

SE/BAN  
TOB/NCD/001  
DOC/1

# **Impact of Tobacco-related Illnesses in Bangladesh**



World Health Organization  
Dhaka, Bangladesh

January 2005



© World Health Organization (2005)

The findings, interpretations and conclusions expressed herein are those of the investigators and do not necessarily reflect the views of the World Health Organization. WHO does not guarantee the accuracy of the data included in this work.

Publications of WHO enjoy copyright protection in accordance with the provisions of Protocol 2 of the Universal Copyright Convention. For rights of reproduction or translation, in part or in toto, of publications issued by the WHO Bangladesh of the South-East Asia Region, application should be made to WHO Representative's Office, House No. 12, Road No. 7, Dhanmondi Residential Area, Dhaka 1205, GPO Box No. 205, Bangladesh. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Printed in Bangladesh

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

**Investigators:**

Dr. Arnab Acharya, The Research Triangle Institute, USA  
Dr. M Mostafa Zaman, WHO Bangladesh  
Dr. Iftekhar Quasem, Bangladesh Rural Advancement Committee (BRAC), Bangladesh  
Dr. Syed Mahfuzul Huq, National Institute of Cardiovascular Diseases, Bangladesh  
Dr. Nigar Nargis, Department of Economics, University of Dhaka  
Mr. Golam Kibria Nury, WHO Bangladesh  
Ms. Tahmina Begum, WHO Bangladesh

**With assistance from:**

Drs. Anne Marie Perucic, WHO Geneva  
Arifuzzaman Khan, WHO Bangladesh  
Khalilur Rahman, WHO SEARO  
Douglas Bettcher, WHO Geneva  
Sawat Ramaboot, WHO SEARO  
Ayda Yurekli, WHO Geneva

**Under overall supervision of:**

Dr. Suniti Acharya, WHO Bangladesh

**Editors:**

Drs. M. Mostafa Zaman  
Nigar Nargis

**In collaboration with:**

Drs. Taimor Nawaz and Farid Uddin Bhuiyan, Bangladesh Medical College Hospital, Dhaka;  
Faridul Islam, Emran Bin Yunus and Toufiqul Alam, Chittagong Medical College Hospital, Chittagong;  
M. A. Faiz, F. M. Siddiqui and Md Nazmul Huda, Dhaka Medical College Hospital, Dhaka;  
Quazi Tarikul Islam and Abul Kalam Azad, Rajshahi Medical College Hospital, Rajshahi;  
Imran Matin, Bangladesh Rural Advancement Committee (BRAC), Dhaka.

---

\*Preliminary results were presented at the Ministry of Health and Family Welfare, Dhaka on 26 September 2004





## Foreword



Bangladesh has been passing through an epidemiological transition. The disease patterns have been changing from predominance of communicable diseases to non-communicable diseases such as heart diseases, strokes, chronic respiratory diseases, and cancers. Many of these major killer diseases are largely preventable by appropriate lifestyle measures. Use of tobacco is one of such lifestyle factors. This study provides a very comprehensive evidence-based data on tobacco-related illnesses and their impact on Bangladesh economy. I hope that the data and information contained in this report will provide valuable insight not only to Bangladesh but also to other developing and transitional economies for tobacco control measures such as legislations and programme implementations.

I acknowledge the hard work of the investigators from the Research Triangle Institute (USA), Bangladesh Rural Advancement Committee (BRAC), Department of Economics of Dhaka University, and WHO. I express my deep indebtedness to the collaborators and experts in four medical college hospitals (Chittagong, Dhaka and Rajshahi Medical Colleges from public sector and Bangladesh Medical College from private sector) and four specialised institutes (National Institute of Cardiovascular Diseases, National Institute of Cancer Research and Hospital, National Institute of Diseases of Chest and Hospital, and Neuro Medicine Department of Bangabandhu Sheikh Mujib Medical University) for providing valuable data and extending active support. These were instrumental to the success of this study. I would also like to extend appreciation to the common people of Bangladesh who provided essential information regarding tobacco and related diseases during both hospital and population-based surveys.

January 2005

সুমি আচার্যা  
WHO Representative  
Bangladesh



## Contents

Executive summary	
I. Introduction	1
II. Objectives	7
III. Methods and analytical framework	11
III.1. Cost of illness (COI) approach	11
III.2. Household survey	12
III.3. Hospital survey	19
III.4. Secondary data	24
III.5. Analysis of data	24
IV. Results	45
IV.1. Tobacco usage	45
IV.2. Illnesses	46
IV.3. Knowledge about tobacco and illnesses	50
IV.4. Tobacco usage and poverty	53
IV.5. Health seeking behavior	55
IV.6. Direct cost of illnesses	55
IV.7. Indirect cost of illnesses	59
IV.8. Cost-benefit of tobacco consumption	61
V. Discussion	65
V.1. Discussion	65
V.2. Conclusion	71
V.3. Recommendation	72
Acknowledgments	74
References	75



## Executive Summary

Data from developing countries regarding the impact of tobacco usage on the countries' economy are insufficient. This study examines the costs of tobacco use in Bangladesh to determine: (i) 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 present study is based on the data collected through a sample survey of 2467 households, hospital cost and patient surveys in three public and one private medical college hospitals, an expert survey that determines the survival rate and quality of life after occurrence of the diseases attributable to tobacco, and a supplementary survey of four specialised institutes to identify the additional cost of specialised treatment of tobacco-related diseases.

The results show that prevalence of tobacco usage (smoking or non-smoking) is 55% in the population and 57% among hospital outpatients aged 30 years and above. Prevalence in men is higher, but surprisingly, unlike other developing countries, prevalence in women is very high—42% at the population level. Population data show that 9% of people aged 30 and above suffer from 8 tobacco-related diseases (ischemic heart disease, lung cancer, stroke, oral cancer, cancer larynx, chronic obstructive pulmonary disease, pulmonary tuberculosis, and Buerger's disease), and 41% of them are attributable to tobacco. Hospital data indicate that 29% of inpatients aged 30 years and above have eight tobacco-related diseases. It is also estimated that these diseases are responsible for 16% of all deaths and 9% of all deaths are attributable to tobacco.

The cost of tobacco-related illnesses in Bangladesh as attributable to tobacco usage is estimated to be 27.4 billion taka. On the other hand, the total benefit from tobacco sector is 24.8 billion taka—20.3 billion taka collected as tax revenue on the domestic consumption of tobacco and 4.5 billion taka earned as wages in tobacco production. The cost of

tobacco usage to the country thus outweighs the benefit from revenue and wages by 2.6 billion taka. Therefore Bangladesh economy would benefit from controlling the usage of tobacco.

The study confirms that the economic and health cost of tobacco usage is inversely related to the socio-economic status of tobacco consumers. This finding has important implication for the distributional consequence of tobacco control policies. It suggests that by curbing tobacco usage in the country, these policies can immensely benefit the nation, especially the poor, by improving their economic and health conditions. As such, the tobacco control policies can be nested as an effective instrument in the national poverty alleviation strategy.



## **Chapter : I**

# Introduction



## I. INTRODUCTION

Worldwide tobacco usage accounted for 4.1% of global burden of ill health in 2000; much of this burden was due to an increase in the last full decade of tobacco-related illnesses in developing countries. Almost 4.9 million deaths in 2000 can be attributed to tobacco usage (Ezzati *et al* 2002). According to the estimate of a recent study reporting only on smokers, the average loss of life expectancy per tobacco-related illness in India is 20 years with middle age smoker having twice the death rates than non-smokers (Gajalakshmi *et al* 2003). Thus tobacco results in loss of life during active years, reducing the productivity of experienced workers in turn.

This study identifies and compares the economic costs and benefits of tobacco consumption in Bangladesh toward providing economic justifications for the framing of tobacco control policy. More specifically it provides an estimation of opportunity costs (costs that would have alternative usage which would yield greater enjoyment than those expenditures necessitated by tobacco usage) imposed on Bangladeshi economy due to ill health attributable to tobacco usage. The cost 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 cost. To this the cost on the economy due to premature death and disabilities, making up the indirect costs, is added.

The initial task in the cost studies is to identify the types of illnesses that can be attributed to tobacco usage, although the aetiology of the illnesses is not exclusive to tobacco<sup>1</sup>. The list of illnesses can vary from country to country due to different habits for tobacco usage (Peto *et al* 1992). Here a modest list of eight illnesses is considered

---

<sup>1</sup> By tobacco-related illnesses we mean all illnesses that have been associated with tobacco usage, although there may be other risk-factors associated with these illnesses. A portion of the prevalence of these illnesses can be attributed to tobacco usage. Thus the main interest of this study is to estimate the opportunity costs imposed by occurrences of illnesses directly caused by tobacco usage.

to have direct links to tobacco usage. Most likely in all regions of the world tobacco contributes to the occurrences of lung cancer, cancers of the mouth and larynx, stroke and ischemic heart diseases (IHD), and chronic obstructive pulmonary disease (COPD) (Murray and Lopez 1996). To these six conditions two more are added. Recent studies in India and China showed that tobacco contributes to incidence of pulmonary tuberculosis (Gajalakshmi *et al* 2003, Liuetal *et al* 2001). Additionally Buerger's Disease (thromboangiitis obliterans), occurring primarily among heavy smokers who are poor and work bare feet in wet soil condition, is a source of disease burden in Bangladesh and other poor countries (Rahman *et al* 2000).

With the identification of the relevant illnesses, various types of cost studies are possible. This study attempts to account for total costs of tobacco usage compared to zero usage of tobacco. Thus the measured cost is an indication of the size of the problem arising out of tobacco usage. The calculation of costs here follows the cross section approach for cost of illness studies (Cooper and Rice 1976).

The cross-section approach can be thought of as a prevalence-based approach. It estimates current costs as a function of all current illnesses due to current and past smoking. Costs are accounted by following standard guidelines of economic cost-benefit analysis. As tobacco is addictive, all costs undertaken due to the prevalence of tobacco-related illnesses is taken as excess medical costs. If the costs exceed the benefits that may accrue from tobacco consumption, there is considerable economic reason for tobacco consumption to be severely restricted.

Consumption of tobacco should be seen as a cost as it is abusive consumption. However, an alternative assumption is that consumption yields benefit in terms of relaxation and pleasure. Perhaps the primary reason for its exclusion as a cost is the distributional concern of the policy makers in poorer countries that the tax revenue collected from sales of tobacco products (justified through the

recognition that this is part of the producer and consumer surpluses which are normally seen as the benefit in welfare economics) along with wages earned through production of tobacco, if any, should be seen as benefits. Thus a hybrid approach is adopted. While the tax and the wages associated with tobacco consumption and production are seen as benefits, the remaining parts of the producer's and consumer's surpluses from domestic consumption are discounted completely as they stem solely from addictive consumption.

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

Social costs include costs due to indirect costs of morbidity and premature mortality, as well as direct medical costs. The social costs amount to 1.4% to 1.6% of GDP in the US; a similar estimate came from Canada. The China study showed that amount to be 1.7% of GDP (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 the poor are significantly higher than it is for other income groups. If education can stand as proxy for income levels then the data from both developed and developing country suggests that the poor consume more tobacco products than the more well off in nearly all regions of the world. When compared to the highest socio-

economic group, among the least educated, smoking rate is 3 folds higher in the UK and 5 to 7 folds higher in some developing countries. Risk of death due to tobacco usage is similarly related to income (Jha and Chaloupka 2000). The Canadian finding is indicative of what one can expect elsewhere—the risk of death attributable to smoking is 5% for high income earners while the same rate is 15% for the poorest group.

An added aspect of high consumption of tobacco usage in a developing country is the fact that the opportunity cost of tobacco consumption is high in terms of other essential consumption items. Studies in several countries observed that for some households up to 5% and, in some instances, even up to 17% of household income is being spent on tobacco products (*de Beyer et al 2001*). A study in Bangladesh indicated that an estimated 10 million people currently malnourished could have an adequate diet if money spent on tobacco were spent on food instead (*Effroymsen et al 2001*).

In developed countries, considerable strides have been made against the burden of tobacco usage through increase in quit rate among smokers, usually the result of such measures as banning of direct and indirect tobacco advertising, imposition of high taxes on tobacco products and enforcement of laws requiring all public spaces and workplaces to be free of tobacco smoking, and requiring clear graphic health messages on tobacco packaging. In developing countries as noted before tobacco usage is on the rise whilst corresponding laws either have not been enacted or often go un-enforced. A primary reason for this failure is likely due to the consideration that tobacco usage yields significant benefit through tax revenue and, where applicable, wages from production of tobacco and tobacco products. Among some policy makers the view is held that this amount exceeds the costs on the society that arise due to the prevalence of tobacco-related illnesses. This study seeks to assess the validity of that view as applicable to Bangladesh, a country which is among the pioneers in considering legislations to control tobacco consumption.

## **Chapter : II**

Objectives



## II. OBJECTIVES

The objective of the study is to obtain information on the economic cost of illnesses resulting from tobacco usage in Bangladesh. It entails calculating the opportunity cost borne by the economy, attributable to tobacco-related illnesses, which may provide economic justifications for the framing of tobacco control policy.

Specific objectives are to determine the following:

- i. prevalence of tobacco usage
- ii. prevalence of tobacco related diseases
- iii. utilization of health services in Bangladesh (in a partial way)
- iv. hospital costs borne by the health system due to tobacco-related illnesses
- v. out-of-pocket expenditure of households both when people are hospitalised and when they attend outpatient departments due to tobacco-related illnesses
- vi. deaths and disabilities due to tobacco-related illnesses
- vii. benefit of tobacco consumption for the economy

Using the above information we attempt to test the following set of hypotheses in the context of Bangladesh:

- i. Tobacco-related illnesses impose substantial costs to the society.
- ii. Total expenditure (household out-of-pocket expenditure plus health system cost, and indirect costs) exceeds total income earned out of domestic consumption of tobacco.
- iii. 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 those diseases have been estimated using the data collected in 2004 from various sources including household survey throughout the country, hospital cost and patient surveys (surveys from three public and one private medical college hospitals), and expert survey that determines the survival rate and quality of life after occurrence of the diseases attributable to tobacco. These data were finally supplemented by data from the specialized institutes that deal with these diseases. In what follows is the description of the methods including the four surveys conducted for the present study.



## Chapter : III

*Methods and Analytical Framework*



### III. METHODS AND ANALYTICAL FRAMEWORK

#### III.1. Cost of Illness (COI) Approach

The opportunity cost of tobacco-related illnesses includes the following components:

- (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 the society.

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

- (1) the relative risk of eight illnesses with respect to tobacco—the proportion of tobacco users having either of these diseases;
- (2) the rates of prevalence of the eight diseases attributable to tobacco usage—the conditional probability that one of the eight diseases would befall an individual with tobacco consumption habit, which is given by the ratio of the proportion of tobacco users having either of the eight illnesses to the proportion of tobacco users in the economy;
- (3) average private cost of treatment of individual patients;
- (4) average hospital cost (inpatient and outpatient) of treatment of individual patients;

- (5) 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 illnesses, 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:

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

where, i = {inpatient, outpatient},  
nh = {non-hospitalised},  
O = average out-of-pocket expenditure,  
H = average hospital cost,  
N = number of patients with tobacco-related illnesses  
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, and  
t = time.

### III.2. Household survey

The household survey allowed us to construct population disease profile for the age group of 30 years and above, determine out-of-pocket costs undertaken for these types of illnesses, and diagnose associated health seeking behaviour.

Sampling and  
cluster selection

The household survey took place from 27 May, 2004 and ended on 25 July, 2004. The coding of the survey was completed by 9 September, 2004. A representative sample of 2467 households was drawn from six divisions. Districts were purposively selected to take account of different degrees of accessibility to tertiary health care facilities: districts within 25 kilometres radius from tertiary health care facility were considered *near* and those 25 to 50 kilometres away from tertiary health care facilities were considered *far*.

Unions/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 people.

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

Division	Districts	Upazilla/ Thana	Union/ Ward	Village/ JLs	Total HHs	Population ≥ 30 years	Total population
Dhaka	5	15	17	27	767	1304	3558
Chittagong	2	7	7	9	470	919	2725
Rajshahi	4	9	12	16	606	951	2518
Khulna	3	7	11	12	295	556	1355
Barisal	2	6	6	9	164	327	839
Sylhet	2	5	6	7	165	322	990
Total	18	49	59	80	2467	4394	11985

- Notes: 1. Total urban clusters in the sample were 23 and total rural clusters were 36  
 2. 30% of the sampled population was urban and 70% was from rural.  
 3. JL indicates jurisdiction limit; and HH, households.

**Table 2: Distribution of sample population by age group**

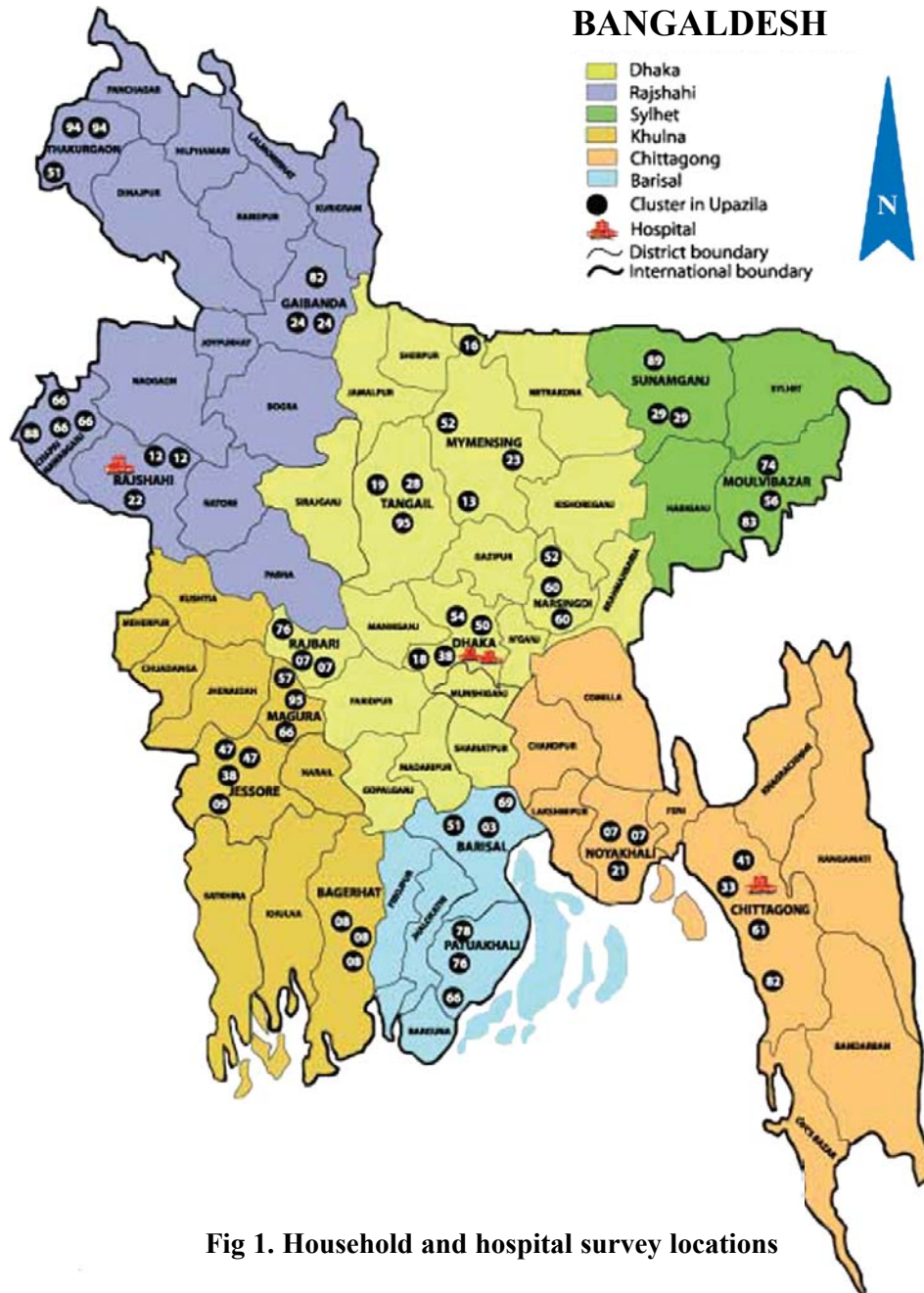
Age, y	Divisions													
	Dhaka		Chittagong		Rajshahi		Khulna		Barishal		Sylhet		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-29	2249	63	1806	66	1567	62	779	57	512	61	658	66	7591	63
30-39	531	15	335	13	363	15	207	16	96	12	115	12	1647	14
40-49	371	10	242	9	283	11	171	14	85	10	84	9	1236	10
50-59	210	6	150	5	165	6	79	6	71	8	63	6	738	6
60-69	114	3	94	4	102	4	54	4	43	5	29	3	436	4
≥70	83	3	98	3	38	2	45	3	32	4	41	4	337	3

Note: 1. 37% (n = 4394) is aged 30 years and above.  
 2. Mean education for those ≥ 30 is 4.8 years (men 6.1 and women 3.3)

Distribution of the clusters is depicted in Fig.1. The household sample is representative of Bangladeshi population in terms of urban-rural composition, distribution of expenditure, and the distribution of other household characteristics such as education. As for example, the number of youth and infants in our sample, those aged below 30, is at 63%, while the national figure is 64%. The distribution of sample population by age group is shown in Table 2; 37% of these individuals are aged 30 years and above, constituting the population of interest to the present study. Tobacco-related illnesses are observable primarily among people at this stage of their life cycle.

#### Survey tools

1. *Household questionnaire*: The household questionnaire was designed to obtain information on household characteristics, such as, household monthly expenditure, its assets, tobacco usage by each member, occupation and the educational achievement of each member, etc. General information on lifestyle habits,



health, and reported morbidity were collected from individuals aged 30 years and above.

2. *Medical questionnaire:* A more structured medical questionnaire sought to obtain information on health seeking behavior and cost of treatment for 15 days morbidity. Questions were asked as to whether anyone in the household has been diagnosed within the last six months with either of the eight tobacco-related diseases—IHD, stroke/transient ischemic attack (TIA), oral cancer, lung cancer, laryngeal carcinoma, COPD, pulmonary tuberculosis and Buerger’s diseases.

Additionally, an in-depth survey was done to detect eight tobacco-related illnesses. Standard WHO questionnaires were used to detect the IHD, stroke/TIA. Other six diseases were screened initially with a questionnaire regarding cardinal symptoms. This questionnaire was developed by two members of the research team and finalized on the basis of pretesting and opinions of experts.<sup>2</sup>

3. *X-ray:* For any suspected cases found during questionnaire survey, chest X-ray was done to make appropriate diagnosis of lung cancer, COPD or tuberculosis.
4. *Carbon Mono-oxide Monitor (CO-monitor):* 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). The purpose of this exercise was to obtain information that corroborates smoking habit.

<sup>2</sup> The research team members are Dr. M. Mostafa Zaman of WHO, Bangladesh, and Dr. Iftekhar Quasem of BRAC. The experts are Dr Asif Mujtaba Mahmud of National Institute of Diseases of Chest Hospital and Dr Syed Md Akram Hussain of National Institute of Cancer Research and Hospital.

5. *Diagnosis of diseases:* The 6 months morbidity questionnaire allowed the screening of those who are known to be suffering from tobacco-related illnesses. Only those who had valid documents (e.g., prescription from a qualified doctor (at least MBBS), hospital records) on any of the eight diseases, as checked by the survey physician, were taken as diagnosed cases. The in-depth medical questionnaire was designed to detect probable cases of tobacco related diseases. Those detected as probable cases and not having a validation document were given a medical examination by the survey physician and referred for X-ray if needed, free of charge. The survey physician made final comments and diagnosed the cases according to the history, documents, physical examination and X-ray findings.

#### Survey team and its activities

For six divisions, six survey teams were 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. They were provided one day practice in the nearby cluster. In the urban clusters, survey started from Ward Commissioner's Office and in the rural clusters from the office of the Chairman of the Union council till recruitment of desired number of households.

Enumerators recorded all information noted in household questionnaire and diagnosed probable cases of tobacco related illnesses. They referred suspected cases to the survey physician. If any member of the household needed X-ray, the team motivated the household to send the person to the selected X-ray 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 (perceived by the household) of that household.

In the evening, enumerators made a list of information lacking from the households surveyed. Each pair of enumerators exchanged their surveyed questionnaires to the other pair for cross-examination and then the supervisor checked the questionnaires. If any information regarding the household or an individual was lacking, the enumerators tried to collect it within their stay in that cluster.

#### Quality control

---

*Training:* The trainers who were involved in developing the questionnaire imparted the training. Every question was clarified. Field like condition was simulated in the classroom and mock interviews were done to make questionnaire clear to the enumerators. After every mock interview, problems were raised and were clarified by the trainers. One day field practice was done in the urban area of Dhaka before beginning the actual survey.

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

#### Data management

---

*At the central level:* Before handing over the questionnaires for coding, each team checked again the questionnaires in the presence of the supervisor working at the head office. Coders then worked on the questionnaire under the guidance of the data management supervisor and coordinator of the household survey.

*At the entry level:* Data entry supervisor was present during the data entry. A trained pool of data entry personnel did the data entry work under one supervisor. Consistency check was done by the data entry supervisor and by the investigators.

### III.3. Hospital survey

In Bangladesh most of the relevant eight illnesses are treated in specialized institutes as well as medical college hospitals all of which can deliver specialized care. The district and the sub-district hospitals deliver preliminary care and refer the cases of these illnesses to the facilities delivering specialized care. While tuberculosis cases are treated in medical colleges, they are mostly treated in Tuberculosis Clinics and hospitals located throughout the country. Buerger's disease is treated mostly in the medical college hospitals. For the rest of the six illnesses both the specialised institutes, all located in Dhaka, and the medical college hospitals located throughout the country are able to deliver care. The care in the specialised institutes is uniformly superior to the care received in the medical colleges.

#### Survey of medical college hospitals

Initially four medical college hospitals were surveyed to obtain epidemiological as well as cost data regarding the eight relevant illnesses. The survey included patient surveys regarding health habits and costs, examination of hospital records regarding costs and illnesses. We surveyed one public and one private medical college hospital in Dhaka (the capital city, where one in fourteen people of Bangladesh live), and one public medical college hospital each in Chittagong (south eastern divisional headquarters) and Rajshahi (north western divisional headquarters) to obtain information about tobacco usage, eight concerned diseases and system costs relating to our concern (Fig. I). The survey sample is described in Table 3.

**Table 3: Number of patients in four medical college hospitals in a one-day cross-section (except paediatric, psychiatric and gynecology-obstetric cases<sup>1</sup>)**

Medical college hospitals <sup>3</sup>	Sex	Age groups						Total
		<=29	30-39	40-49	50-59	60-69	>=70	
Emergency and outpatients <sup>2</sup>								
BMCH	Male	217	87	39	24	23	11	401
	Female	185	69	49	33	16	13	365
	Combined	402	156	88	57	39	24	766
CMCH	Male	202	95	94	56	26	19	492
	Female	146	61	32	27	13	1	280
	Combined	348	156	126	83	39	20	772
DMCH	Male	212	84	65	54	33	16	464
	Female	169	94	84	32	25	14	418
	Combined	381	178	149	86	58	30	882
RMCH	Male	167	48	46	37	23	11	332
	Female	153	74	51	26	16	10	330
	Combined	320	122	97	63	39	21	662
<i>Total</i>	<i>Male</i>	<i>798</i>	<i>314</i>	<i>244</i>	<i>171</i>	<i>105</i>	<i>57</i>	<i>1689</i>
	<i>Female</i>	<i>653</i>	<i>298</i>	<i>216</i>	<i>118</i>	<i>70</i>	<i>38</i>	<i>1393</i>
	<i>Combined</i>	<i>1451</i>	<i>612</i>	<i>460</i>	<i>289</i>	<i>175</i>	<i>95</i>	<i>3082</i>
Inpatients								
BMCH	Male	42	20	25	29	13	25	154
	Female	29	14	16	14	14	10	97
	Combined	71	34	41	43	27	35	251
CMCH	Male	200	142	110	105	44	38	639
	Female	133	62	70	53	22	16	356
	Combined	333	204	180	158	66	54	995
DMCH	Male	172	95	97	98	73	60	595
	Female	73	41	32	23	22	9	200
	Combined	245	136	129	121	95	69	795
RMCH	Male	101	45	67	54	62	40	369
	Female	60	26	25	12	13	13	149
	Combined	161	71	92	66	75	53	518
<i>Total</i>	<i>Male</i>	<i>515</i>	<i>302</i>	<i>299</i>	<i>286</i>	<i>192</i>	<i>163</i>	<i>1757</i>
	<i>Female</i>	<i>295</i>	<i>143</i>	<i>143</i>	<i>102</i>	<i>71</i>	<i>48</i>	<i>802</i>
	<i>Combined</i>	<i>810</i>	<i>445</i>	<i>442</i>	<i>388</i>	<i>263</i>	<i>211</i>	<i>2559</i>

<sup>1</sup> In these departments there were 1110 outpatients and 964 inpatients.

<sup>2</sup> The number of patients in emergency department was 406.

<sup>3</sup> BMCH indicates Bangladesh Medical college Hospital; CMCH, Chittagong Medical College Hospital; DMCH, Dhaka Medical College Hospital; RMCH, Rajshahi Medical Hospital.

The hospital survey has two components:

- i. An outpatient and an inpatient survey were used to collect information on patient composition of the hospital to determine the proportion of all cases that can be classified as tobacco-related illnesses. All departments except paediatrics, psychiatry and gynaecology-obstetrics were surveyed. Further information on patients was collected to determine economic wellbeing, smoking habits including other relevant risk factors (e.g., alcohol, physical activity, fruits and vegetables intake, blood pressure, diabetes mellitus and waist circumference, for inpatients only, according to WHO STEPwise approach to Surveillance of non-communicable diseases (step 1. of core variables) (WHO STEPS 2003) , media exposure to tobacco advertisements, knowledge of its harmful effects, as well as their out-of-pocket costs. Costs for consultation, investigation, medicines, transportation, meals etc for both the patient and accompanying person(s) were considered.
- ii. A hospital cost survey, designed to determine the costs undertaken by the hospital, involved accounting the costs of operation of hospitals including fixed assets and variable costs. This survey allows us to calculate the cost incurred by the hospitals in their entirety. The details of the cost survey is described in section III.5. below. The private hospital in Dhaka was used both for comparative interest and to determine unit cost of care in the private sector.

Training of  
enumerators

Four doctors, two for outpatient department (OPD) and two for inpatient department (IPD), from each medical college hospital were recruited from the respective hospitals with selection consideration given to their familiarity acquaintance with the hospital. They were

trained for three days by the investigators from WHO in a single batch to have a common understanding of the questionnaires. A field training component in one of the medical colleges was included. To collect data on the hospital system cost, twelve enumerators were trained, three for each medical college hospital. A medical doctor acted as the supervisor of the team in each hospital. The rest of the two team members had health economics/ accounting background. Two of the researchers periodically visited the hospitals during the survey to monitor the enumeration.

Expert survey

An expert survey was designed to determine the impact of illness on daily lives (quality of life) and average duration of survival that allowed estimation of case fatality rate by interviewing the experts of relevant fields. 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).

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

Tobacco-related diseases	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

The survey was carried out in Dhaka, Chittagong and Rajshahi medical college hospitals. One hundred and twenty experts (5 from each speciality, 40 from each medical college) were interviewed. The ‘Quality of Life’ patients would have, if diagnosed at certain stage of illness and received full treatment, were determined. The scale takes into account five attributes, namely, mobility, self-care, usual activity, pain or discomfort and anxiety or depression. Each attribute has three levels—no problem, some problems and major problems—and each level has a unique coefficient. The score is calculated through a formula, which takes these coefficients into account. The score falls 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 done to supplement the data of our main study. The four medical college hospitals that we surveyed cater services for both tobacco-related and non-related diseases. They offer a level of treatment (as mentioned above), which may not be the best possible treatment available in the country. For example, medical colleges cannot offer percutaneous transluminal coronary angioplasty (PTCA) to a patient with heart attack, which is offered by the specialized hospitals. Keeping this in mind, this supplementary survey determined what the patients should get instead of what they are getting for treating their tobacco-related illnesses. This component of the survey was done in i) National Institute of Cardiovascular Diseases, ii) National Institute of Cancer Research and Hospital, iii) National Institute of Diseases of Chest and Hospital, and iv) Neuro medicine department of Bangabandhu Sheikh Mujib Medical University.

### **III.4. Secondary data**

---

As the task is to weight the costs imposed on society due to tobacco consumption against its benefits, information regarding benefits in the form of tax revenues and wage income from the production and distribution of tobacco and tobacco products were needed. The tax revenue and the wage of agricultural and industrial workers in Bangladesh are routinely documented by various statistical surveys and censuses. This study resorts to those secondary data from the published sources (BBS 2000, 2002). Data on number of hospitals, in-patients and out-patients were obtained from the Yearly Health Situation Report (IEDCR 2000).

### **III.5. Analysis of data**

---

As in most developing countries, Bangladeshi people do not necessarily visit the formal health care facilities to treat their ailments. Disease prevalence and behaviour associated with the occurrences of these illnesses have to be determined by examining data beyond records from health facility. Therefore, a household level survey was needed to complement information on the prevalence of illness obtained from the hospital-based surveys.

As the household survey is a population-based study without any interventions, we do not identify experimental or control group among the population. However, we are able to identify those with tobacco-related illnesses, who are essentially the experimental group, and those who do not have these illnesses constitute the control group.

The household survey helped determine population based risk ratios of tobacco-related illnesses and identify the determinants of accessing different types of health care services, out-of-pocket expenses and loss of income at the time of obtaining care due to illness. The risk ratios were

also determined through hospital survey data on patient conditions and when possible were compared to the risk ratios obtained from the household data.

The hospital cost survey was used to determine the unit cost of common procedure for treatment of these illnesses as well as the outpatient cost in Bangladesh. To determine the level of care devoted to the illnesses of concern, we apportioned the total hospital level cost in proportion to the prevalence of tobacco-related illnesses among all types of illnesses observed in the hospital outpatient survey.

Broadly speaking, there are three components of our analysis. First, we provide summary sample statistics for all of 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 examine 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. The analytical approaches stemming from the three components are described at length as follows.

### Epidemiological analysis

Population prevalence rates regarding the eight illnesses of interest were determined through the household survey. In order to attribute the level of illnesses directly to tobacco usage, likelihood of finding one of the eight illnesses, given the one consumes tobacco products, were determined through the use of risk ratios (RR). The standard formula for RR was used, which is essentially the ratio of proportion of illnesses among tobacco users to the proportion among non users in a given sample or a population:

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

where  $a$  and  $b$  are the number of the disease people among tobacco users and non users. The total number of tobacco user is  $a+c$ , with  $c$  being those who are smokers but do not have the illness of concern. Similarly  $b+d$  makes the number of non-smokers in the sample.

$RR$  is the likelihood of finding a person to be afflicted with a tobacco-related illness given that one is a tobacco user in comparison to someone who is not tobacco user. Given that there are multiple factors for causation of these diseases, attribution of tobacco to these diseases should be reported (Nakayama *et al* 1998, Nakayama *et al* 2000). To obtain how much of the population prevalence of the illness one can attribute to tobacco usage, one needs to know what proportion of the population is exposed to the particular risk of being a tobacco user. One needs to obtain the population attributable risk (PAR), which is 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  $RR$  is calculated by obtaining the figures  $a,b,c,d$  from the hospital IPD survey and  $P_e$  is obtained from the household survey.<sup>3</sup>

Death rates were determined through soliciting expert opinion on life-expectancy for various stages of the illnesses. For late stages of an illness it was assumed the treatment makes no difference (based on the expert survey described in Section III.3 above). The expert view incorporated the impact of intervention only at the early stage.

The number of deaths solely came from the late stage where we assumed uniform distribution of death over the

<sup>3</sup> The survey from the hospital yielded different PAR from the household survey PAR as expected. The lower PAR in the hospital could be due to lower attendance of tobacco users and we note hereafter that the poor use tobacco disproportionately at a greater rate. The PAR difference is about 5%.

remaining expected life as reported by the experts surveyed. This approach is described below in the section on indirect costs.

### **Analysis of direct hospital costs**

In order to obtain the costs of treating a patient for a tobacco-related illness we tried to obtain the costs of attending a patient in the OPD and one-day stay in the IPD with specialized costs needed for the cases we examined. In order to ascertain these costs we determined the entire costs of the hospitals. These costs then were apportioned to the OPDs and the IPDs. In what follows the details of the allocation method are provided. All costs defined here are consistent with the WHO guideline for cost-effectiveness analysis (Baltussen *et al* 2004).

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 centres. 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).

- i. 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 centres. 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.

- ii. Defining cost centres: The next step for computing unit costs is to determine the centres 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 criteria for choosing centres 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 centres that correspond to the existing organizational structure of the hospital. From an administrative standpoint, cost centres can be distinguished based on the nature of their work—patient care, intermediate clinical care and overhead centres. As explained below, some costs centres represent patient-centered activities (i.e., final or intermediate cost centres), while others are primarily for general services (i.e., overhead cost centres) such as housekeeping, laundry, maintenance, and many other tasks necessary for the satisfactory operation of a complex organization like a hospital.

- iii. 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) annualised capital costs.

The annualisation of capital costs involves standard steps as recommended by the WHO guideline for cost-effectiveness exercise (Baltussen *et al* 2004). Depreciation and longevity of costed items differ by types of items. A standard discount rate of 5% is used.

- iv. *Allocation of all costs to final cost centres:* The next step is to reallocate all direct costs to the final cost centres. Indirect costs, arising out of expenditure on items not directly used for patient care such as utility, land, etc., are also allocated similarly.
- v. Intermediate services, such as pharmacy and radiology, are allocated to each of the medical departments.

The allocation bases for the cost centres 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 centres 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 centre and can be represented through a step-down sequence. We use the step-down methods to identify the cost for those cost centres, which directly provide services for tobacco related illnesses. Although the aim is to allocate most of the hospital costs to final output centres, some costs are not relevant to tobacco related illnesses. We exclude those cost from the final measurement.

- vi. *Computing unit cost for direct cost centre:* At this point one can calculate the total costs that were incurred at each of the final cost centres. 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.
- vii. *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 critical depended on other estimates we obtained. It is explained in more details in the direct cost section.

## **Econometric analysis of household costs**

### Average out-of-pocket expenditure of outpatients

The out-of-pocket expenditure of households on health care (except hospital episodes) is determined by different household characteristics, such as, the age distribution and household size, income, wealth, food habit, among others, as well as the type of illnesses. It is expected that the presence of young children in the household would add to household health expenditure. So the number of household members aged below 15 years is likely to increase health expenses. In the absence of any accurate measure of household income, we have used monthly household expenditure as a proxy for income.

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, telephone, and so forth. The weighting of these indicators is done using factor analysis. The wealth index has been used to group the sample households into wealth quartiles.

In finding out how much health services cost to people in relation to the abovementioned determinants, we encounter a problem typical in any expenditure analysis. The survey shows that 60% of the patients diagnosed with tobacco-related illnesses do not seek any medical care. As a result, we have no data on health expenditure for such patients. We have data only on those people who actually sought health care.

If we use only the observed costs to estimate average cost, we would definitely underestimate the true cost to the diseased. A majority of them are not undertaking any expenses because these expenses may be prohibitively

high for them. The other possibility is that they are 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.<sup>4</sup> By using observations with positive health expenditure, this model imputes health expenditure to the 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.

#### Average out of pocket cost of inpatients

We expect that poor people would spend less for hospital care than the non-poor would. The poverty status of the sample inpatients is determined on the basis of an index of economic well-being. This index is constructed by factor analysis using their self-assessment on their well-being

<sup>4</sup> Let  $Y_i^*$  be the latent variable determined by a set of characteristics of household  $i$ ,  $X_i$ .  $Y_i^*$  in turn determines whether the household will incur health expenditure ( $Y_i$ ) or not. Formally,

$$Y_i^* = \beta' X_i + \varepsilon_i, \quad Y_i^* \sim N[\mu, \sigma^2],$$

$$Y_i = 0 \text{ if } Y_i^* \leq 0,$$

$$Y_i = Y_i^* \text{ if } Y_i^* > 0.$$

where  $Y_i^*$  is assumed to be normally distributed with mean  $\mu$  and variance  $\sigma^2$ . The set of parameters,  $\beta$ , reflect the impact of changes in  $X$  on the household health expenditure and  $\varepsilon_i$  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:

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

\*\*\* 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,  $E[Y_i | X_i] = \Phi\left(\frac{\beta' X_i}{\sigma}\right) \left(\beta' X_i + \sigma \lambda_i\right)$ , where  $\sigma$  is the standard deviation of the latent variable  $Y_i^*$ ,  $\Phi(\cdot)$  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.

regarding food, housing, health care, education and clothing. The patients at or below the median of the index are grouped as the poor and those above the poverty line are grouped as non-poor. This classification of people by poverty status is consistent with the approach of setting the poverty line at the median income level when income data was available.

The average hospital cost of inpatients is higher the longer the duration of stay in the hospital. The durations for lung cancer and stroke were obtained from the specialized hospital survey through expert opinion. For other illnesses it 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 have duration variable censored at the upper end, which is variant across the patients. We can reasonably claim that the inpatients who have been admitted just on the date of the interview or a few days ago would continue to stay in the hospital longer. 50% of the sample report duration of less than or equal to 3 days. 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 Tobit model again to predict the complete duration of the right-censored observations.<sup>5</sup>

<sup>5</sup> 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,

$$\begin{aligned} Z_i^* &= \beta' X_i + \varepsilon_i, & Z_i^* &\sim N[\mu, \sigma^2], \\ 0 &= Z_i \leq 3 \text{ if } Z_i^* \leq 3, \\ Z_i &= Z_i^* \text{ if } Z_i^* > 3. \end{aligned}$$

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

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

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

Then the expected duration of stay for each patient is predicted using the conditional censored mean,  $E[Z_i | X_i] = \Phi\left(\frac{\beta' X_i}{\sigma}\right) (\beta' X_i + \sigma \lambda_i)$  where  $\sigma$  is the standard deviation of the latent variable  $Z_i^*$ ,  $\Phi(\cdot)$  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 estimate a weighted ordinary least squares regression function of hospital cost.<sup>6</sup>

### Probability of tobacco-related illnesses

---

The probability that an individual will have one of the eight tobacco-related illnesses is found to depend on his/her tobacco usage, prevalence of high blood pressure, age, gender, food habit, and education, among others. By tobacco users, we mean both smokers and chewers of tobacco who either discontinued using tobacco some time ago or are still using it. We expect that tobacco users have a higher probability of falling ill than the non-users. High blood pressure is likely to be associated with these illnesses as well. Good food habit is expected to enhance healthy life and thus lower the probability of falling ill. As a proxy for food habit, we have used information on the weekly intake of leafy and other vegetables of individuals

---

<sup>6</sup> Hospital cost =  $-21375.72^{***} + 1686.69$  (Dummy for men) + 168.70 (Age) + 1029.95<sup>\*\*\*</sup> (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<sup>\*\*\*</sup> (Dummy for tobacco-related illnesses) + 1078.55 (Predicted duration of hospital stay) + 467.76 (Dummy for CMCH) + 22123.67<sup>\*\*\*</sup> (Dummy for DMCH) + 12567.02<sup>\*\*\*</sup> (Dummy for RMCH) + 17113.87<sup>\*\*\*</sup> (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.

measured in servings of spoon. Education plays the role of a proxy for individual earning capability as well as health awareness that contribute to lower probability of illness.<sup>7</sup>

## Assessment of net cost of tobacco usage

There are two steps necessary to calculate the net cost of tobacco usage to Bangladesh 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 of Bangladesh have been used to supplement the primary data collected through the sample surveys undertaken by this study.

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 using the total value added in the tobacco industry, as noted in the Bangladesh Bureau of Statistics reports, and then dividing by the number of workers in the industry in previous years. This average figure is then adjusted for inflation. Apparently, the wages used for

<sup>7</sup> 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 use a probit model that estimates 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 ( $Y=1$ ) =  $\Phi(\beta'X)$

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

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  $\hat{\alpha}$  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.

tobacco workers are slightly higher than the national average.<sup>8</sup> From this figure average consumption is subtracted to obtain net wages.

### Direct costs

The direct costs incurred by the patients, both for hospital and non-hospital care, are derived according to the econometric method explained in the current section and the health system costs.

This study was not able to collect the costs of typical care for most of these illnesses directly. We do 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 inpatients cost to the number of inpatients suffering from 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 determined to be 191 taka, for all illnesses. The inpatient bed-day costs for the hospitals differed in the four hospitals with the private hospital costing the highest.<sup>9</sup> The average cost was 726 taka.

The bed-cost in specialized hospitals were similar; however out of pocket expenditure was much higher. For example for treating lung cancer the costs ranged from 60,000 taka to 500,000 taka for different stages of illnesses. As much of this is out of pocket costs it was difficult to determine the exact cost without a large sample. We do not incorporate the costs from the

<sup>8</sup> The overestimation is partly due to the fact that the value added, used for the calculation of wage rate, includes return to capital employed in tobacco industry as well, which cannot be isolated given the secondary data. Besides, the number of tobacco workers includes both industrial and farm labourers. There is no denying the fact that industrial wage, as attributed to the wage income in the tobacco sector, is an overstatement of agricultural wage. Thus the wage benefit of tobacco is overstated.

<sup>9</sup> Bed-day costs from medical college hospitals:

	Bangladesh	Chittagong	Dhaka	Rajshahi
Costs (Taka)	1198.43	462.14	1010.44	704.96

specialized hospitals into the large study. We note that the costs would be much higher and much of it within the present system be borne by private individuals.

The number of outpatient that suffered the eight illnesses of concern was found to be 8% of all hospital outpatients. This value was extrapolated to all Bangladeshi outpatients. We observed that 24% of all IPD patients in Bangladesh were hospitalised due to tobacco-related care; this amounts to nearly 14% of all patients in the population afflicted with these illnesses obtaining inpatient care.<sup>10</sup> We believe that additionally 5% of those afflicted that should be going to hospitals do not obtain care. Thus in total 19% of all the cases we are likely to observe in the population need IPD care. However, we assumed that perhaps some may not attend hospital even if the referral system improves soon. Thus a conservative estimate was obtained that only 15% (463,000) of all the eight cases would show up in IPD ward for now. The composition of illnesses in the IPD obtained from the hospital survey was maintained to distribute the number of patients within the eight disease categories.

It is likely that the hospitals in the survey are more equipped to handle the eight illnesses of our concern than other hospitals in Bangladesh. Thus that we observe 24% of all cases in the hospital are our cases is likely an over-estimate of the actual attending IPD. On the other hand, our estimate of about 19% of cases of the eight illnesses needing hospital probably should receive care. Our estimate of 15% attending IPD care in the near future is appropriate (only 3 times the number actually attending currently when we have nearly 60% of cases undetected in the population)<sup>11</sup>; and the speculation that 19% of all 2.9

<sup>10</sup> Some Bangladeshis receive care abroad. This cost is not shown within the 15% we think are likely to be attending IPD within the near future. The expert survey yielded varied numbers; for lung cancer could cost as much as 1 million taka, depending on the country and hospital for the treatment (and number of accompanying persons).

<sup>11</sup> Only 5% of all cases found in the population were hospitalized in our survey, while 60% of the cases diagnosed had not received any care at all. These people would be eventually diagnosed and attend hospital, nearly doubling the number presently. Thus it is likely that a better referral system could increase the proportion attending care to 15%. Further, it is likely that there may be a significant number of patients who will never attend hospital; that is 4% will go completely undetected in the near future.

million cases in the population should attend IPD care is an underestimate.

### Indirect costs

In order to calculate the indirect costs, three steps were needed: (i) the calculation of the number of dying and disabled and associated costs (ii) due to deaths and (iii) due to disability.

(i) Assessing the number of the dead and the disabled: It was determined that all deaths in a given year would come from those at the late stage of the illnesses. The proportions of the patient at different stages for different illnesses were reported by experts.<sup>12</sup> The number of patient 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 the eight illnesses were considered disabled and the degree of disability was determined from Table 4.

(ii) 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 the possibility of survival to age 55. Thus for 17 years wages would be earned at the labour force participation rate and

<sup>12</sup> The proportions of dead and disabled by stages of illness and hospital departments:

Illness	Hospital Department	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%

expenditure would be incurred due to consumption. Using the following formula, the net wages (wages minus the stream of consumption) lost was calculated:

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

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.<sup>13</sup> The discount rate is 5%. Wage and expenditure are taken to be non-variant in time.

- (iii) Costs due to disability: The disability was calculated according to disease specific EuroQol rating (see Expert Survey in Section III.3). It was assumed that earning would decrease by the disability level. The net loss would be this wage loss minus the expenditure. This calculation is made for one year.

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

- (i) cost borne by households;
- (ii) cost borne by the health system;
- (iii) cost borne due to loss of employment stemming from disabilities and deaths;
- (iv) psychic cost due to reduction of loss of enjoyment of a healthy life; and
- (v) expenditure on tobacco as it deprives families of other necessary consumption such as food, child education etc.

Assuming that some of tobacco consumption is purely due to addiction, we have left out component (v) from tobacco costs, as acceptance of this fact may entail from the beginning that tobacco usage adds no benefit to society.

<sup>13</sup> 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.

We have also excluded (iv) as it is difficult to measure. However, the theoretical foundation of such a measure is sound. Thus we have under-estimated the cost of tobacco-related illnesses.

Summary of constructed variables

A synopsis of the variables worked out in course of the analysis and the corresponding methodology for the calculations of these variables is 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 survey	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

<b>Variable description</b>	<b>Data sources</b>	<b>Inference</b>	<b>Population level generalization</b>
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



## **Chapter : IV**

Results



## IV. RESULTS

### IV.1. Tobacco usage

Tobacco usage is high among the Bangladeshi population. In total 55% of the population are habitual tobacco users—either through smoking, oral intake or sometimes both. This study has corroborated smoking usage with a breath test.<sup>14</sup>

Current smoker rate among hospital patients is 76% among men, while the comparable figure for women is 7%. In the hospital survey, while non-smoking tobacco-usage rate among men is found 25%, the comparable figure is 20% for women. Table 5 summarises this information. The

**Table 5: Tobacco usage in population and hospital outpatients aged 30 years or older**

Descriptions	Household (n = men 2276, women 2118)			Hospital outpatients (n = men 758, women 667)		
	Smoker <sup>1</sup>	Chewer <sup>2</sup>	Either <sup>3</sup>	Smoker <sup>1</sup>	Chewer <sup>2</sup>	Either <sup>3</sup>
Men <sup>4</sup> :						
Prevalence (%)	58	23	68	76	25	79
Starting age of tobacco usage, y	20	24		20	19	
Duration of tobacco usage, y	20.3	15.4		19.8	20.7	
Frequency of tobacco usage/day	12.8	7.0		10.4	8.7	
Women <sup>5</sup> :						
Prevalence (%)	4	40	42	7	20	25
Starting age of tobacco usage, y	26	29		20	19	
Duration of tobacco usage, y	25.5	18.2		17.6	18.9	
Frequency of tobacco usage/day	7.0	7.3		9.3	10.2	
All :						
Prevalence (%)	31	32	55	48	22	57

Results are mean, unless indicated otherwise.

<sup>1</sup> Those who are currently smoking and those who quit smoking within 6 months prior to the survey.

<sup>2</sup> Those who are currently chewing tobacco or using any other form and those who quit within 6 months prior to the survey.

<sup>3</sup> Any form of tobacco (smoking or non-smoking) user.

<sup>4</sup> Mean age for household participants, 46 y; outpatients, 46 y.

<sup>5</sup> Mean age for household participants, 45 y; outpatients, 44 y.

<sup>14</sup> While 91% of never smokers showed low carbon mono-oxide level (10 ppm), 25% of smokers showed such low levels. High level of carbon mono-oxide was present among 75% of smokers, the comparable rate was 9% for never-smokers.

household survey indicates that 58% of men and 4% of women are smokers. The chewers are greater in proportion among women (40%) than among men (23%).

Table 6 provides information on the characteristics of inpatients classified by tobacco-related illnesses and non-tobacco-related illnesses as obtained 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.

**Table 6: Tobacco usage among inpatients aged 30 or above<sup>1</sup>**

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 <sup>2</sup> , mean	15.2	17.1	12.2
Times chewed per day <sup>2</sup> , mean	6.7	6.8	6.4

<sup>1</sup> Results are %, unless indicated otherwise.

<sup>2</sup> For current users.

#### IV.2. Illnesses

Illness profile at the population level is determined mainly through a household survey. The findings are supplemented by data collected from hospital on disease profile both at the inpatient and outpatient levels to give a more detailed account of profile of these illnesses in Bangladesh. We predict that 2.9 million cases of the eight-

Table 7: 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	RR1	PAR <sup>2</sup>	Per 1000	Total No. of Cases	No. of cases attributable to tobacco usage
Ischemic heart disease	53	26	52	25	105	25		0.19 <sup>3</sup>	22.59	735,856	139,813
Stroke/TIA <sup>4</sup>	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		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	0.22	71,413	51,417
COPD <sup>4</sup>	92	45	46	22	138	33		0.62	29.69	967,126	595,053
Pulmonary tuberculosis	33	16	13	6	46	11		0.47	9.86	322,375	151,499
Total	241	117	168	81	409	99		0.41 <sup>5</sup>	88 <sup>6</sup>	2,937,101	1,226,251

<sup>1</sup> RR (risk ratio) refers to the proportional likelihood of finding an illness when one uses tobacco in comparison to non-tobacco user. Thus in this case the 5.48 would indicate that someone using tobacco (a smoker in this case) is 5.48 times more likely to be afflicted with lung cancer than the non-smoker would be. All RR here are obtained from the population sample except for laryngeal cancer where RR is obtained from hospital data. Laryngeal is usually difficult to diagnose verbally. The reported RRs are the only ones found to be of statistically significant value.

<sup>2</sup> PAR (population attributable risk) in this case refers to the proportion of cases in the population that can be attributed to tobacco usage. Thus 0.71 for lung cancer entail that 71% of all cancer among men can be attributed to tobacco.

<sup>3</sup> These PAR were obtained by clumping all remaining illnesses for which we didn't find significant RR; the overall RR is significant.

<sup>4</sup> TIA indicates transient ischaemic attack; COPD, Chronic obstructive pulmonary diseases.

<sup>5</sup> This value is not a PAR, just a proportion obtained from summing all individual illnesses.

<sup>6</sup> Obtained through probit analysis.

tobacco related illnesses can be found in the population of which 1.2 million can be attributed to tobacco usage (Table 7).

To be more specific, the prevalence of lung cancer among men is about 150 thousand, of which about 106 thousand can be attributed to tobacco usage. In the population we are likely to observe about 71 thousand cases of laryngeal cancer, of which about 51 thousand cases can be attributed to tobacco usage. The former figure is obtained from the household survey, while the latter figure is 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 report only hospital level figures. The hospital data indicates that more than 72% of laryngeal cancer can be attributed to tobacco usage (reported in the column of PAR in Table 7).

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.

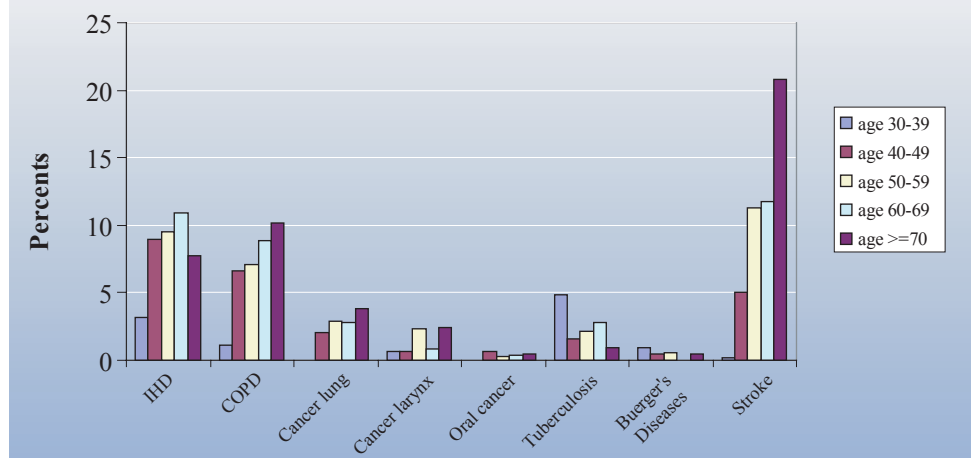
This study predicts a smaller prevalence rate of tobacco-related illnesses than the sample rate. While the sample suggests that we should observe 9.9% prevalence of all the eight diseases among Bangladeshis of age 30 and above, the predicted value, when population level determinants are taken into account, stands at 8.8% (obtained from the probit estimation described in Section III.5 above). Table 7 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 8: Prevalence of eight tobacco-related diseases among patients aged 30 and above of four medical college hospitals**

Diseases	OPD <sup>1</sup> and emergency		IPD <sup>1</sup>	
	number	%	number	%
<b>Men</b>	<b>(n=1118)</b>		<b>(n=1242)</b>	
Ischaemic hear disease	12	1.1	108	8.7
Chronic obstructive pulmonary disease	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
<b>All</b>	<b>100</b>	<b>8.9</b>	<b>394</b>	<b>31.7</b>
<b>Women</b>	<b>(n=916)</b>		<b>(n=507)</b>	
Ischaemic hear disease	6	0.7	27	5.5
Chronic obstructive pulmonary disease	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
<b>All</b>	<b>46</b>	<b>5.0</b>	<b>118</b>	<b>24.2</b>
<b>Men and Women</b>	<b>(n=2034)</b>		<b>(n=1749)</b>	
Ischaemic hear disease	18	0.9	135	7.7
Chronic obstructive pulmonary disease	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
<b>All</b>	<b>146</b>	<b>7.2</b>	<b>512</b>	<b>29.3</b>

<sup>1</sup>OPD indicates outpatient department; IPD, inpatient department.

**Fig 2. Age-specific prevalence of tobacco-related illnesses among inpatients of four medical college hospitals (except paediatric, psychiatric and gynaecology-obstetric patients)**



Tables 8 reports the prevalence of tobacco-related diseases from the hospital survey. It is observed that 7% of outpatients and 29% of inpatients aged 30 or above (24% of all in patients) are due to these diseases. The age-specific prevalence of tobacco-related illnesses among inpatients is depicted in Figure 2. Table 9 explores the relation between tobacco usage and illness using hospital inpatients data. However, this information has not been used for extrapolation. We note as expected the relation between tobacco usage and illnesses is stronger in the hospital than that found in the household.

### IV.3. Knowledge of tobacco and illnesses

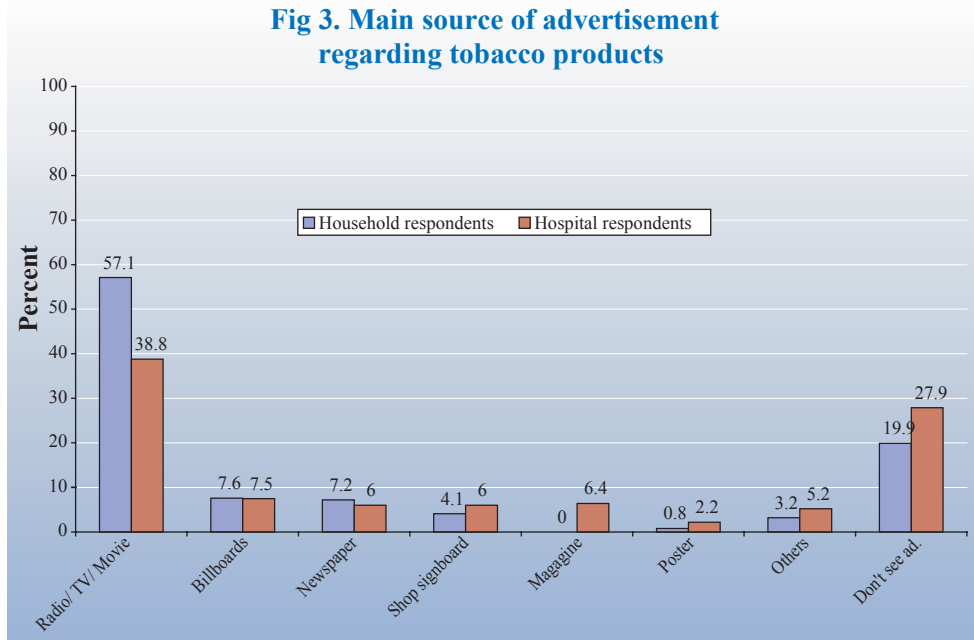
Two policy instruments often adopted to combat tobacco-related illnesses are (1) to limit advertisement and (2) to make people aware of the link between tobacco-related illnesses and tobacco. Figure 3 describes the sources of advertisement of tobacco products to which the respondents in the surveys were exposed. Figure 4 shows the source of

**Table 9: Relative risk (RR) and population attributable risk (PAR) of diseases for tobacco usage from the hospital survey**

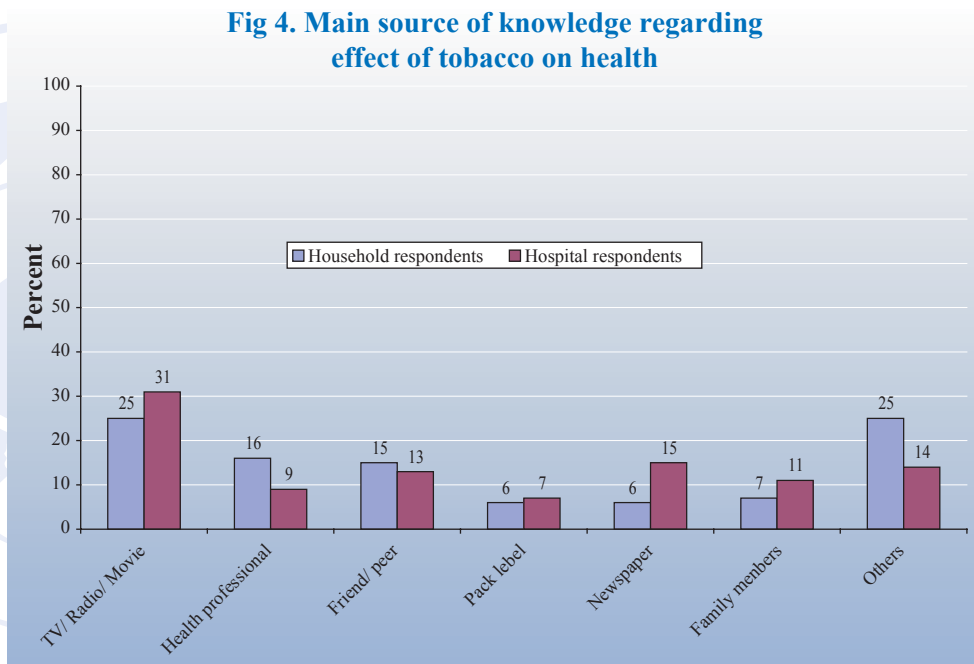
Diseases	Smoking tobacco		Non-smoking tobacco*	
	RR	PAR%	RR	PAR%
<b>Men</b>				
Ischaemic hear disease	1.7	33.6	2.6	32.5
Stroke	1.5	25.9	2.1	23.8
Buerger's disease	5.8	54.7	1.8	16.1
Oral cancer	4.5	71.3	4.9	48.1
Lung cancer	6.2	79.4	1.2	3.9
Laryngeal cancer	12.6	89.4	1.5	10.2
Chronic obstructive pulmonary disease	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
<b>Women</b>				
Ischaemic hear disease	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
Chronic obstructive pulmonary disease	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
<b>Combined</b>				
Ischaemic hear disease	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
Chronic obstructive pulmonary disease	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

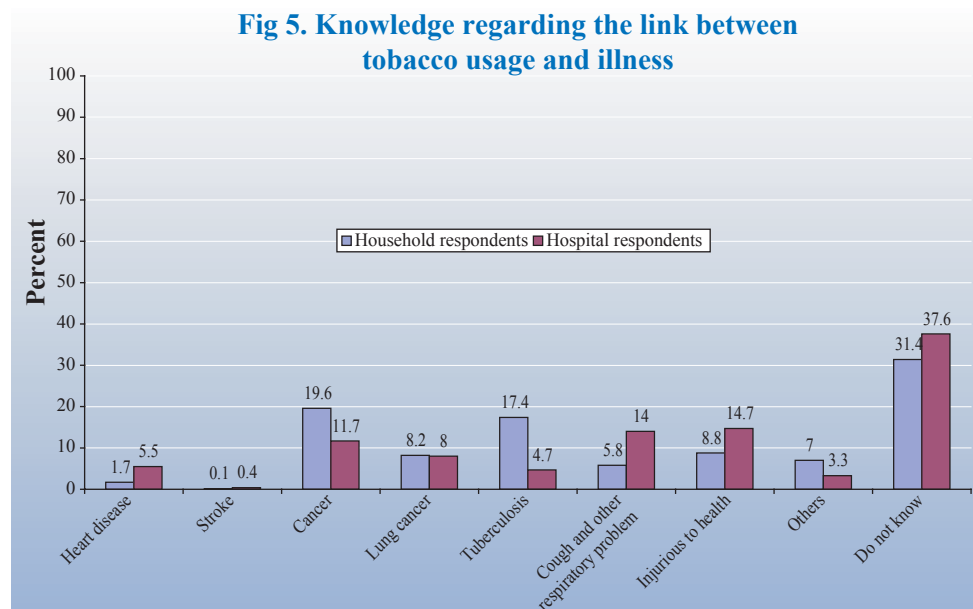
\* Proportion of patients using either form of tobacco is higher in this group.

**Fig 3. Main source of advertisement regarding tobacco products**



**Fig 4. Main source of knowledge regarding effect of tobacco on health**





knowledge that links tobacco usage with different types of illnesses. Figure 5 reports awareness of the link between tobacco usage and illnesses. Although nearly 95% were aware about the harmful effects of tobacco on health, they do not necessarily have knowledge about the specific outcomes. One-third in households and two-fifth in hospitals do not know clearly. Television is one of the main sources for both providing the knowledge of this link and providing exposure to the lure of tobacco usage.

#### IV.4. Tobacco usage and poverty

It is evident from our study that in Bangladesh, the tobacco users across all economic groups (classified by wealth quartiles) spend around 4.5% of their total monthly household expenditure on tobacco consumption, as reported in Table 10. This percentage is slightly higher (5.1%), when we observe the tobacco users inflicted with the eight tobacco-related diseases. The variation of the allocation of household expenditure to tobacco consumption is not discernible across economic groups.

**Table 10: Average monthly household health expenditure vis-à-vis monthly expenditure on tobacco for the cases of tobacco-related illnesses in Bangladesh by wealth quartiles**

Wealth quartile	Tobacco-related illnesses						Expenditure on tobacco as a percentage of total household expenditure by all tobacco users
	Average health expenditure (Taka)	Average household expenditure (Taka)	Health expenditure as a percentage of total household expenditure	Expenditure on tobacco (Taka)	Expenditure on tobacco as a percentage of total household expenditure	Expenditure on tobacco as a percentage of total household expenditure by all tobacco users	
First	311	3271	11.4	116	4.2	4.5	
Second	457	4964	8.7	172	3.8	4.0	
Third	992	7055	12.6	389	5.8	4.4	
Fourth	1205	23953	6.8	956	6.7	5.3	
All	740	9237	10.2	379	5.1	4.5	

Notes: 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, telephone, and so forth.

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

The average household expenditure for tobacco-related illnesses goes up by the wealth status of the household.

Table 10 further shows that the percentage of monthly household expenditure devoted to the treatment of tobacco-related diseases averages to 10.2%, which is twice as much as spent on tobacco consumption. However, the poorer spend relatively greater proportion of their household resources compared to those at the top economic group. It implies that the poorer segment of the population is relatively more exposed to the adverse consequences of tobacco usage.

#### **IV.5. Health seeking behaviour**

Our household survey indicates that most of the cases of tobacco-related illnesses in the households were not diagnosed before our visit. Thus until our effort to diagnose such illnesses the 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 currently Bangladesh is under-spending in the treatment of tobacco-related illnesses. In the present analysis, we adjust only marginally for this under-spending when predicting the out of pocket expenditure (see Econometric Analysis in Section III.5 above for the method of adjustment using censored regression or “Tobit” model).

#### **IV.6. Direct cost of illnesses**

Direct costs are separated by two types of costs: (1) out-of-pocket expenditures that are borne by households which include costs borne away from medical facilities as well as cost of hospitalisation and (2) costs borne by the health system in the public sector.

(1) Out-of-pocket expenditure

We report out-of-pocket expenditure that families might incur when they face tobacco-related illnesses in Table 11. It shows that when a household member is afflicted by one of the eight diseases on average 1,275 taka is incurred by the household when no hospitalisation occurs. This cost rises to a high level when someone in the household is hospitalised to 22,528 taka. The poor undertake on 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

**Table 11: Average predicted out-of-pocket expenditure (Taka) by type of illnesses**

	Tobacco-related illnesses		Non-tobacco-related illnesses	
	Non-hospital expenditure	Hospital expenditure	Non-hospital expenditure	Hospital expenditure
Average predicted expenditure	1,275	22,528	1,199	15,995
Standard error	8	607	8	1052
Number of observations	377	602	101	420

Note: 1. The average predicted non-hospital expenditure is obtained from the household survey and the average predicted hospital expenditure is obtained from the hospital cost survey of inpatients at the four sample medical college hospitals.  
 2. For the details of estimation from the household survey and from the hospital cost survey, see the Econometric Analysis Section .

other illnesses. This high cost may help explain why households do not often seek care; as we find only 41% of those who have the eight illnesses among the sample households actually sought care. The average household expenditure for tobacco-related illnesses appears to be positively related to the wealth status of the household.

(2) Cost borne  
by the health  
system

Health system incurred 191 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 illness as the number of hospital stay varied. The hospital stay was based on survey carried out for the specialised hospital with experts. While we estimated that the average stay for lung cancer was 30 days, it was 20 days for COPD, stroke and IHD. The cost of tuberculosis treatment is from secondary data.<sup>15</sup> The information regarding hospital unit cost is reported in Table 12.

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

Description	Amount
<b>A. Hospital costs borne by the health system</b>	
(a) OPD <sup>1</sup> : Unit cost	191
Total usage	1,369,443
Total cost of OPD usage	261,000,000
(b) IPD <sup>1</sup> : Unit cost:	
Stroke, IHD and COPD <sup>2</sup>	16,766
Lung cancer	25,046
Tuberculosis	20,827
All others	6,534
Total usage	463,000
Total cost of IPD usage	8,304,650,876
Total cost (a+b) of health system	8,565,705,229
<b>B. Costs borne by the households (out-of-pocket expenditure)</b>	
Cost borne by non-hospitalised patients	1,825,697,881
Hospitalised patients	10,436,805,432
Total out-of-pocket expenditure	12,262,503,313
Total (A+B)	20,882,343,767
Attributable to tobacco (41%)	8,561,760,944

<sup>1</sup>OPD indicates outpatient department; IPD, inpatient department.

<sup>2</sup>IHD indicates ischaemic heart disease; COPD, chronic obstructive pulmonary disease.

<sup>15</sup> Personal Communication : Dr. Marijke Becx-Bleumink, WHO Bangladesh.

The assumption that 19% of all cases of the illnesses we found in the population should attend hospital is an over-estimation of the actual number that attended; it is more likely about 13-14% of attended care. The reason for basing the calculation on a more ideal number is simple. The actual number reflects unawareness of illnesses as well as lack of utilization of health services as our household survey indicated. This figure for IPD attendance was used to calculate the cost to the health system. We calculate this cost, not what is being undertaken, as this potential cost would come to place if the health system can now made to work somewhat more efficiently. Thus the total number of IPD patients should be around 463,000 for all the eight illnesses that we examined.

The number 463,000 was distributed to different illnesses as found in the IPD ward. Then the unit cost was multiplied to the respective numbers. In all cases no significant adjustment was necessary in regards to any particular illnesses. We obtain a total cost of 8.3 billion taka with respect to hospital inpatient cost.

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 191 taka, which yielded the OPD cost to be 0.26 billion taka. The total cost to the health system then should be 8.6 billion taka. The total health system cost attributed to tobacco (41%) is 3.5 billion taka. Table 12 details these costs.

The total direct costs of tobacco related illnesses amounted to 20.9 billion taka, of which 8.6 billion taka can be attributed to tobacco usage. These costs are detailed in Table 12.

#### IV.7. 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 an expert (physicians) survey regarding approximate longevity of life when one is afflicted with 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 (16% of all deaths, age  $\geq 30$ ) were caused by tobacco-related illnesses of which 57,583 (8.7% of all illnesses, age  $\geq 30$ ) can be directly attributed to tobacco usage. These people on

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

Diseases	Deaths	Attributable to tobacco	Disability (in a given year)	Disability attributable to tobacco
Ischaemic 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
Chronic obstructive pulmonary disease	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 death ( $\geq 30$ y)	16	8.7		
Total deaths in Bangladesh ( $\geq 30$ y) (Lopez <i>et al</i> 2002).		658,751		

average lose 17 years of life some of which are working years (Lopez *et al* 2002). These 17 years are ‘conditional life expectancy’- indicating that if a person survives upto 55 years s/he is expected to live 17 more years. The discounted (at 5%) stream of net wages lost is due to these years lost. We assume that as these workers are older and more experienced they cannot be replaced directly.

**Table 14: Costs and benefits of tobacco usage (Taka)**

Description	Amount
<b>Direct costs of medical care</b>	<b>20,828,343,767</b>
Health system cost	8,565,705,229
Out-of-pocket cost	12,262,503,313
<b>Indirect costs</b>	<b>46,012,696,659</b>
Loss of net-wages due to deaths	16,150,005,664
Current year loss of net-wages due to disability	29,862,690,664
<b>Total costs imposed on society due to the prevalence of tobacco-related illnesses</b>	<b>66,895,040,426</b>
<b>Total costs imposed on society directly due to tobacco usage<sup>1</sup></b>	<b>27,426,966,575</b>
<b>Total benefit<sup>2</sup></b>	<b>24,832,089,768</b>
Total revenue collected	20,348,800,000
Net-wage labour earned <sup>3</sup>	4,483,700,000
<b>Net-costs on society due to tobacco usage</b>	<b>2,594,876,807</b> <b>(equivalent to US\$ 44 million<sup>4</sup>)</b>

Notes: 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 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.

The mortality numbers were calculated by making a few assumptions regarding severity of cases among the people actually attending care. Similar assumptions were extended to people who should be attending. We have collected expert opinions to determine the impact of these illnesses on daily lives with and without treatment. Using the EuroQol method through obtaining the expert view, it was estimated that on average those living with the eight illnesses will be impaired by 32 % (see Expert Survey in Section III.3). Thus all activities of these individuals are approximately reduced by 32%. This loss is accounted for the current year only; and this cannot be compensated by a situation of surplus labor in a short time such as 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 is approximately 46 billion taka. Table 14 details the costs, as well as summarise the cost-benefit calculations.

#### **IV.8. Cost-benefit of tobacco consumption**

The benefit of tobacco consumption is mainly due to 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 do not include the value of tobacco export, as that value does not depend on domestic tobacco consumption.

The revenue calculation is composed of VAT and supplementary duties which amount to 20.3 billion taka in 2001. The net wage earnings from tobacco sector, given by the wage net of average consumption, amounts to 4.5 billion taka a year.

Thus the approximate benefit is 24.8 billion taka, which is roughly 1 % of current Bangladeshi GDP (see Table 14 for the breakdown of the costs).

Profits of this industry have not been included, as no figures were found for this amount. It is uncertain as to how much of it is remitted outside. Further one may view profit as a transfer of income from other sources of income while taxes have multiplier effect. One further note is that we have not been able to account for tobacco import which may contribute to negative balance of trade.

The total annual costs incurred due to tobacco-related illnesses amount to 66.9 billion taka, when both direct and indirect costs are taken into account. Of this total, 27.4 billion taka can be attributed directly to tobacco usage. The net difference between costs due to tobacco-related illnesses directly attributable to tobacco and benefits from tobacco usage is nearly 2.6 billion taka per year that taxes nearly 0.1% of the current GDP of Bangladesh.



## **Chapter : V**

# Discussion

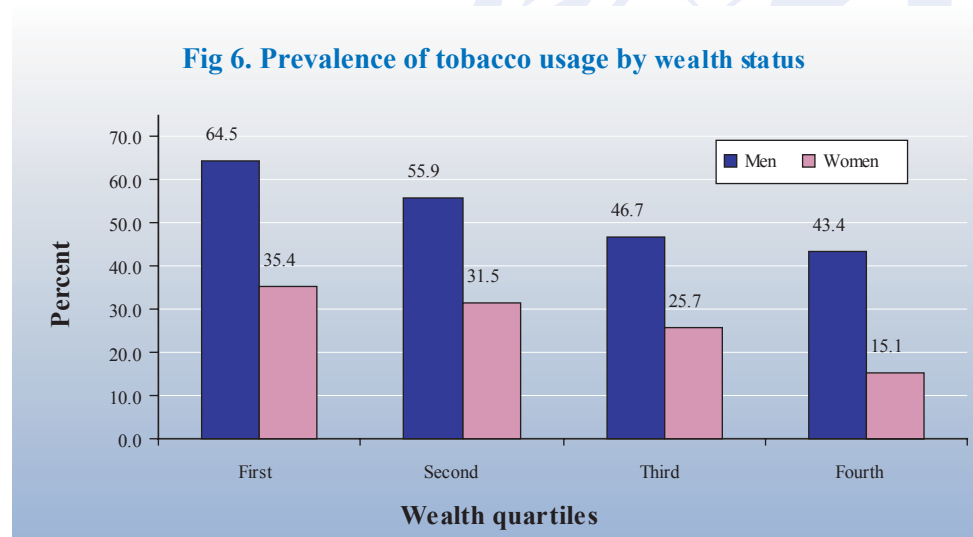


## V. DISCUSSION

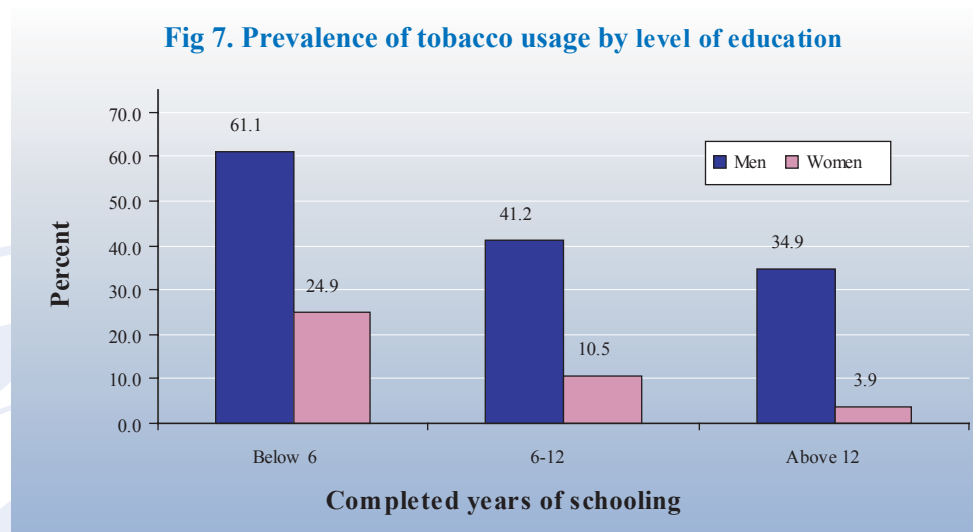
### V.1. Discussion

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 observes that the cost of tobacco largely outweighs its benefit. Tobacco-related diseases are commonly prevalent and consequent mortalities are high. These phenomena cost the society much resources which could be used otherwise in meeting 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, is higher among the lower economic class of

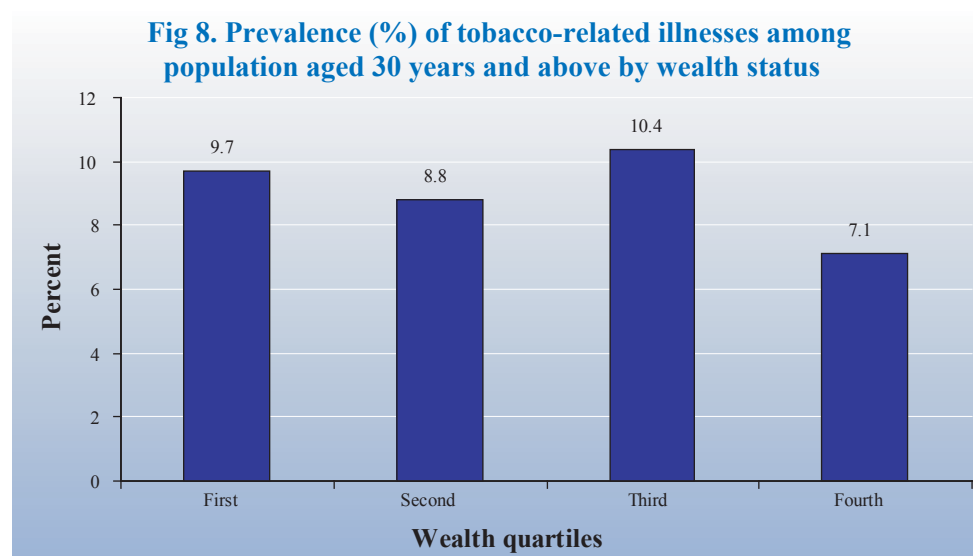


people. This is true for both men and women, the percentage being higher for men than for women across all wealth quartiles, as shown in Figure 6. The prevalence of tobacco usage drops substantially with higher level of education in Bangladesh, more strikingly for women than for men as shown in Figure 7. 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 7), the prevalence is higher in lowest quartile than other quartiles except the third. This finding is consistent with the finding on health expenditure as a percentage of total household expenditure shown in Table 10. Absence of relevant population-based data on these diseases does not allow this study an in-country comparison of prevalences. The predicted prevalence of pulmonary tuberculosis is a

little higher than that found in other studies (7 per 1000 for age 15 or above),<sup>16</sup> because of the difference in age group composition, given that the highest prevalence is observed in 30-39 years (Figure 2). The prevalence of oral cancer is also higher than the finding of another study in 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 reveals that the older and retired people incur the larger amount on outpatient care among all occupational groups for both tobacco-related and non-tobacco-related illnesses. The patients suffering from tobacco-related illness who are engaged in trade, transport sector, and services spend the next largest amounts followed by the agricultural population. The day labourers and the unemployed spend the least as they belong to the poorest income group and have not much to spend on anything including tobacco. In Bangladesh, because of very low wages rates, cigarettes are least affordable, even though prices of local brands are among the lowest (*de Beyer and Brigden 2003*).

<sup>16</sup> Personal Communication : Dr. Marijke Becx-Bleumink, WHO Bangladesh.

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 highly toxic products, and a highly negative impact on the environment make the production and use tobacco an issue inextricably linked to poverty. This is more of a concern in view of the remarkably increasing trend in cigarette and bidi production in Bangladesh since 1980 (BBS 2000). From 1988-89 to 1999-2000, the volume of production of cigarettes increased by about 40%, while that of bidi increased by about 295%. The fact that tobacco consumption imposes higher cost on the people at the lower socio-economic status has important implication for the tobacco control policies and legislation.

The counter argument that less tobacco consumption would result in net loss of jobs can be refuted. As a matter of fact, the net change in jobs would depend on whether the money saved from decreased tobacco usage would be spent on goods and services produced in more or less labour-intensive ways compared to cigarettes. In Bangladesh, cigarette manufacturing is only a small source of jobs (*see footnote of Table 14*), as it is usually highly mechanized. So those who would lose jobs in the tobacco industry are likely to be absorbed in other more labour-intensive industries.

Besides, the agricultural labourers freed from tobacco cultivation can be employed in producing other crops as the land would be freed as well and reallocated to those crops. Although, tobacco is a minor crop in Bangladesh, 123,000 acres of land are currently devoted to the production of tobacco. This constitutes a serious loss of land which might otherwise be used to grow rice needed. It is estimated that the annual rice production loss attributable to the use of land to grow tobacco is equal to half of the country's yearly food grain deficit (Cohen 1981). Substitution of tobacco cultivation by maize has been

reported to be attractive. Although incentives to the farmers by the government would be necessary, it is not very optimistic to say that cultivation of food grains can replace tobacco in a profitable way in 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 showing negative trade balance in this sector (Ali *et al* 2003). It indicates that Bangladesh would especially benefit from decreasing cigarette consumption, as it would help reverse the negative trade balance and divert resources to goods and services produced domestically.

Present study shows that the total cost of tobacco-related illnesses amounts to 66.9 billion taka. Of this, 27.4 billion taka can be attributed to tobacco usage. This is a huge cost to an economy like Bangladesh. This study has accounted for most of the cost that can be attributed to tobacco usage. The cost reported here, although highly significant is still likely to be an under-estimation for the following reasons:

1. This study has not fully accounted for the fact that better health care seeking behaviour would entail significant increase in IPD and OPD attendance, raising the direct medical costs. This number is likely to be higher than the 15% of all the cases of the eight illnesses we report.
2. This study has not been able to include those who sought care abroad. As suggested by our expert survey, these patients incur high costs that are surely a burden on the economy, although it is difficult to get the exact number of patient going abroad.
3. The estimates of prevalence of tobacco-related illnesses are likely to be an undercount as this study did not include patients suffering from tobacco related illnesses aged below 30 years.

4. Women and children suffering from environmental tobacco smoke (ETS) related diseases like acute respiratory illnesses, premature birth and low birth weight were not included.
5. The list of tobacco-related diseases are not exhaustive. There are other diseases related to tobacco usage, although their contribution is considered to be minimal.
6. Cost of absenteeism due to these illnesses that most tobacco user endure throughout their lives before being incapacitated was not included.
7. The benefit of tobacco in terms of wages is over-estimated (see footnote on page 36).



## V.2. CONCLUSION

This study concludes that:

- Tobacco-related illnesses account for 16% deaths in Bangladesh among people aged 30 years and above. More than half of this can be attributed to tobacco usage. These people on average lose 17 years of life some of which are working years.
- Hospital sample shows tobacco-related illnesses account for 29% of all the inpatients aged 30 years and above or about 24% of all patients in the IPD.
- Tobacco-related illnesses impose a cost of 66.9 billion taka on the economy, of which 27.4 billion taka can be attributed directly to tobacco usage.
- 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 outweighs the benefit from tobacco by 2.6 billion taka.
- It is the poor who smokes the most and who bear most of the economic and disease burden of tobacco usage.

The need for tobacco control on health ground is unquestionable. From the economics point of view, this study concludes that it would be beneficial to tobacco users to stop their tobacco consumption. As majority of the affected population are poor and less educated, controlling tobacco usage would benefit the poor most leading to the equalization of economic and social welfare. In turn, the economy of Bangladesh would benefit as a whole by avoiding the deadweight loss attributable to tobacco usage in the country.

### **V.3. RECOMMENDATIONS**

---

Tobacco not only impoverishes those who use it, it puts an enormous financial burden on countries. The costs of tobacco use at the national level encompass increased health-care costs, lost productivity due to illness and early death, foreign exchange losses, and environmental damage. These costs are high enough to exceed the benefits from tobacco consumption. So it is imperative to control (if not eradicate) tobacco usage through government regulation and intensive follow up of its implementation.

Among the policy instruments to curb tobacco usage, the most prominent one is raising taxes, both domestic and import, that would increase the real price of tobacco and discourage its usage. Ali *et al* (2003) estimated the price elasticity of cigarette at -0.27, which means that a 10% increase in price would reduce demand by 2.7%. Apparently, given the inelastic demand for cigarettes, the rise in cigarette tax would increase revenue yield to the government and at the same time attenuate the cost of tobacco consumption leading to a net welfare gain. Increase in cigarette price has already shown to be effective in decreasing tobacco consumption in many countries (Jha and Chaloupka 2000, Abedian *et al* 1998)

The indirect measure of raising the consumer price of tobacco products needs to be supported by self-control on the part of the current as well as the potential tobacco users. It is necessary to infuse awareness among people that the ill consequences of tobacco consumption may fairly outweigh the pleasure derived from it. About 77% sample in the household survey and 67% of the hospital survey reported that they come across advertisements on tobacco products in newspaper, radio, television, movies, billboard, shop signboard, and posters. This large fraction of the population can likewise be accessed to disseminate

information regarding the costs tobacco consumption entails and to discourage the current and potential users of tobacco. Many of the sources for this usually manipulative information conveying the glamour of smoking should be restrained. Enhancing the rights of the non-smoker through restriction in smoking in public places should receive serious consideration as well.

As a staggeringly large proportion (40%) of the female population of the country is tobacco users who are presumably outside the purview of media coverage for the most part, alternative measures can be taken. For example, the tobacco awareness programme can be integrated with the existing domiciliary services of the government and NGOs.

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



## **ACKNOWLEDGEMENTS**

WHO acknowledges the following enumerators for their sincere efforts to data collection in medical college hospitals: Drs. AHM Kabir, AH Rezwatul Kabir, Faizunnesa Alam, Farhana Sultana (Bangladesh Medical College Hospital); Mohiuddin H Kabir Chowdhury, MA Naser Siddique, M Nazmul Ahsan, Sagar Chowdhury (Chittagong Medical College Hospital); Abdullah Abu Sayeed, Laboni Afsana, Rumana Rashid, SM Abu Sayeed (Dhaka Medical College Hospital); Partho M Bhattacharya, Ahmed Sharif Uzzal, Rahat Nazma, Sharmina Aftab (Rajshahi Medical College Hospital) for the patient and expert surveys.

The hard work of the following cost survey enumerators deserves special appreciation: Mr Ishraful Awlia Chowdhury, Dr. ASM Nurullah Awal (Dhaka Medical College Hospital); Mr. Khairul Hossain Azad, Mr. Susanta Kumer Chakraborty, Mr. M Sabbir Haider (Bangladesh Medical College Hospital); Mr Abdullah Al Mamun, Mr. Tareq M S Arefin, Dr. Md. Moinul Ahsan (Chittagong Medical College Hospital); Ms. Rajwana Parvin, Mr. Wahid Mostafa, Dr. Md. Akhtarul Islam (Rajshahi Medical College Hospital).

## REFERENCES

Abedian L, *van der Merwe* R, Wilkins N, Jha P (eds). The economics of tobacco 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. Monthly Statistical Bulletin of Bangladesh, Dhaka, 2000.

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

*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: Strategies, 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 Security 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.

Efroymsen 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.

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 fibrillation. *Neuroepidemiology* 2000;19:217-26.

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](http://ncd_surveillance.who.int)).