 1 million taka, depending on the country, hospital and number of accompanying persons.

cases cited above may be an overestimate of the actual proportion attending IPD. The estimated 19% of cases needing hospital care is considered appropriate, as is the estimate of 15% imminently expected to attend IPD care (three times the number currently attending when nearly 60% of cases are undetected in the population)[10]; and the supposition that 19% of the 2.9 million cases in the population should attend IPD care is an underestimate. In the absence of any unified estimate of the rate of hospital attendance of tobacco-related patients, and in view of the perceived gap between the observed and the ideal rates of attendance, we undertook a simulation analysis to show how total health system costs might change with a coverage rate at 25%, 50%, 75% and full coverage.

Indirect costs

Three figures were used to calculate the indirect costs:

(1) the number of dead and disabled;

(2) costs attributed to the deaths; and

(3) costs linked to disability.

(1) Assessing the number of dead and disabled: It was determined that deaths would occur at the late stage of the illnesses. The proportion of patients at different stages of each illness was reported by experts as follows: (Table 5)

Table 5: *The proportion of dead and disabled by stages of illness and hospital departments*

Illness	Hospital Dept.	Early stage	Typical stage	Late stage
Lung Cancer	OPD	5%	10%	85%
	IPD	10%	10%	80%
Stroke	OPD	20%	40%	40%
	IPD	70%	20%	10%
COPD	OPD	10%	50%	40%
	IPD	0%	70%	30%
Others	OPD	10%	30%	60%
	IPD	40%	30%	30%

[10] Only 5% of all cases found in the population were hospitalized in our survey, while 60% of the cases diagnosed had received no care at all. These people would be eventually diagnosed and attend hospital, nearly doubling the current number. Thus it is likely that a better referral system could increase the proportion attending care to 15%. Furthermore, there may be a significant number of patients who will never attend hospital; that is 4% will go completely undetected.

The number of patients at OPD was taken as the observed number; the number that should attend the IPD ward was determined to be 19%. The expert survey as described earlier in Table 4 reported life expectancy at a given stage of a particular illness. It was assumed that deaths in the population occurred uniformly over the remaining years of life when patients are at late stage of illness. All not dying and afflicted with one of the eight illnesses were considered disabled and the degree of disability was determined from Table 4.

(2) Costs due to death: It was noted from the hospital survey that most patients in IPD were about 53 years, with median age at 55. At this age, 17 years of expected life remains, conditional on survival at 55. During these 17 years, wages would be earned at the labour force participation rate and expenditure would be incurred due to consumption. The following formula was used to calculate the net wages lost, i.e. wages minus the stream of consumption:

$$\text{Net wage loss} = \sum_{t=0}^{17} \frac{p_t W_t - E_t}{(1+.05)^t},$$

where W stands for wages, E stands for expenditure, p stands for age-specific labour force participation rate calculated from the years following age 55, and t denotes time.[11] The discount rate was 5%. Wage and expenditure were assumed to be non-variant in time.

(3) Costs due to disability: The degree of disability was determined according to disease specific EuroQol rating (see Expert Survey in Section 3.3). It was assumed that earning would decrease at higher levels of disability. The net loss would be wage loss less consumption expenditure. This calculation was made for one year.

To summarize, the total cost of tobacco-related illnesses consists of the following factors:

(1) cost borne by households;

(2) cost borne by the health system;

(3) cost due to loss of employment stemming from disabilities and deaths;

(4) psychic cost due to reduction of loss of enjoyment of a healthy life; and

[11] The yearly wage used for anyone working in Bangladesh is 48,340 (=W) taka whilst average consumption is set at 14,028 (=E) taka. All figures including p were obtained from BBS (2000). The tobacco workers had an imputed wage higher than W, with consumption set at the same level of average consumption.

(5) expenditure on tobacco as it deprives families of other necessary consumption such as food, child education etc.

Assuming that some tobacco consumption is purely due to addiction, we omitted component (5) from tobacco costs, as acceptance of this fact may entail from the beginning that tobacco usage adds no benefit to society. We also excluded (4) as it is difficult to measure. However, the theoretical foundation of such a measure is sound. Thus, we present an understatement of the true cost that tobacco-related illnesses impose on the economy as a whole in Bangladesh.

Results

4.1 Socioeconomic background of participants

The background of the participants appeared to represent the Bangladeshi population at large, in terms of education, diet, physical activity and household possessions. The recent flourishing markets of cell phones and electronic household commodities are reflected in the findings of Table 2. Although we could not include ultra poor, there were ten beggars in the sample.

4.2 Tobacco usage

Tobacco usage is high among the Bangladeshi population. In total, 36.8% of persons aged 15 years and above, and 51.7% of persons over 30 years of age were current tobacco users – either through smoking, chewing or both.

Table 6.1 presents the prevalence of tobacco usage in the population, obtained from the household survey data. It shows that 41% of men and 1.8% of women aged 15 years and over, and 50.1% of men and 3.1% of women aged 30 years and over are current smokers. The current chewers are greater in proportion among women (24.4% for those aged 15 years and over, 39% for those aged 30 years and over) than among men (14.8% for those aged 15 years and over, 24.4% for those aged 30 years and over). Altogether, 48.6% of men and 25.4% of women aged 15 years and above, and 62.1% of men and 40.8% of women aged 30 years and above were found to either smoke or chew tobacco at the time of the survey.

The breakdown of the prevalence of tobacco usage by household location in Table 6.1 indicates that a greater proportion of men and women in rural areas are current tobacco users compared to the urban areas. Given the predominance of the rural population in Bangladesh, this divergence in the prevalence of tobacco users points out that majority of smokers and chewers are located in rural areas. A further detailed account of respondents per sex, age group, household location, and habits of tobacco use is given in Annex 5. People started smoking at around 20 years of age, but tobacco chewers started about a decade later. Table 6.2 summarizes other attributes of tobacco usage such as frequency. The validity of responses of the

Table 6.1: *Tobacco usage in population by age, sex and household location*

Sex	Tobacco usage	Smoking tobacco						Smokeless tobacco						Either					
		Household location				Total		Household location				Total		Household location				Total	
		Urban		Rural				Urban		Rural				Urban		Rural			
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Age 15 y or older																			
Men	Never	692	59.6	1244	51.5	1936	54.1	1029	87.8	2013	82.9	3042	84.5	648	55.0	1110	45.3	1758	48.4
(n=3786)	Past[1]	61	5.3	114	4.7	175	4.9	13	1.1	11	0.5	24	0.7	52	4.4	56	2.3	108	3.0
	Current[2]	407	35.1	1059	43.8	1466	41.0	130	11.1	403	16.6	533	14.8	479	40.6	1286	52.4	1765	48.6
Women	Never	1216	98.7	2459	97.3	3675	97.7	1022	82.7	1792	71.1	2814	74.9	1018	82.1	1770	69.9	2788	73.9
(n=3809)	Past	3	0.2	15	0.6	18	0.5	9	0.7	17	0.7	26	0.7	11	0.9	18	0.7	29	0.8
	Current	13	1.1	53	2.1	66	1.8	205	16.6	711	28.2	916	24.4	211	17.0	746	29.4	957	25.4
Men &	Never	1908	79.8	3703	74.9	5611	76.5	2051	85.2	3805	76.9	5856	79.6	1666	68.9	2880	57.8	4546	61.4
Women	Past	64	2.7	129	2.6	193	2.6	22	0.9	28	0.6	50	0.7	63	2.6	74	1.5	137	1.9
(n=7595)[3]	Current	420	17.6	1112	22.5	1532	20.9	335	13.9	1114	22.5	1449	19.7	690	28.5	2032	40.8	2722	36.8
	Total	2392	100.0	4944	100.0	7336	100.0	2408	100.0	4947	100.0	7355	100.0	2419	100.0	4986	100.0	7405	100.0
Age 30 y or older																			
Men	Never	342	50.0	582	38.9	924	42.3	558	80.8	1120	74.6	1678	76.6	294	42.3	447	29.5	741	33.5
(n=2276)	Past[1]	55	8.0	109	7.3	164	7.5	13	1.9	11	0.7	24	1.1	46	6.6	52	3.4	98	4.4
	Current[2]	287	42.0	807	53.9	1094	50.1	120	17.4	370	24.7	490	22.4	355	51.1	1017	67.1	1372	62.1
Women	Never	623	97.5	1394	95.4	2017	96.0	442	69.1	812	55.7	1254	59.8	436	67.9	782	53.5	1218	57.9
(n=2118)	Past	3	0.5	15	1.0	18	0.9	8	1.3	17	1.2	25	1.2	10	1.6	18	1.2	28	1.3
	Current	13	2.0	52	3.6	65	3.1	190	29.7	628	43.1	818	39.0	196	30.5	663	45.3	859	40.8
Men &	Never	965	72.9	1976	66.8	2941	68.7	1000	75.1	1932	65.3	2932	68.4	730	54.6	1229	41.3	1959	45.4
Women	Past	58	4.4	124	4.2	182	4.3	21	1.6	28	0.9	49	1.1	56	4.2	70	2.3	126	2.9
(n=4394)	Current	300	22.7	859	29.0	1159	27.1	310	23.3	998	33.7	1308	30.5	551	41.2	1680	56.4	2231	51.7
	Total	1323	100.0	2959	100.0	4282	100.0	1331	100.0	2958	100.0	4289	100.0	1337	100.0	2979	100.0	4316	100.0

1. Those who had stopped using tobacco for at least six months.
2. Those who were currently using tobacco or who had quit during the previous six months.
3. Minor differences in figures are due to missing values

Table 6.2: *Tobacco usage in population by age, sex and household location*

Variables	Smoking				Chewing			
	Male		Female		Male		Female	
	Median	IQ range	Median	IQ range	Median	IQ range	Median	IQ range
Starting age of tobacco usage (years)	20	15-25	22	15-32	32	25-43	28	20-35
Duration of tobacco usage (years)	23	15-33	20	12-40	12	5-25	15.5	6-30
Frequency of tobacco usage/ day	10	7-20	5	3-10	6	4-10	6	4-10

IQ: Iner-quartile

participants regarding smoking habits was tested using a monitor that could detect the level of carbon monoxide in their exhaled air.[12]

Table 7 provides information on the characteristics of inpatients classified by tobacco-related illnesses and non-tobacco-related illnesses as obtained

Table 7: *Tobacco usage among inpatients aged 30 or above[1], 2004*

Variables	Illnesses		
	All (n = 1749)	Tobacco-related (n = 512)	Non-tobacco related (n = 1237)
Age (years), mean	52.3	55.7	47.7
Education (years), mean	4.4	4.1	4.7
Men	71.0	77.0	68.6
Current smoker	35.4	36.7	33.7
Ever smoker	59.7	65.9	51.3
Current chewer	23.2	24.2	22.0
Ever chewer	33.8	37.6	28.8
Ever smoker or chewer	76.6	83.4	67.6
Sticks smoked per day[2], mean	15.2	17.1	12.2
Times chewed per day[2], mean	6.7	6.8	6.4

[1]Results are %, unless indicated otherwise.
[2]For current users.

[12] While 91% of never smokers showed a low carbon mono-oxide level (10 ppm), only 25% of smokers showed such low levels. A high level of carbon mono-oxide was present among 75% of smokers; the comparable rate was 9% for never-smokers. [the second sentence is the automatic parallel of sentence one.]

from the hospital patient survey. It is evident from the comparison of the last two columns that the patients with tobacco-related illnesses have higher smoking and chewing propensity than the patients with other illnesses, suggesting some degree of causal relationship between tobacco usage and the illnesses of concern.

4.3 Illnesses

The illness profile at the population level was determined mainly through the household survey. The findings were supplemented by data collected from hospitals to give more detailed disease profiles both at the inpatient and outpatient levels. We predicted that 2.9 million cases of the eight tobacco-related illnesses could be found in the population, of which 1.2 million could be attributed to tobacco usage (Table 8).

We found that the prevalence of lung cancer among men was about 150 000 of which about 106 000 could be attributed to tobacco usage. In the population, we are likely to observe about 71 000 cases of laryngeal cancer, of which about 51 000 cases could be attributed to tobacco usage. The former figure was obtained from the household survey, while the latter was obtained from the hospital survey. The latter figure is most likely to be an underestimate as this measurement is conditional on hospital admittance. Our survey technique failed to pick up laryngeal cancer among the population; thus we reported only hospital level figures. The hospital data indicated that more than 72% of laryngeal cancer could be attributed to tobacco usage (reported in the column of PAR in Table 8).

The risk ratios (RR) should be understood as the likelihood of finding an illness among tobacco users in comparison to non-tobacco users. Population attributable risk (PAR) refers to the proportion of the population prevalence attributable to a particular risk factor; in this case, tobacco usage.

This study predicted a lower prevalence rate of tobacco-related illnesses than the sample rate. While the sample suggested that we should observe 9.9% prevalence of all eight diseases among Bangladeshis of 30 years and above, the predicted value, when population level determinants were taken into account, stood at 8.8% (obtained from the probit estimation described in Section 3.5 above). Table 8 reports the relation between the eight illnesses and tobacco usage at the population level along with the prevalence of tobacco-related illnesses among Bangladeshis.

Table 9 reports the prevalence of tobacco-related diseases from the hospital survey. It was observed that 7% of outpatients and 29% of inpatients aged 30 or above (24% of all inpatients) received hospital care due to these diseases.

Table 8: *Population level prevalence of tobacco-related illnesses: Sample summary and predictions*

Diseases	Observed values								Predicted values		
	Men No	Per/ 1000	Women No	Per/ 1000	Total No	Per 1000	RR	PAR	Per 1000	Total No. of cases	No. of cases attributable to tobacco usage
Ischemic heart disease	53	26	52	25	105	25	–	0.19[1]	22.59	735 856	139 813
Stroke/ TIA [2]	36	17	45	22	81	20	–	0.19	17.43	567 661	107 856
Buerger's disease	4	2	0	0	4	1	–	1.00	–	28 033	–
Oral cancer	2	1	5	2	7	2	–	0.8	1.51	49 057	39 246
Lung cancer	20	10	7	4	27	7	5.48	0.71 (M) 0.15 (F)	8.6 3.02	149 958 45 622	106 470 6 865
Laryngeal cancer	0	0	1	0	1	0	13.8	0.72	0.22	71 413	51 417
COPD [4]	92	45	46	22	138	33	6.16	0.62	29.69	967 126	595 053
Pulmonary tuberculosis	33	16	13	6	46	11	3.86	0.47	9.86	322 375	151 499
Total	241	117	168	81	409	99	–	0.41[3]	88[4]	2 937 101	1 226 251

[1] These PAR were obtained by clumping all remaining illnesses for which we didn't find significant RR; the overall RR is significant.
[2] TIA indicates transient ischaemic attack, COPD, chronic obstructive pulmonary disease
[3] This value is not a PAR, just a proportion obtained from summing all individual illnesses.
[4] Obtained through Probit analysis.

Table 9: *Prevalence of eight tobacco-related diseases among patients aged 30 and above of four medical college hospitals*

Diseases	OPD[1] and emergency		IPD[2]	
	number	%	number	%
Men	(n=1118)		(n=1242)	
Ischaemic heart disease	12	1.1	108	8.7
COPD[3]	8	0.7	69	5.6
Cancer lung	17	1.5	30	2.4
Cancer larynx	14	1.3	22	1.8
Oral cancer	13	1.2	5	0.4
Pulmonary tuberculosis	9	0.8	36	2.9
Buerger's disease	8	0.7	9	0.7
Stroke	19	1.7	115	9.3
All	100	8.9	394	31.7
Women	(n=916)		(n=507)	
Ischaemic heart disease	6	0.7	27	5.5
COPD[3]	6	0.7	35	7.2
Cancer lung	1	0.1	5	1.0
Cancer larynx	1	0.1	0	0.0
Oral cancer	5	0.5	1	0.2
Pulmonary tuberculosis	13	1.4	10	2.1
Buerger's disease	0	0.0	0	0.0
Stroke	14	1.5	40	8.2
All	46	5.0	118	24.2
Men and Women	(n=2034)		(n=1749)	
Ischaemic heart disease	18	0.9	135	7.7
COPD[3]	14	0.7	104	5.9
Cancer lung	18	0.9	35	2.0
Cancer larynx	15	0.7	22	1.3
Oral cancer	18	0.9	6	0.3
Pulmonary tuberculosis	22	1.1	46	2.6
Buerger's disease	8	0.4	9	0.5
Stroke	33	1.6	155	8.9
All	146	7.2	512	29.3

[1] OPD indicates outpatient departments
[2] IPD: inpatient departments
[3] Chronic Obstructive Pulmonary Disease

Table 10: *Related risk (RR) and population attributable risk (PAR) of diseases for tobacco usage from the hospital survey*

Diseases	Smoking tobacco		Smokeless tobacco[1]	
	RR	PAR%	RR	PAR%
Men				
IHD[2]	1.7	33.6	2.6	32.5
Stroke	1.5	25.9	2.1	23.8
Buerger's disease	5.8	54.7	1.8	16.1
Oral cancer	4.5	71.3	4.9	48.1
Lung cancer	6.2	79.4	1.2	3.9
Laryngeal cancer	12.6	89.4	1.5	10.2
COPD[2]	5.6	77.2	1.7	15.0
Pulmonary tuberculosis	1.9	39.1	1.9	18.8
All	2.3	50.6	1.5	12.9
Women				
IHD[2]	6.4	18.2	1.7	22.6
Stroke	2.1	6.3	2.6	41.2
Oral cancer	6.3	21.8	4.7	59.3
Lung cancer	10.0	35.9	12.6	82.7
Laryngeal cancer	3.8	12.7	7.8	73.1
COPD[3]	15.6	61.6	1.8	24.6
Pulmonary tuberculosis	1.7	3.2	3.5	51.0
All	3.7	21.7	2.0	33.1
Combined				
IHD[2]	1.5	21.4	2.0	25.3
Stroke	1.2	10.7	2.2	29.1
Buerger's disease	28.1	93.4	1.4	10.4
Oral cancer	4.8	66.3	2.5	30.5
Lung cancer	5.3	69.8	1.4	11.3
Laryngeal cancer	10.0	82.7	1.4	9.9
COPD[3]	3.0	52.5	1.8	18.5
Pulmonary tuberculosis	2.2	38.7	1.4	11.1
All	2.0	36.6	1.6	16.4

[1] Proportion of patients using either form of tobacco is higher in this group
[2] Ischaemic heart disease
[3] Chronic obstructive pulmonary disease

Table 10 explores the relation between tobacco usage and illness in terms of RR and PAR using hospital inpatient data, although this information was not used for extrapolation. We noted, as expected, that the relation between tobacco usage and illness was stronger in the hospital setting than that found in the household.

4.4 Knowledge of tobacco and illnesses

Two policy instruments often adopted to combat tobacco-related illnesses are limiting advertisements and making people aware of the causal link between tobacco-related illnesses and tobacco usage.

Fifty seven percent of the household respondents were exposed to tobacco promotional advertisement through electronic media such as radio, television and movies. Interestingly, the same electronic media were the source of knowledge for 25% of the respondents that tobacco causes major illnesses (Figure 2). Figure 3 reports their awareness about the link between tobacco usage and illnesses. Although nearly 95% of the respondents said they knew that tobacco was harmful to health, they did not necessarily know about the specific outcomes. One-third of the household respondents had no idea about the link between tobacco and specific diseases.

Figure 2: Source of knowledge about harmful effects of tobacco, 2004

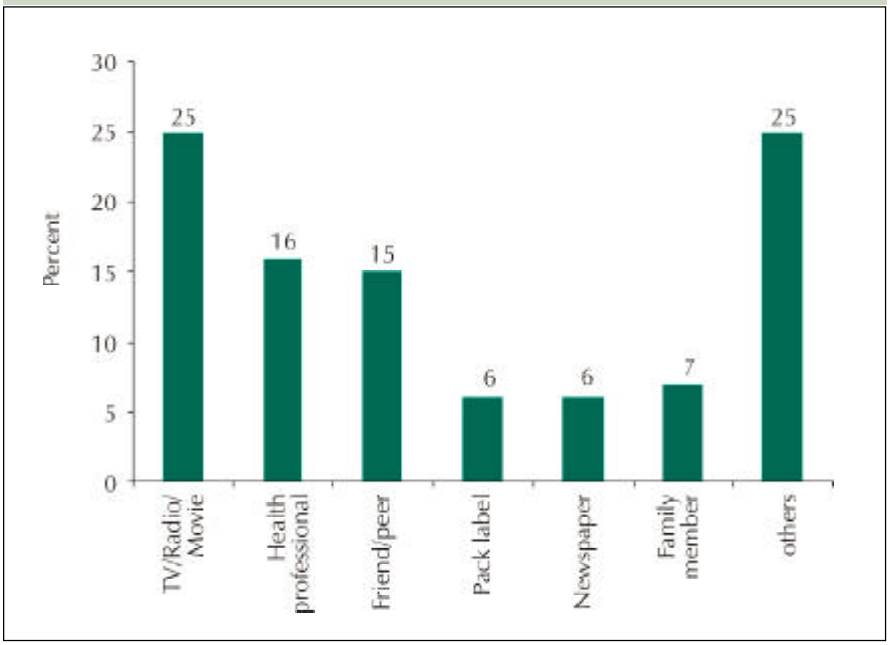
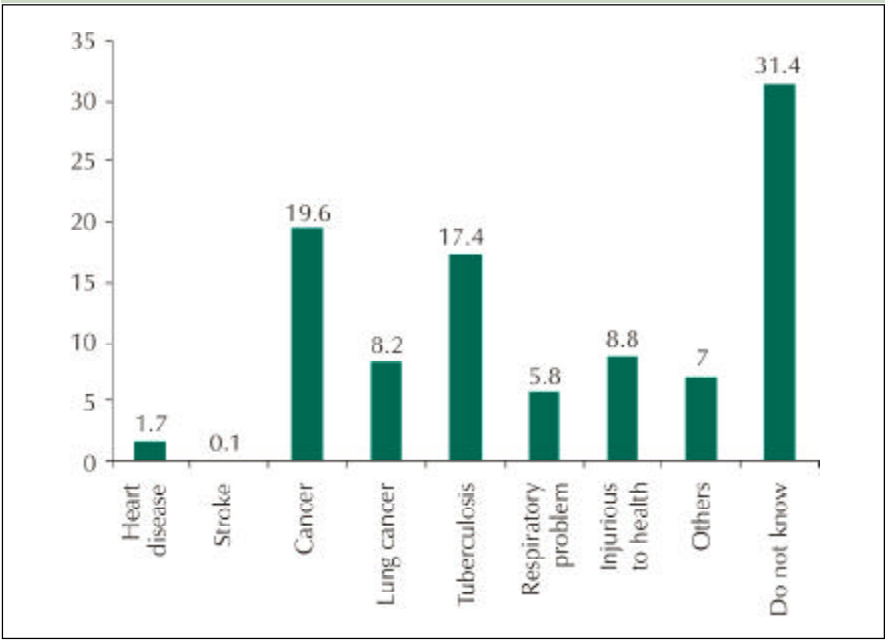


Figure 3: Knowledge about diseases caused by tobacco consumption



4.5 Tobacco usage and poverty

Evidence from our study showed that, in Bangladesh, those with tobacco-related illnesses spent more than average on tobacco (Taka 379 for those reporting illness compared with Taka 269 for all users, see Table 11.1). The average household expenditure on tobacco increases with socioeconomic status (classified by wealth quartiles). Moreover, the differential of average expenditure for those with illnesses from all users widens at upper wealth quartiles. These patterns were mostly attributable to the better quality of tobacco products consumed by people with a higher economic status.

Tobacco users across all socioeconomic groups spent about 4.5% of their total monthly household expenditure on tobacco smoking and/or chewing (Table 11.1). This percentage rises (5.1%) in tobacco users that suffered from a tobacco-related illness. The variation in the allocation of household expenditure to tobacco consumption as a percentage of monthly household expenditure was, however, not discernible by socioeconomic hierarchy.

Taking another perspective, Table 11.2 shows that, on average, households reporting tobacco-related illnesses spent 13.5% of their total

Table 11.1: *Household expenditure (Taka) on tobacco consumption by wealth qaurtile, 2004*

Wealth quartile	Households with tobacco-related illnesses			All households		
	N	Expenditure on tobacco (Taka)	% of monthly household expenditure	N	Expenditure on tobacco (Taka)	% of monthly household expenditure
First	74	116	4.2	447	113	4.5
Second	78	172	3.8	459	134	4.0
Third	95	389	5.8	414	261	4.4
Fourth	60	956	6.7	351	656	5.3
All	307	379	5.1	1671	269	4.5

Table 11.2: *Health care expenditure (Taka) for households with tobacco-related illnesses, 2004*

Wealth quartile	Average monthly household expenditure		Average household health expenditure			Average household expenditure for treatment of tobacco-related illnesses	
	N	Taka	N	Taka	% of monthly household expenditure	N	Taka
First	89	3271	68	645	16.2	29	629
Second	92	4964	76	776	13.6	39	2225
Third	116	7055	97	902	12.6	50	3128
Fourth	78	18070	67	2090	11.7	53	3816
All	375	7935	308	1072	13.5	171	2712

1. Household wealth is represented by a wealth index measured as a weighted sum of several indicators, such as sources of drinking water, type of housing materials, sanitation, access to electricity and communication, possession of electrical devices and telephone.

2. The averages are obtained using the observations with positive values of expenditure.

monthly expenditure on health care, of which 5.5% points are attributable to tobacco usage (attributing 41% of total monthly health care expenditure to tobacco usage as done in the calculation of direct cost of illness in the present study). This percentage of tobacco-induced health expenditure is remarkably close to the percentage of monthly household expenditure allocated to tobacco consumption at 5.1% shown in Table 11.1, suggesting almost one-to-one correspondence in the aggregate from one taka spent on tobacco to one taka needed to treat consequent illness. In the extreme case of complete elimination of tobacco usage, households suffering from tobacco-related illnesses would have been able to reallocate as much as 10.6% (total of 5.5% and 5.1%) of their total household expenditure for welfare enhancing purposes.

The average monthly household expenditure and health expenditure thereof are found positively correlated with the socioeconomic status of households reporting tobacco-related illnesses. This correlation is consistent with the reality that wealthier households can afford better health-care facilities and quality treatment in a highly imperfect health-care market typical of Bangladesh.

Monthly health-care expenditure as a percentage of total household expenditure was greater for the poorer households, implying that the disease burden was even heavier for them. Thus, the poorer segment of the population is progressively more exposed to the adverse consequences of tobacco usage in Bangladesh.

Isolating households who reported spending on treatment of tobacco-related diseases in particular, Table 11.2 demonstrates that the average expenditure goes up consistently for upper wealth quartiles. It should be noted that only 171 out of the 375 cases (45.6%) of illness diagnosed during the survey received formal medical treatment. Again, this percentage started from 32.6% at the bottom wealth quartile, rising to 42.4% for the second, 43.1% for the third, and 67.9% for the top wealth quartile of affected households. Be it lack of access to formal health-care facilities or unawareness on the part of those in need of treatment, tobacco took the heaviest toll on the poorest of its users.

4.6 Health seeking behaviour

The household survey indicated that before our diagnoses of the tobacco-related illnesses, households were not aware of their illnesses. Nearly 59% of the cases diagnosed by the survey physicians at the household level had not sought any care at all. Thus, Bangladesh was under-spending on the

treatment of tobacco-related illnesses. In the present analysis, we adjusted marginally for this under-spending when predicting the out-of-pocket expenditure (see Econometric Analysis in Section 3.5 above for the method of adjustment using censored regression or "Tobit" model).

4.7 Direct cost of illnesses

Direct costs comprise two types of costs:

(1) out-of-pocket expenditures that is borne by households which include costs incurred away from medical facilities as well as the cost of hospitalization, and

(2) costs borne by the health system in the public sector.

(1) Out-of-pocket expenditure

Out-of-pocket expenditure that families might incur when they face tobacco-related illnesses was determined. When a household member was afflicted by one of the eight diseases, an average 1 275 taka was incurred by the household, and this figure rises to 22 528 taka when someone in the household is hospitalized. The poor pay an average 17 371 taka when afflicted with tobacco-related illnesses. The out-of-pocket expenditure at the household level is higher for tobacco-related illnesses than for all other illnesses. This high cost may help explain why only 41% of those who had one of the eight illnesses among the sample households actually sought care. The average household expenditure for tobacco-related illnesses appeared to be positively related to the wealth status of the household due to their ability to afford better health-care facilities.

(2) Costs borne by the health system

The health system incurred 190 taka per patient to treat nearly 1.3 million tobacco-related illnesses in the outpatient department (OPD). The figures for IPD care varied according to duration of hospital stay dictated by the illness. The length of hospital stay required was determined by experts at the specialized hospitals. In this way, we estimated that the average stay for lung cancer was 30 days, and 20 days for COPD, stroke and IHD. The cost of tuberculosis treatment was developed using secondary data (personal communication, Dr Marijke Becx-Bleumink, WHO, Bangladesh). Information on the hospital unit cost and the total cost calculation are reported in Table 12.

Calculating the direct cost, we did not consider what was actually being incurred by society, but what it would have incurred had the level of patient care been higher. This was perceived as the real cost on the basis of a fully efficient health system. Thus we obtained a total cost of 15.9 billion taka

Table 12: *Direct costs of eight tobacco-related illnesses (in Taka)*

	Percentage of patients with tobacco-related illnesses receiving inpatient treatment			
	25%	50%	75%	100%
A. Hospital costs borne by the health system				
(a) OPD[1]: Unit cost	190	190	190	190
Total usage [2]	1,369,443	1,369,443	1,369,443	1,369,443
Total cost of OPD usage	261,054,353	261,054,353	261,054,353	261,054,353
(b) IPD[1]: Unit cost				
Stroke, IHD and COPD[3]	284	284	284	284
Lung cancer	425	425	425	425
Tuberculosis	353	353	353	353
All others	111	111	111	111
Total usage	929,665	1,654,533	2,405,288	3,130,473
Total cost of IPD usage	15,881,909,779	28,224,291,079	41,007,471,711	53,356,567,041
Total cost of health system (a + b)	16,142,964,132	28,485,345,432	41,268,526,064	53,617,621,394
B. Costs borne by households (out-of-pocket expenditure)				
Cost borne by non-hospitalized patients	1,879,833,106	1,879,833,106	1,879,833,106	1,879,833,106
Cost borne by hospitalized patients	20,943,503,461	37,273,314,575	54,186,333,228	70,523,287,928
Cost for treatment abroad	11,284,500,000	11,284,500,000	11,284,500,000	11,284,500,000
Total out-of-pocket expenditure	34,107,836,567	50,437,647,681	67,350,666,334	83,687,621,034
Total (A + B)	50,250,800,699	78,922,993,113	108,619,192,398	137,305,242,428
Attributable to tobacco (41%)	20,602,828,287	32,358,427,176	44,533,868,883	56,295,149,395

Notes: 1. OPD indicates out patient department; IPD, inpatient department
2. Bangladesh Health Bulletin 1999. Unified Management Information System. Directorate General Health Services
3. IHD – Ischemic Heart Disease; COPD – Chronic Obstructive Pulmonary Disease

with respect to hospital inpatient costs at 25% of patient attendance, 28.2 billion taka for 50% attendance, 41 billion taka for 75% attendance, and 53.4 billion taka for 100% attendance.

The OPD numbers for the eight illnesses were nearly 7.2% of all OPD patients according to the hospital survey. This figure was not changed. This value was multiplied to 190 taka, which yielded the OPD cost to be 0.26 billion taka. The total cost to the health system would then be 16.1, 28.5, 41.3, and 53.6 billion taka respectively for 25%, 50%, 75%, and 100%

patient attendance. The corresponding total health system costs attributed to tobacco (41%) would therefore be 6.6, 11.7, 16.9, and 22 billion taka.

The costs borne by the households were found to be much greater than the hospital system costs. The total out-of pocket expenditure, if 25% patients sought hospital inpatient care, was estimated to be 34.1 billion taka. The cost gradually increased to 50.4, 67.4, and 83.7 billion taka with greater coverage of 50%, 75% and 100%. The out-of-pocket expenditure attributable to tobacco usage (41%) would therefore be 14, 20.7, 27.6, and 34.3 billion taka respectively.

The total direct cost, hospital system and household out-of-pocket expenditure as attributable to tobacco usage, was thus estimated at 20.6, 32.3, 44.5, and 56.3 billion taka for 25%, 50%, 75%, and 100% hospital attendance of patients with tobacco-related illnesses (Table 12).

4.8 Indirect cost of illnesses

The number of deaths and disabilities due to tobacco-related illnesses, as reported in Table 13, were obtained using information from the expert (physician) survey regarding approximate longevity of life when one is afflicted with any of the eight illnesses of our concern. We further needed to assume the distribution of stages of illnesses in the population. The assumptions were kept at a conservative level to report that 102,117 deaths (16% of all deaths of people aged 30 years and over) were caused by tobacco-related illnesses, of which 57,583 cases (8.7% of all illnesses of those aged 30 years and above) can be directly attributed to tobacco usage. These people on average were losing 17 years of life, some of which were working years (Lopez *et al*., 2002). These 17 years are 'conditional life expectancy', indicating that persons who survive up to 55 years are expected to live 17 more years. The discounted (at the rate of 5%) stream of net wages lost was due to these working years lost. We assumed that as workers aged and became more experienced, they were not easily replaceable.

The mortality numbers were calculated by making a few assumptions regarding the severity of cases among people seeking care. Similar assumptions were extended to people who should have been receiving care. We collected expert opinions to determine the impact of these illnesses on daily lives with and without treatment. Using the EuroQol method with the expert view, it was estimated that on average those living with any of the eight illnesses would be impaired by 32 % (see Expert Survey in Section 3.3). Thus, all activities of these individuals were reduced by approximately 32%. This loss was accounted for in the current year only; and could not be compensated by surplus labour

Table 13: *Disability and deaths due to tobacco-related illnesses in Bangladesh, 2004*

Diseases	Deaths	Attributable to tobacco	Disability (in a given year)	Disability attributable to tobacco
Ischemic heart disease	6,235	1,185	137,169	26,062
Stroke	21,267	4,041	264,455	50,246
Oral cancer	164	131	15,206	2,889
Cancer lung	45,437	32,715	122,507	85,198
Cancer larynx	23,950	17,244	11,211	8,072
COPD[1]	3,743	2,303	299,612	184,345
Pulmonary tuberculosis	4,046	1,902	37,244	17,503
Buerger's disease	93	93	8,633	8,633
Total deaths and disabilities due to eight illnesses	102,117	57,583	896,037	382,949
Percentage of all deaths (≥ 30 years)	16	8.7	–	–
Total deaths in Bangladesh (≥ 30 years), (Lopez et al., 2002).	–	658,751	–	–

[1]COPD stands for Chronic Obstructive Pulmonary Disease.

within a year. Wage losses when netted by consumption yield total indirect loss in financial terms. The total loss of income due to tobacco-related illnesses was thus estimated to be 46 billion taka.

4.9 Impact of second-hand smoking

Involuntary exposure to second-hand smoking may cause cancer, cardiovascular and respiratory diseases, abortion or perinatal mortality. Accounting for the direct and indirect costs of these illnesses is important in its own right. For the present study, we needed to estimate the total cost to society of second-hand smoke-induced illnesses, in addition to the health costs due to active smoking. Excluding the cost of second-hand smoking borne by the non-smoking population would result in an underestimation of the social cost of tobacco usage, even if the causal link between exposure

to second-hand smoke and tobacco-related illnesses was weaker than the link between active smoking and those illnesses.

In evaluating the effects on health of second-hand smoking, as reviewed in Behan et al. (2005), researchers have used a number of different approaches for quantifying exposure to indirect smoke, such as:

- the number of smokers in a non-smoker's household;
- the number of cigarettes smoked by members of a non-smoker's household;
- the number of hours per day during which a non-smoker can smell tobacco smoke in his or her environment;
- the concentration of cotinine in the blood serum – a metabolite of nicotine associated quantitatively with the amount of tobacco smoke absorbed by the body.

In our study, about 43.5% of all individuals lived in non-smoking households. Among the remaining 56.5% of people who live in smoking households (households where at least one member is a smoker), 77.4% were non-smokers. Thus, approximately 44% of the total population was found to be exposed to second-hand smoke at home. Of the smoking households, 85.5% had one smoker, 11.8% had two smokers, 1.9% had three smokers, and less than 1% had four smokers. About 15.7% of smokers smoked 1 to 5 cigarettes daily. The largest proportion of smokers (44.2%) smoked 5 to 10 cigarettes a day. Another 23.5% smoked 10 to 20 cigarettes per day and the remaining 16.6% of smokers consumed an average of 20 cigarettes or more.

Exposure to second-hand smoke is not limited to the home environment. While indoor smoking mostly affects children, women, the elderly and disabled people who spend most of their time at home, the working population are more likely to be exposed to smoke in their workplace environment. Unfortunately, we were not able to include information on non-smoking individuals in the survey. As such, we would be underestimating the impact of second-hand smoking to the extent that workplace environment is not regulated to be smoke-free.

To measure the level of exposure to second-hand smoke at home, the survey physicians collected data on concentrations of carbon mono-oxide (CO) in the breath for household members aged 15 years and above. They also measured the ambient air quality using carbon mono-oxide monitor. The average CO level for smokers was estimated at 14.63 parts per million (ppm), which is 4.6 times higher than the average level for non-smokers (3.19 ppm). Both individual and household CO readings were found to be

higher for smoking households than non-smoking ones (Table 14). It should be noted that not only individual smokers had high CO levels (14.63 ppm) in their breath; their non-smoking household members also demonstrated significantly higher readings (3.42 ppm) than members of non-smoking households.

Table 14: *Reading of carbon mono-oxide (CO) level by smoking behaviour of households, 2004*

	No. of households	Household reading (ppm)	No. of individuals	Individual reading (ppm)
Non-smokers' households	1135	1.07 (0.0113)	3125	2.91 (0.0666)
Smokers' households	1260	1.23 (0.0424)	4065	7.46 (0.1378)
t-statistic for difference	–	3.87	–	29.73

1. The figures in the parenthesis below each reading represent the standard error of the average reading.
2. The t-statistics for testing the difference of average CO level between smokers' and non-smokers' households are significant at 5% level.

In order to evaluate the health effects of passive smoking, we identified the relative risk (RR) of the rate of prevalence of tobacco-related diseases among the exposed group to the rate in an unexposed group. In Table 15, the RRs for IHD, Stroke and COPD calculated from the population survey for passive smokers in relation to unexposed non-smokers are presented separately. Overall, it appears that exposure to second-hand smoke increased the probability of having one of these three tobacco-related diseases by 21%. As such, 8% of all cases of these diseases in the population are attributable to second-hand smoke. Thus the total number of cases of IHD, stroke, and COPD due to second-hand smoke stands at 237,577. The cases for five other tobacco-related diseases could not be obtained from population data because of an insufficient number of observations to make a reliable estimate.

Using the same set of assumptions about life expectancy and distribution of severity of different illnesses as used for the mortality estimation relative to active smoking, we found that the total number of deaths attributable to passive smoking was 5 788 a year. This estimate accounts for approximately 1% of total deaths from these three diseases in the country every year. For those who stay alive with these three diseases, 70,497 people become disabled, accounting for 10% of all disabilities caused by these diseases. For all these calculations, the percentage of those seeking inpatient hospital care for a tobacco-related illness was assumed to be 25%.

Table 15: *Relative risk ratios of tobacco-related diseases for passive smokers, 2004*

Disease	Relative risk ratio (RR)	Population attributable risk (PAR)	Estimated total number of cases in population	Number of cases attributable to second-hand smoke
IHD	1.12	0.05	735, 856	36, 793
Stroke/TIA	1.07	0.03	567, 661	17, 030
COPD	1.52	0.19	967, 126	1, 83, 754
All	1.21	0.08	2, 270, 643	2, 37, 577

1. The relative risk ratio of eight tobacco-related illnesses for passive smokers was obtained by dividing the probability of respective illness for a non-smoker living in a smoking household by the probability of the same illness for a non-smoker living in a non-smoking household.
2. PAR is calculated by using the formula PAR = $(RR-1)P_e/[1 + (RR-1)P_e]$, where P_e is the proportion of population exposed to second-hand smoke. In this case, $P_e = 0.44$.

Accounting for the direct costs of the hospital system and households to treat IHD, stroke, and COPD, and the indirect costs imposed by these diseases through disability and premature death, it transpired that second-hand smoke costs society a further 5.8 billion taka every year (Table 16).

Table 16: *Economic costs of second-hand smoking, Bangladesh, 2004*

Costs	Amount (taka)
Direct costs of medical care	2,809,368,191
Health system cost	1,146,147,793
Out-of-pocket-cost	1,663,220,398
Indirect costs	2,991,043,036
Loss of net-wages due to deaths	1,157,887,377
Current year loss of net wages due to disability	1,833,155,659
Total cost to society due to second-hand smoking	5,800,411,227

4.10 Cost-benefit analysis of tobacco consumption

The cost-benefit calculations for the economy due to tobacco usage are summarized in Table 17. The benefit of tobacco consumption is mainly from wages earned through tobacco production for domestic consumption and the portion of value added from domestic consumption that is taxed. The value of all production consumed domestically is included as a benefit to the economy. We did not include the value of tobacco exports, as that value does not depend on domestic tobacco consumption.

The revenue calculation is composed of value added tax (VAT) and supplementary duties which amounted to 20.3 billion taka in 2001. The net wage earnings from the tobacco sector, i.e. the wage net of average consumption, was estimated at 4.5 billion taka a year. Thus, the benefit amounted to approximately 24.8 billion taka.

The profits of this industry were not included, as no figures were available for this item. It is uncertain how much of the profit is exported, as 60% of the market share of manufactured cigarettes in Bangladesh is owned by British American Tobacco, a multinational company. Besides, one may view profit as a transfer of income from other sources of income, whereas taxes

Table 17: *Costs and benefits of tobacco usage (Taka), Bangladesh, 2004*

Description	Percentage of patients with tobacco-related illnesses receiving inpatient care			
	25%	50%	75%	100%
A. Direct costs of medical care	**50,250,800,699**	**78,922,993,113**	**108,619,192,398**	**137,305,242,428**
Health system cost	16,142,964,132	28,485,345,432	41,268,526,064	53,617,621,394
Out-of-pocket cost	34,107,836,567	50,437,647,681	67,350,666,334	83,687,621,034
B. Indirect costs	**59,791,327,903**	**70,170,611,251**	**80,920,583,289**	**91,311,098,522**
Loss of net-wages due to deaths	30,222,582,467	41,140,789,429	52,448,932,354	63,379,566,444
Current year loss of net-wages due to disability	29,568,745,436	29,029,821,822	28,471,650,935	27,931,532,079
C. Total costs imposed on society due to the prevalence of tobacco-related illnesses	**110,042,128,602**	**149,093,604,363**	**189,539,775,687**	**228,616,340,950**
D. Total cost imposed on society directly due to tobacco usage	**45,117,272,727**	**61,128,377,789**	**77,711,308,032**	**93,732,699,790**
E. Cost of illness attributable to second hand smoking	**5,800,411,227**	**5,800,411,227**	**5,800,411,227**	**5,800,411,22**
F. Total cost of illness attributable to direct and second hand smoking (D+E)	**50,917,683,954**	**66,928,789,016**	**83,511,719,259**	**99,533,111,017**
G. Total benefit	**24,832,089,768**	**24,832,089,768**	**24,832,089,768**	**24,832,089,768**
Total revenue collected	20,348,800,000	20,348,800,000	20,348,800,000	20,348,800,000
Net-wage labor earned	4,483,700,000	4,483,700,000	4,483,700,000	4,483,700,000
H. Net costs on society due to tobacco usage	**26,085,594,186**	**42,096,699,248**	**58,679,629,491**	**74,701,021,249**
US$ equivalent in 2004	442,128,715	713,503,377	994,569,991	1,266,119,004

1. Total cost imposed on society directly due to tobacco usage is 41% of the total cost of tobacco-related illnesses.
2. The figures for total revenue collected and net wage earned are available for 2001. These figures are adjusted for inflation to obtain the figures for 2003.
3. The size of the labour force involved in the tobacco sector, including agricultural production, is 121,338. The total net-wage earned is calculated for this labour force (BBS 2002).
4. The net loss in taka is converted to US dollar equivalent using the exchange rate of $1 = 59 taka.

have a multiplier effect. One further note is that we were not able to account for tobacco imports which account for 8% of the market share of manufactured tobacco and may contribute to a negative balance of trade.

As shown in Table 17, the total annual costs incurred due to tobacco-related illnesses amount to 110 billion taka, when both direct and indirect costs are taken into account and based on 25% of potential patients receiving inpatient hospital care. Of this total, 45 billion taka can be attributed directly to tobacco usage. Similar cost calculations show that second-hand smoke costs 5.8 billion every year. Therefore the costs attributable to tobacco per year are 51 billion taka. The net difference between costs due to tobacco-related illnesses directly attributable to tobacco and benefits from tobacco usage is nearly 26.1 billion taka per year that taxes more than 1% of the current GDP of Bangladesh.

Chapter 5

Discussion and conclusion

5.1 Discussion

Researchers had so far lacked the data to produce reliable estimates of the prevalence of tobacco usage and the disease burden attributable to tobacco consumption in Bangladesh. The present study has pioneered a fairly complete investigation of the costs and benefits of tobacco in a low-income country like Bangladesh. This study observed that the cost of tobacco largely outweighs its benefit. Tobacco-related diseases are prevalent and consequent mortalities are high. These phenomena divert significant resources that could have been used to meet pressing needs.

Although tobacco usage has been decreasing in developed countries, the tobacco epidemic is still expanding in developing countries. Available data from countries show that tobacco consumption varies by socioeconomic group (Jha and Chaloupka, 2000). It is typically the poor who smoke the most and who bear most of the economic and disease burden of tobacco use. This study observed that in Bangladesh, the percentage of tobacco users, both smokers and chewers, was higher among the lower economic class of people. This is true for both men and women, the percentage being higher for men than for women across all wealth quartiles, as shown in Figure 4. The prevalence of tobacco usage drops substantially with higher levels of education in Bangladesh, more strikingly for women than for men as shown in Figure 5. This is similar to that observed in Chennai in India (Jha and Chaloupka, 2000). The highest rate of tobacco users (64%) was found among the illiterate population. This prevalence decreases to about one fifth (21%) among those with more than 12 years of schooling. This happens in developed countries too (Jha and Chaloupka, 2000).

Although a very clear gradient of prevalence of tobacco-related illnesses is not seen across wealth quartiles (Figure 6), the prevalence is higher in lowest quartile than other quartiles except the third. This is consistent with the finding on health expenditure as a percentage of total household expenditure shown in Table 11.1 and 11.2. Absence of relevant population-based data on these diseases did not allow this study a within-country comparison of prevalence. The predicted prevalence of pulmonary tuberculosis was a little higher than that found in other studies (7 per 1000

Figure 4: Prevalence of tobacco usage by wealth status

Figure 5: Prevalence of tobacco usage by level of education

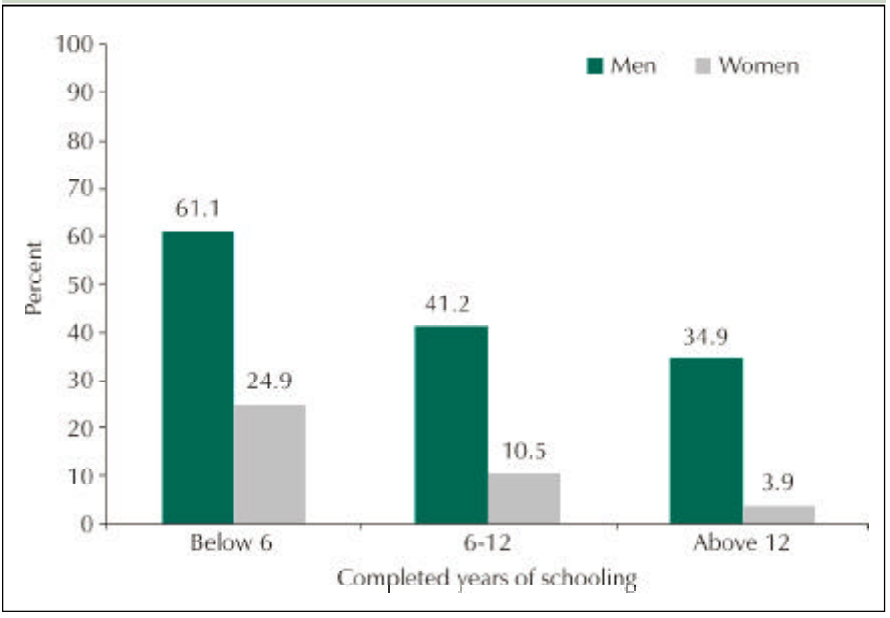
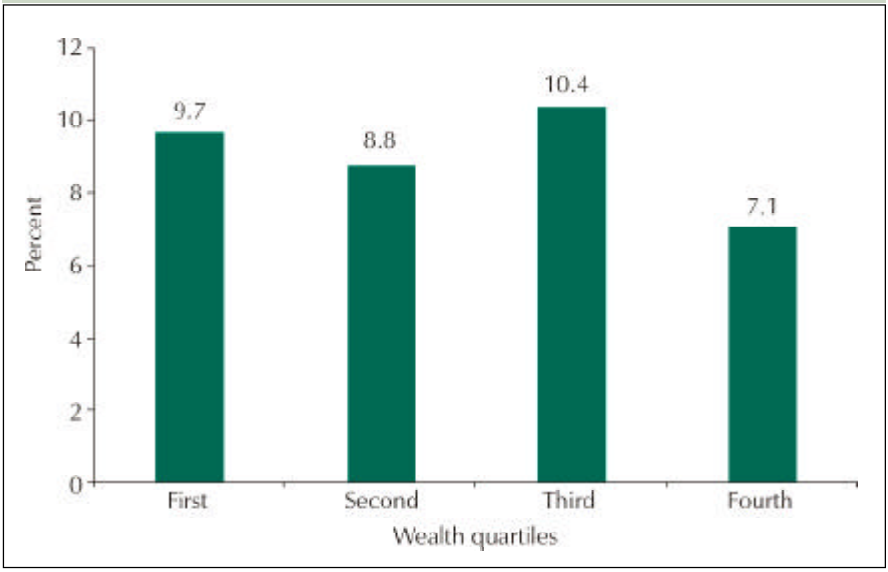


Figure 6: Prevalence of tobacco-related diseases according to wealth quartiles



for age 15 or above) because of the difference in age group composition, given that the highest prevalence is observed in 30-39 years (data not shown). The prevalence of oral cancer is also higher than the finding of another study on Bangladesh (about 0.6 per 1000 of similar age group, *de* Beyer and Brigden, 2003) but lower than that of India. This finding needs further corroboration.

The occupational classification of health expenditure revealed that the older and retired people incurred more on outpatient care among all occupational groups for both tobacco-related and non-tobacco-related illnesses. The patients suffering from a tobacco-related illness who are engaged in trade, the transport sector, and services spent the next largest amounts followed by the agricultural population. The day labourers and the unemployed spent the least as they belong to the poorest income group and have low purchasing power, including for tobacco. In Bangladesh, very low wage rates make cigarettes difficult to afford, even though the price of local brands are among the lowest (*de* Beyer and Brigden, 2003).

A big part of the health and economic costs related to tobacco are endured by small farmers and their families that grow the tobacco crop. Precarious labour conditions, including the use of child labour and exposure to very toxic products, and a highly negative impact on the environment

link the production and use of tobacco inextricably to poverty. This is more of a concern in view of the fast increasing trend in cigarette and bidi production in Bangladesh since 1980 (BBS, 2000). From 1988 to 2000, the volume of production of cigarettes increased by about 40%, while that of bidi increased by about 295%. The fact that people with a lower socioeconomic status end up paying more on tobacco consumption has important implications for tobacco control policies and legislation.

The counter argument that less tobacco consumption would result in a net loss of jobs can be refuted. In reality, the net change in the number of jobs depends on whether the money saved from decreased tobacco usage would be spent on goods and services produced in similarly labour-intensive ways as for cigarettes. In Bangladesh, cigarette manufacturing is only a small source of jobs (see footnote to Table 15), as it is highly mechanized. Those who would lose jobs in the tobacco industry are likely to be absorbed in other, more labour-intensive industries.

Moreover, agricultural labourers freed from tobacco cultivation could be employed in producing other crops on the newly-available land. Although, tobacco is a minor crop in Bangladesh, 123 000 acres of land are currently devoted to the production of tobacco. This is a sizeable amount of land which might otherwise be used to grow rice or other important crops. It is estimated that the annual rice production loss attributable to the use of land to grow tobacco is equal to half the country's yearly food grain deficit (Cohen, 1981). Substitution of tobacco cultivation with maize has been reported to be attractive. Despite government incentives to farmers, it is fair to say that cultivation of food grain in place of tobacco will not be profitable in the near future.

The role of tobacco in the international trade of Bangladesh is minimal. During the 1990s, tobacco accounted for at most 0.12% of total exports and 0.35% of total imports, (Ali et al., 2003). This indicates that Bangladesh would benefit from decreased cigarette consumption as the negative trade balance could be reduced and resources diverted to goods and services produced domestically.

The present study shows that the total cost of tobacco-related illnesses is 110 billion taka, on the basis of 25% of potential patients being admitted to hospital. Of this, 50.1 billion taka can be attributed to tobacco usage. The total cost of tobacco use, net of benefits from tax revenue and income generated in the tobacco sector, amounts to 26.1 billion taka per year, or US$ 442 million (Table 17). This is a huge cost to an economy like Bangladesh.

This study took account of most costs that can be attributed to tobacco usage. The costs reported here, although significant, are still likely to be underestimated for the following reasons:

(1) Better health-care seeking behaviour would entail a significant increase in OPD attendance, raising direct medical costs.

(2) The cost of treatment abroad at 11.3 billion taka is probably an underestimation, as reliable data are not available. The experts questioned suggest that the high costs incurred in this way are no doubt a burden on the economy, although it is difficult to ascertain the number of patients receiving treatment abroad.

(3) The cost estimates of tobacco-related illnesses are likely to be understated as this study did not include patients suffering from tobacco related illnesses aged below 30 years.

(4) The list of tobacco-related diseases is not exhaustive. There are other diseases related to tobacco usage, although their contribution is considered minimal.

(5) The cost of absenteeism due to the illnesses that most tobacco users endure throughout their lives before being incapacitated was not included.

5.2 Policy implications

Tobacco not only impoverishes those who use it, it puts an enormous financial burden on countries. At the national level, the cost of tobacco use entails increased health-care costs, lost productivity due to illness and premature death, foreign exchange loss and environmental damage. These costs far exceed the benefits from tobacco consumption. It is therefore imperative to control (if not eliminate) tobacco usage through government regulation and intensive monitoring of its implementation.

The annual development and revenue budget of the Government of Bangladesh typically allocates around 7% to health and family welfare programmes. Immediately prior to the enactment of the Tobacco Control Act 2005, the health budget was Taka 1 815 138 billion in the fiscal year 2003–2004. The annual direct cost of the health system and out-of-pocket expenditure for treating illnesses from tobacco usage is estimated at Taka 50 billion (assuming 25% of patients receive hospital inpatient care), which is equivalent to 0.003% of the national health budget.

The increase in the price of tobacco products through raised taxes is a universal measure of tobacco control. The effectiveness of this policy has been broadly evaluated by the price elasticity of tobacco products estimated from data on tobacco consumption and varying prices over time. These estimates are used to predict an individual tobacco user's response to the increase in tobacco price from raised taxes in terms of reduction (and cessation in extreme cases) of tobacco consumption.

In two separate studies on Bangladesh, the price elasticity of cigarettes has been estimated at -0.27 for the period 1991–2000 (Ali et al., 2003) and -0.31 as of 2002 (Howlader, 2003). These estimates are based on the pattern of tobacco consumption under the following regime of excise taxes for manufactured cigarettes:

Retail Price (Taka)	Tax rate (%)
4.50–4.99	35
5.00–9.99	50
>=10	55

The excise tax on handmade cigarettes and bidi is 10% of the producer price. In addition, a value added tax is imposed at the rate of 15% on all cigarettes (NBR, 2003).

The point estimate of price elasticity of cigarettes at around -0.3 indicates that a 10% increase in price would reduce demand by 3%. It appears that, given the inelastic demand for cigarettes, the rise in cigarette tax would not only increase revenue to the government, but also attenuate the cost of tobacco consumption leading to a net welfare gain. Increased cigarette prices have already shown to be effective in decreasing tobacco consumption in many countries (Jha and Chaloupka, 2000; Abedian *et al*., 1998).

The high insensitivity of cigarette consumption to price increases has apparently contributed to the failure of tobacco control initiatives to offset escalating demand for tobacco driven by rapid income growth since the 1990s, alongside the aggressive advertising practices of tobacco marketing agencies. As a consequence, we observed an upward trend in tax revenue collected from various tobacco products, accounting for approximately 10% of all tax revenue in 2001–2002 (Ali et al., 2003). To aggravate the situation, the retail prices of some brands have even decreased since then in different regions of the country (see Annex 6), which is expected to lead to a further rise in tax revenue from this sector.

The trend of falling prices of cigarettes may be attributed partly to an increase in producers' capacity and willingness to supply tobacco at every level of price. According to BBS (2003) data, the acreage of tobacco cultivation diminished from 81 000 to 76 000 from 1998 to 2003, yet production remained stable at around 37 000 metric tons throughout the period. This clearly indicates greater productivity from 452 to 484 kg per acre. Over the same timescale, the manufacture of cigarettes increased by as much as 40%, which might primarily be due to an improved supply mechanism of raw tobacco from farmers to manufacturers and greater commercialization of tobacco cultivation.

The above observations led the researchers to believe that the growing population of smokers is of more benefit to the producers at the manufacturing level, and not at the farm level. This finding suggests that policy interventions to discourage tobacco production and supply should target the manufacturing level.

Apart from fiscal measures of tobacco control, it is necessary to inform people that the ill consequences of tobacco consumption outweigh the pleasure derived from it. About 77% of the household survey sample and 67% of the hospital survey reported having noticed tobacco advertising in newspapers, radio, television, movies, billboards, shop signboards and posters. It is expected that the ban on advertising cigarettes in the media, in effect since September 2006 under the Tobacco Control Act, will lead to a noticeable reduction in demand for tobacco. The large number of people who are exposed to the above media can also be readily accessed to disseminate information on the costs that tobacco consumption entail and to discourage current and potential users of tobacco. A parallel restriction in smoking in public places would enhance the rights of non-smokers by eliminating their exposure to second-hand smoke. The requirement of graphic warnings on cigarette packets, which also came into effect with the Act, will impart health awareness and caution to smokers to a considerable extent. It is crucial, at this point in the tobacco control drive in Bangladesh, to enforce the regulations as effectively as possible.

As a staggering proportion (40%) of the female population of the country are tobacco users who are conceivably outside the purview of media coverage for the most part, alternative measures are needed. For example, the tobacco awareness programme could be integrated into the existing domiciliary services of the government and NGOs.

Finally, given the finding that the poorer segment of the population carries the greater proportion of the economic and disease burden of tobacco use, it is imperative to integrate the tobacco control measures within the existing rubric of the poverty alleviation programmes in Bangladesh.

5.3 Conclusion

This study concludes that:

- The smoking prevalence in Bangladesh as of 2004 is 41% among men aged 15 years and over (50.1% among men aged 30 years and over). In women it is 1.8% among those aged 15 years and over (3.1% among women aged 30 years and over). In addition, 14.8% of men 15 years and above (22.4% of men 30 years and

above), and 24.4% of women 15 years and above (39% of women 30 years and above) currently used smokeless tobacco in chewable form. Altogether, 62% of men and 41% of women (52% sexes combined) aged 30 years and above were found to either smoke or chew tobacco at the time of the survey.

- The prevalence of eight tobacco-related diseases (ischemic heart disease, lung cancer, stroke, oral cancer, cancer of the larynx, chronic obstructive pulmonary disease, pulmonary tuberculosis, and Buerger's disease) among the people aged 30 and above was found to be 9%, and 41% of them are attributable to tobacco.
- The hospital sample showed that tobacco-related illnesses accounted for 29% of all inpatients aged 30 years and above.
- Tobacco-related illnesses accounted for 16% of deaths in Bangladesh among people aged 30 years and above. More than half of this death toll could be attributed to tobacco usage. It was estimated that those who die from these illnesses lose 17 years of life on average, some of which are working years.
- Tobacco-related illnesses impose a cost of 110 billion taka on the economy, of which 50.9 billion taka can be attributed directly to tobacco usage (considering that only 25% of potential patients are admitted to hospital).
- On the other hand, the total benefit from the tobacco sector in terms of taxes and wages is 24.8 billion taka. Therefore, the costs that can be directly attributed to tobacco usage outweigh the benefits from tobacco by approximately 26 billion taka.
- It is the poor who smoke the most and who bear most of the economic and disease burden of tobacco usage.

The need for tobacco control on health grounds is unquestionable. From the economic point of view, this study concluded that it would also be beneficial to tobacco users to stop their tobacco consumption. As the majority of the affected population are poor and less educated, controlling tobacco usage would benefit them the most, and could open more economic and social opportunities for this population group. In turn, the economy of Bangladesh would benefit as a whole by avoiding the deadweight loss attributable to tobacco usage in the country.

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WHO acknowledges the contribution of the following experts for designing and conducting the study, and writing the report:

Research team:

Dr Arnab Acharya, The Research Triangle Institute, NC, USA

Dr M Mostafa Zaman, WHO, Dhaka, Bangladesh

Dr Iftekhar Quasem, Bangladesh Rural Advancement Committee, Dhaka, Bangladesh

Dr Syed Mahfuzul Huq, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh

Dr Nigar Nargis, Department of Economics, University of Dhaka, Bangladesh

Mr Golam Kibria Nury, WHO, Dhaka, Bangladesh

Ms Tahmina Begum, WHO, Dhaka, Bangladesh

Ms Anne-Marie Perucic, WHO HQ Geneva, Switzerland

Dr Khalilur Rahman, WHO SEARO, New Delhi, India

Technical editors:

Dr M Mostafa Zaman, WHO, Dhaka, Bangladesh

Dr Nigar Nargis, Department of Economics, University of Dhaka, Bangladesh

Ms Anne-Marie Perucic, WHO HQ Geneva, Switzerland

Dr Khalilur Rahman, WHO SEARO, New Delhi, India

With assistance from:

Dr Duangvadee Sungkhobol, WHO, Dhaka, Bangladesh

Mr Arifuzzaman Khan, WHO, Dhaka, Bangladesh

Dr Douglas Bettcher, WHO HQ, Geneva, Switzerland

Dr Khalilur Rahman, WHO SEARO, New Delhi, India

Dr Dhirendra N. Sinha, WHO SEARO, New Delhi, India

References

Abedian L, *van der* Merwe R, Wilkins N, Jha P (eds). The economics of toabcco control: Towards an optimal policy mix. Applied Fiscal Research Centre, University of Cape Town, South Africa, 1998.

Ali Z, Rahman A, Rahman T. An appetite for nicotine: an epidemiological analysis of tobacco control in Bangladesh, Economics of tobacco control paper number 16, HNP discussion paper, World Health Organization, 2004.

Baltussen R, Taghreed A, Torres T, Hutubessy R, Acharya A, Evans, D and Murray C (eds). Making Choices in Health: WHO Guide to Cost-effectiveness Analysis, Geneva, 2004.

Bangladesh Bureau of Statistics. Statistical Pocketbook, 2003.

Bangladesh Bureau of Statistics. Monthly Statistical Bulletin of Bangladesh, Dhaka, 2000.

Bangladesh Bureau of Statistics. Statistical Year Book of Bangladesh, Dhaka, 2000.

Behan, Donald F., Michael P. Eriksen, and Yijia Lin. Economic Effects of Environmental Tobacco Smoke, Society of Actuaries, March 31, 2005.

de Beyer J, Chris L, Yurekli A. Poverty and Tobacco. Tobacco Control 2001;10:210-211.

de Beyer J, Brigden LW (editors). Tobacco Control Policy: Strategics, Success, and Setbacks. The World Bank, 2003.

Cohen N. Smoking, health, and survival: Prospects in Bangladesh. Lancet 198;1:1090-3.

Cooper BS, Rice DP. The economic cost of illness revisited. Social Secunity Bulletin 1976; 39:21-36.

Drummond MF, O'Brien BJ, Stoddart GL, Torrance GW (eds). Methods for the Economic Evaluation of Health Care Programme, Oxford University Press, 1997.

Efroymson D, Ahmed S, Townsend J, Alam SM, Dey AR, Saha R, Dhar B, Sujon AI, Ahmed KU, Rahman O. Tobacco Control 2001;10:212-217.

Ezzati M, Lopez AD, Rodgers A, Hoorn SV, Murray CJL. Selected major risk factors and global and regional burden of disease. Lancet 2002;360:1347-1360.

Gajalakshmi V, Peto R, Kanak TS, Jha P. Smoking and mortality from tuberculosis and other diseases in India: retrospective study of 43000 adult male deaths and 35000 controls. Lancet 2003;362:507-715.

Howlader, Sushil Ranjan, Shamsuddin Ahmed, Syed Abdul Hamid, Azaher Ali Molla, and Abdul Haque. "Prevalence and Economic Impact of Tobacco Consumption in Bangladesh: A Household Survey in Selected Rural and Urban Areas," Research Report No.7, Institute of Health Economics, University of Dhaka, December 2003.

Institute of Epidemiology, Disease Control and Research (IEDCR). Yearly Health Situation Report 2000, Government of Bangladesh, Dhaka.

Jha P, Chaloupka FJ (eds). Curbing the Epidemics: Governments and the Economics of Tobacco Control. The World Bank, Oxford University Press, 2000.

Liu BQ, Peto R, Chen ZM, Boreham J, Wu YP, Li JY, Campbell TC, Chen JS. Emerging tobacco hazards in China: 1. Retrospective proportional mortality study of one million deaths. Br Med J 1998;317:1411-1422.

Lopez AD, Ahmad OB, Guillot M, Ferguson BD, Salmon JA, Murray CJL, Hill KH (eds). World Mortality in 2000: Life Tables for 191 Countries. Geneva, WHO 2002.

Murray CJ, Lopez AD (eds). The Global Burden of Disease. Geneva, World Health Organization, Harvard School of Public Health, World Bank, 1996.

Nakayama T, Zaman MM, Tanaka H. Reporting of attributable and relative risks, 1966-97. Lancet 1998;351:1179.

Nakayama T, Yokoyama T, Yoshiike N, Zaman MM, Date C, Tanaka H, Detels R. Population attributable fraction of stroke incidence in middle aged and elderly people: contribution of hypertension, smoking and atrial fibrilation. Neuroepidemiology 2000;19:217-26.

National Board of Revenue, Gazette notification, Government of Bangladesh, 12 June 2003.

Peto R, Lopez, AD, Boreham J, Thun M, Heath C Jr. Mortality from smoking in developed countries, indirect estimations from national and vital statistics. Lancet 1992;339:1268-78.

Rahman M, Chowdhury AS, Fukui T, Hira K, Shimbo T. association of thromboangiitis obliterans with cigarette and bidi smoking in Bangladesh: a case-control study. Int J Epidemiol 2000;29;266-270.

Shepherd DS, Hodgkin D, Anthony Y (eds). Analysis of hospital costs: A manual for managers, Geneva, WHO 1998.

World Health Organization, 2003. STEPS Instrument for NCD Risk Factors (Core version 1.4). The WHO STEPwise approach to Surveillance of non-communicable diseases (STEPS), Geneva, (*http: //ncd_surveillance.who.int*).

Annex 1

Summary of constructed variables

A synopsis of the variables worked out during the analysis and the corresponding methodology for the calculations of these variables are presented in the following matrix.

Variable Description	Data Sources	Inference	Population Level Generalization
Prevalence of Tobacco Related Illnesses	Household and Hospital Patient Surveys	Inference on odds ratio by type of illnesses; probit analysis to predict the probability of illness	Using census data and other sample surveys the prevalence of tobacco-related illnesses is generalized to the population level.
Prevalence attributable to tobacco usage – Relative Risk	Tobacco usage from all patient sample surveys and households surveys	Inference regarding risk-factors and confounding factors (biological and social) of prevalence of tobacco related illnesses in the sample	Use of population estimation of tobacco usage for different age groups and the prevalence data above
Out-of-pocket expenditure	Household and the Inpatient Hospital Surveys	Finding determinants of these costs through econometric techniques – Tobit and Weighted Least Squares Regression to correct for sampling bias	Use of census data on socio-economic factors and information on health care infrastructure to obtain population level information
Health system cost – unit cost of care for each patient	Hospital Cost Surveys	Accounting of different part of the standard protocol for treatment for tobacco-related illnesses in approximate manner through survey of time allocation	Unit cost to be multiplied to the prevalence of these illnesses attributable to tobacco.
Indirect costs – loss of income due to premature death and disability attributable to tobacco use	Expert Survey; Secondary data on wages, labour force participation rate, and consumption data at the Bangladesh level	Determining the impact of treatment and case fatality rate etc. through surveys of care givers	Unit costs to be multiplied to figures such as tobacco-related disabilities and case fatality rates estimated at the national level
Net benefit of tobacco usage	Secondary data on taxes, value added and employment in tobacco industry, rate of inflation, and average consumption of industrial production worker	Calculation of net wage rate of tobacco production worker	Multiply the average net wage rate by the number of workers to obtain population level net benefit in addition to the total tax revenue

Distribution of sample population by age, group, sex and division

Age group	Divisions												Total	
	Dhaka		Chittagong		Rajshahi		Khulna		Barisal		Sylhet			
Men	N	%	N	%	N	%	N	%	N	%	N	%	N	%
0-14	640	36	527	39	470	38	238	34	153	35	201	42	2229	37
15-19	181	10	152	11	105	8	55	8	46	10	47	10	586	10
20-29	258	15	233	17	181	14	117	17	73	17	62	13	924	15
30-39	270	15	148	11	188	15	104	15	51	12	60	13	821	14
40-49	209	12	119	9	140	11	91	13	35	8	41	9	635	11
50-59	115	6	82	6	94	8	46	7	35	8	34	7	406	7
60-69	59	3	46	3	52	4	27	4	28	6	11	2	223	4
>=70	47	3	58	4	22	2	23	3	18	4	23	5	191	3
Total	1779	100	1365	100	1252	100	701	100	439	100	479	100	6015	100
Women														
0-14	625	35	532	39	476	38	206	31	122	31	200	39	2161	36
15-19	178	10	135	10	99	8	63	10	34	9	72	14	581	10
20-29	367	21	227	17	236	19	120	18	84	21	76	15	1110	19
30-39	261	15	187	14	175	14	103	16	45	11	55	11	826	14
40-49	162	9	123	9	143	11	80	12	50	13	43	8	601	10
50-59	95	5	68	5	71	6	33	5	36	9	29	6	332	6
60-69	55	3	48	4	50	4	27	4	15	4	18	4	213	4
>=70	36	2	40	3	16	1	22	3	14	4	18	4	146	2
Total	1779	100	1360	100	1266	100	654	100	400	100	511	100	5970	100
Grand total	3558	30	2725	23	2518	21	1355	11	839	7	990	8	11985	100

Annex 3

Line-item expenditure data

In many hospitals existing accounting systems have gaps, such as excluding some costs or lacking the data to relate the costs to specific cost centers. In these cases, estimates are needed. The cost structure here is organized according to the following seven steps for computing unit costs, a framework built on the procedures for the analysis of district health service costs and financing described by Shepherd *et al*. (1998).

(1) *Defining final product*: The final product of interest was the unit costs for all inpatient, outpatient and emergency services. We can identify the unit cost for tobacco related illness with the disease prevalence data, which were obtained from our surveys of hospital patients. For inpatient care, the usual choices are inpatient days or admissions. The number of days spent in the hospital for our cases was calculated using econometric techniques explained in the next section. For outpatient care, number of visits is the unit of output.

A variety of other output units have been used for other cost centers. Examples include the number of tests or investigations (for laboratory and x-ray departments), the number of operations (for operating theaters), and the number of prescriptions (for pharmacy departments). We identified the number of such intervention needed for our cases and apportioned this to our unit costs. We also recognized that certain items were apportioned to patient's out-of-pocket expenditures.

(2) *Defining cost centers*: The next step for computing unit costs is to determine the centers of activity in the hospital to which direct, indirect and intermediate costs will be assigned. The major direct cost categories of most departments include salaries, supplies, and other purchased services such as dues, travel, and rents. Indirect cost categories include depreciation and allocated costs of other departments. The criterion for choosing centers of activity that absorb costs is that they correspond to the hospital's organizational accounting structure. Hospitals are organized into departments; it is useful to have cost centers that correspond to the existing organizational structure of the hospital. From an administrative standpoint, cost centers can be distinguished based on the nature of their work – patient care, intermediate clinical care and overhead centers. As explained below, some cost centers represent patient-centered activities (i.e., final or intermediate cost centers), while others are primarily for general services (i.e., overhead cost centers)

such as housekeeping, laundry, maintenance, and many other tasks necessary for the satisfactory operation of a complex organization like a hospital.

(3) *Inputs*: An important part of computing unit costs is to obtain the following input costs: (a) salaries (obtained through examination of all hospital posts and associated costs); (b) drugs (not paid by patients for the current fiscal year); (c) supplies (account of medical and non medical supplies in the current fiscal year were used in the analysis); (d) annual expenditure on utilities, e.g., electricity, water, land tax, municipal tax and other utilities; and finally (e) annualized capital costs.

The annualization of capital costs involves standard steps as recommended by the WHO guideline for cost effectiveness exercise (Baltussen *et al*., 2004). Depreciation and longevity of cost items differed by type of items. A standard discount rate of 5% was used.

(4) *Allocation of all costs to final cost centers:* The next step is to reallocate all direct costs to the final cost centers. Indirect costs, arising out of expenditure on items not directly used for patient care such as utility, land, etc., were also allocated similarly.

(5) Intermediate services, such as pharmacy and radiology, were allocated to each of the medical departments.

The allocation bases for the cost centers are the following:

- Salary expenditure allocated according to information of staff time allocation;
- Building cost allocated with the percentage of space occupied by each medical department;
- Supplies costs allocated by the amount of use by each department in the hospital in terms of percentage use of total amount of supplies;
- Utilities cost allocated according to the information of consumption in terms of appliances and floor space used by each department;
- Maintenance cost allocated according to the percentage of space occupied by each medical department;
- Laundry, kitchen and transport cost allocated by the proportion of service provided by each medical department according to the number of patients treated.

A step-down sequencing is used to allocate costs to particular centers which then are divided into patient unit costs. Step-down analysis basically presumes that resource flows are 'one-way' for two given departments;

and that there is hierarchical use of resource from a corresponding cost center and can be represented through a step-down sequence. We use the step-down methods to identify the cost for those cost centers, which directly provide services for tobacco related illnesses. Although the aim is to allocate most of the hospital costs to final output centers, some costs are not relevant to tobacco related illnesses. We exclude those cost from the final measurement.

(6) *Computing unit cost for direct cost center:* At this point one can calculate the total costs that were incurred at each of the final cost centers. We included only those cost centers, which serve patients with tobacco-related illnesses and excluded those cost centers, which do not play any significant role in treating those illnesses.

(7) *Reporting results:* Finally, we use the hospital disease prevalence data to compute unit cost for IPD, OPD and emergency room, all of which provide direct services for tobacco-related illnesses. The unit costs obtained from this exercise for emergency room patients, outpatients and inpatients for the associated illnesses were multiplied to the number attending the hospital. The numbers derived critically depended on other estimates we obtained. It is explained in more details in section 4.5 on direct costs.

Cost of tobacco-related illnesses for treatment in specialized hospitals, Bangladesh, 2004

Type of illness	Percentage of patients with tobacco-related illnesses receiving inpatient treatment			
	25%	50%	75%	100%
Lung Cancer	28,603,575,000	57,207,150,000	85,810,725,000	114,414,300,000
Stroke	19,243,696,876	38,487,393,753	57,731,090,629	76,974,787,505
COPD	112,911,913,115	225,823,826,230	338,735,739,345	451,647,652,460
IHD	110,378,464,548	220,756,929,095	331,135,393,643	441,513,858,191
Total cost of specialized care	271,137,649,539	542,275,299,078	813,412,948,617	1,084,550,598,156

Annex 5

Tobacco usage by sex, age , group and household location

Sex	Age group	Tobacco usage	Smoking tobacco: Urban Number	Smoking: Urban %	Smoking: Rural Number	Smoking: Rural %	Smoking: Total Number	Smoking: Total %	Smokeless tobacco: Urban Number	Smokeless: Urban %	Smokeless: Rural Number	Smokeless: Rural %	Smokeless: Total Number	Smokeless: Total %	Either: Urban Number	Either: Urban %	Either: Rural Number	Either: Rural %	Either: Total Number	Either: Total %
Men	15 - 19	Never	151	88.3	323	84.8	474	85.9	170	98.8	377	98.2	547	98.4	153	88.4	327	83.6	480	85.1
		Past*	3	1.8	0	0.0	3	0.5	0	0.0	0	0.0	0	0.0	3	1.7	0	0.0	3	0.5
		Current	17	9.9	58	15.2	75	13.6	2	1.2	7	1.8	9	1.6	17	9.8	64	16.4	81	14.4
	20 - 29	Never	199	65.2	339	63.0	538	63.8	301	97.4	516	95.2	817	96.0	201	64.6	336	61.7	537	62.7
		Past	3	1.0	5	0.9	8	0.9	0	0.0	0	0.0	0	0.0	3	1.0	4	0.7	7	0.8
		Current	103	33.8	194	36.1	297	35.2	8	2.6	26	4.8	34	4.0	107	34.4	205	37.6	312	36.4
	30 - 39	Never	137	55.0	254	47.5	391	49.9	225	89.3	453	85.2	678	86.5	130	51.0	225	41.7	355	44.7
		Past	9	3.6	14	2.6	23	2.9	2	0.8	2	0.4	4	0.5	9	3.5	8	1.5	17	2.1
		Current	103	41.4	267	49.9	370	47.2	25	9.9	77	14.5	102	13.0	116	45.5	306	56.8	422	53.1
	40 - 49	Never	96	45.3	120	30.5	216	35.6	168	78.5	312	78.8	480	78.7	76	35.3	97	24.3	173	28.2
		Past	18	8.5	22	5.6	40	6.6	4	1.9	3	0.8	7	1.1	16	7.4	15	3.8	31	5.0
		Current	98	46.2	252	64.0	350	57.8	42	19.6	81	20.5	123	20.2	123	57.2	287	71.9	410	66.8
	50 - 59	Never	55	47.4	89	33.2	144	37.5	86	73.5	187	68.8	273	70.2	48	41.0	61	22.2	109	27.8
		Past	12	10.3	19	7.1	31	8.1	3	2.6	2	0.7	5	1.3	7	6.0	9	3.3	16	4.1
		Current	49	42.2	160	59.7	209	54.4	28	23.9	83	30.5	111	28.5	62	53.0	205	74.5	267	68.1
	60 - 69	Never	34	48.6	53	35.8	87	39.9	51	71.8	78	52.3	129	58.6	25	35.2	27	18.0	52	23.5
		Past	8	11.4	20	13.5	28	12.8	4	5.6	1	0.7	5	2.3	8	11.3	3	2.0	11	5.0
		Current	28	40.0	75	50.7	103	47.2	16	22.5	70	47.0	86	39.1	38	53.5	120	80.0	158	71.5
	70 +	Never	20	54.1	66	43.1	86	45.3	28	75.7	90	59.2	118	62.4	15	40.5	37	24.2	52	27.4
		Past	8	21.6	34	22.2	42	22.1	0	0.0	3	2.0	3	1.6	6	16.2	17	11.1	23	12.1
		Current	9	24.3	53	34.6	62	32.6	9	24.3	59	38.8	68	36.0	16	43.2	99	64.7	115	60.5
	All (age 15+)	**Never**	**692**	**59.6**	**1244**	**51.5**	**1936**	**54.1**	**1029**	**87.8**	**2013**	**82.9**	**3042**	**84.5**	**648**	**55.0**	**1110**	**45.3**	**1758**	**48.4**
		Past	**61**	**5.3**	**114**	**4.7**	**175**	**4.9**	**13**	**1.1**	**11**	**0.5**	**24**	**0.7**	**52**	**4.4**	**56**	**2.3**	**108**	**3.0**
		Current	**407**	**35.1**	**1059**	**43.8**	**1466**	**41.0**	**130**	**11.1**	**403**	**16.6**	**533**	**14.8**	**479**	**40.6**	**1286**	**52.4**	**1765**	**48.6**
		Total	**1160**	**100.0**	**2417**	**100.0**	**3577**	**100.0**	**1172**	**100.0**	**2427**	**100.0**	**3599**	**100.0**	**1179**	**100.0**	**2452**	**100.0**	**3631**	**100.0**

*Stopped six month back or before

Sex	Age group	Tobacco usage	Smoking tobacco						Smokeless tobacco						Either					
			Household location				Total		Household location				Total		Household location				Total	
			Urban		Rural				Urban		Rural				Urban		Rural			
			Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Women	15 - 19	Never	202	100.0	361	100.0	563	100.0	204	99.5	347	96.1	551	97.3	204	99.5	350	96.2	554	97.4
		Current	0	0.0	0	0.0	0		1	0.5	14	3.9	15	2.7	1	0.5	14	3.8	15	2.6
	20 - 29	Never	391	100.0	704	99.9	1095	99.9	376	96.2	633	90.2	1009	92.3	378	96.2	638	90.2	1016	92.4
		Past	0	0.0	0	0.0	0	0.0	1	0.3	0	0.0	1	0.1	1	0.3	0	0.0	1	0.1
		Current	0	0.0	1	0.1	1	0.1	14	3.6	69	9.8	83	7.6	14	3.6	69	9.8	83	7.5
	30 - 39	Never	269	100.0	542	98.2	811	98.8	224	82.7	398	72.5	622	75.9	224	82.7	397	71.8	621	75.4
		Past	0	0.0	3	0.5	3	0.4	2	0.7	3	0.5	5	0.6	2	0.7	3	0.5	5	0.6
		Current	0	0.0	7	1.3	7	0.9	45	16.6	148	27.0	193	23.5	45	16.6	153	27.7	198	24.0
	40 - 49	Never	183	96.8	396	96.6	579	96.7	122	64.2	201	49.1	323	53.9	120	63.2	192	46.8	312	52.0
		Past	2	1.1	1	0.2	3	0.5	3	1.6	5	1.2	8	1.3	4	2.1	6	1.5	10	1.7
		Current	4	2.1	13	3.2	17	2.8	65	34.2	203	49.6	268	44.7	66	34.7	212	51.7	278	46.3
	50 - 59	Never	87	95.6	223	92.9	310	93.7	51	56.0	102	42.7	153	46.4	49	53.8	96	40.0	145	43.8
		Past	1	1.1	4	1.7	5	1.5	1	1.1	4	1.7	5	1.5	2	2.2	3	1.3	5	1.5
		Current	3	3.3	13	5.4	16	4.8	39	42.9	133	55.6	172	52.1	40	44.0	141	58.8	181	54.7
	60 - 69	Never	50	90.9	140	90.9	190	90.9	26	48.1	75	48.4	101	48.3	24	43.6	68	43.9	92	43.8
		Past	0	0.0	3	1.9	3	1.4	1	1.9	1	0.6	2	1.0	1	1.8	0	0.0	1	0.5
		Current	5	9.1	11	7.1	16	7.7	27	50.0	79	51.0	106	50.7	30	54.5	87	56.1	117	55.7
	70 +	Never	34	97.1	93	88.6	127	90.7	19	55.9	36	34.3	55	39.6	19	54.3	29	27.6	48	34.3
		Past	0	0.0	4	3.8	4	2.9	1	2.9	4	3.8	5	3.6	1	2.9	6	5.7	7	5.0
		Current	1	2.9	8	7.6	9	6.4	14	41.2	65	61.9	79	56.8	15	42.9	70	66.7	85	60.7
	All (age 15+)	**Never**	**1216**	**98.7**	**2459**	**97.3**	**3675**	**97.7**	**1022**	**82.7**	**1792**	**71.1**	**2814**	**74.9**	**1018**	**82.1**	**1770**	**69.9**	**2788**	**73.9**
		Past	**3**	**0.2**	**15**	**0.6**	**18**	**0.5**	**9**	**0.7**	**17**	**0.7**	**26**	**0.7**	**11**	**0.9**	**18**	**0.7**	**29**	**0.8**
		Current	**13**	**1.1**	**53**	**2.1**	**66**	**1.8**	**205**	**16.6**	**711**	**28.2**	**916**	**24.4**	**211**	**17.0**	**746**	**29.4**	**957**	**25.4**
		Total	**1232**	**100.0**	**2527**	**100.0**	**3759**	**100.0**	**1236**	**100.0**	**2520**	**100.0**	**3756**	**100.0**	**1240**	**100.0**	**2534**	**100.0**	**3774**	**100.0**

Sex	Age group	Tobacco usage	Smoking tobacco						Smokeless tobacco						Either					
			Household location				Total		Household location				Total		Household location				Total	
			Urban		Rural				Urban		Rural				Urban		Rural			
			Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Men & Women	15 - 19	Never	353	94.6	684	92.2	1037	93.0	374	99.2	724	97.2	1098	97.9	357	94.4	677	89.7	1034	91.3
		Past	3	0.8	0	0.0	3	0.3	0		0		0	0.0	3	0.8	0	0.0	3	0.3
		Current	17	4.6	58	7.8	75	6.7	3	0.8	21	2.8	24	2.1	18	4.8	78	10.3	96	8.5
	20 - 29	Never	590	84.8	1043	83.9	1633	84.2	677	96.7	1149	92.4	1826	93.9	579	82.2	974	77.8	1553	79.4
		Past	3	0.4	5	0.4	8	0.4	1	0.1	0		1	0.1	4	0.6	4	0.3	8	0.4
		Current	103	14.8	195	15.7	298	15.4	22	3.1	95	7.6	117	6.0	121	17.2	274	21.9	395	20.2
	30 - 39	Never	406	78.4	796	73.2	1202	74.9	449	85.9	851	78.7	1300	81.0	354	67.3	622	57.0	976	60.3
		Past	9	1.7	17	1.6	26	1.6	4	0.8	5	0.5	9	0.6	11	2.1	11	1.0	22	1.4
		Current	103	19.9	274	25.2	377	23.5	70	13.4	225	20.8	295	18.4	161	30.6	459	42.0	620	38.3
	40 - 49	Never	279	69.6	516	64.2	795	66.0	290	71.8	513	63.7	803	66.4	196	48.4	289	35.7	485	40.0
		Past	20	5.0	23	2.9	43	3.6	7	1.7	8	1.0	15	1.2	20	4.9	21	2.6	41	3.4
		Current	102	25.4	265	33.0	367	30.5	107	26.5	284	35.3	391	32.3	189	46.7	499	61.7	688	56.7
	50 - 59	Never	142	68.6	312	61.4	454	63.5	137	65.9	289	56.6	426	59.2	97	46.6	157	30.5	254	35.1
		Past	13	6.3	23	4.5	36	5.0	4	1.9	6	1.2	10	1.4	9	4.3	12	2.3	21	2.9
		Current	52	25.1	173	34.1	225	31.5	67	32.2	216	42.3	283	39.4	102	49.0	346	67.2	448	62.0
	60 - 69	Never	84	67.2	193	63.9	277	64.9	77	61.6	153	50.3	230	53.6	49	38.9	95	31.1	144	33.4
		Past	8	6.4	23	7.6	31	7.3	5	4.0	2	0.7	7	1.6	9	7.1	3	1.0	12	2.8
		Current	33	26.4	86	28.5	119	27.9	43	34.4	149	49.0	192	44.8	68	54.0	207	67.9	275	63.8
	70 +	Never	54	75.0	159	61.6	213	64.5	47	66.2	126	49.0	173	52.7	34	47.2	66	25.6	100	30.3
		Past	8	11.1	38	14.7	46	13.9	1	1.4	7	2.7	8	2.4	7	9.7	23	8.9	30	9.1
		Current	10	13.9	61	23.6	71	21.5	23	32.4	124	48.2	147	44.8	31	43.1	169	65.5	200	60.6
	All (age 15+)	**Never**	**1908**	**79.8**	**3703**	**74.9**	**5611**	**76.5**	**2051**	**85.2**	**3805**	**76.9**	**5856**	**79.6**	**1666**	**68.9**	**2880**	**57.8**	**4546**	**61.4**
		Past	**64**	**2.7**	**129**	**2.6**	**193**	**2.6**	**22**	**0.9**	**28**	**0.6**	**50**	**0.7**	**63**	**2.6**	**74**	**1.5**	**137**	**1.9**
		Current	**420**	**17.6**	**1112**	**22.5**	**1532**	**20.9**	**335**	**13.9**	**1114**	**22.5**	**1449**	**19.7**	**690**	**28.5**	**2032**	**40.8**	**2722**	**36.8**
		Total	**2392**	**100.0**	**4944**	**100.0**	**7336**	**100.0**	**2408**	**100.0**	**4947**	**100.0**	**7355**	**100.0**	**2419**	**100.0**	**4986**	**100.0**	**7405**	**100.0**

Annual average retail price (Taka) of tobacco (in 1995-1996 prices)

Items	Region	1999-2000	2000-2001	2001-2002	2002-2003
Cigarette (Gold Leaf–king size filter tipped–packet of 20)	Dhaka	34.46	29.75	28.63	28.47
	Chittagong	32.94	29.22	30.20	29.19
	Rajshahi	34.53	32.26	34.23	29.19
	Khulna	35.64	31.22	29.53	27.74
Cigarette (Star–packet of 10)	Dhaka	7.45	7.3	6.70	6.92
	Chittagong	7.78	17.67	7.55	7.30
	Rajshahi	7.78	n.a.	n.a.	7.30
	Khulna	7.07	n.a.	7.55	n.a.
Tobacco leaf (Motihari–kg)	Dhaka	55.71	58.10	55.95	58.17
	Chittagong	46.14	46.05	45.31	43.79
	Rajshahi	42.17	38.37	35.11	29.19
	Khulna	59.45	59.55	54.29	46.20

Source: Bangladesh Bureau of Statistics. Statistical Pocketbook, 2003.

Use of tobacco and exposure to second-hand smoke are major contributors to the chronic disease and economic burdens of citizens and also has a negative impact on national economy of Bangladesh. Scientific research has revealed that tobacco control actually brings significant health and economic benefits without harming the economy.

The present study on the Impact of Tobacco-related Illnesses in Bangladesh presents scientific evidences for strengthening tobacco control measures in the country for consequent economic gain at both the individual and national level, and for overall reduction of morbidity and mortality due to tobacco use.

World Health Organization
Regional Office for South-East Asia

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