A comprehensive economic assessment of the health effects of tobacco use and implications for tobacco control in Bangladesh

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ABSTRACT

Background Despite modest progress in reducing tobacco use, tobacco remains one of the major risk factors for non-communicable diseases in Bangladesh.

Methods Using disease-specific, prevalence-based, cost-of-illness approach, this research estimated the economic costs of tobacco use and exposure to secondhand smoke based on data collected from a nationally representative survey of 10 119 households in 2018.

Results The study estimated that 1.5 million adults were suffering from tobacco-attributable diseases and 61 000 children were suffering from diseases due to exposure to secondhand smoke in Bangladesh in 2018. Tobacco use caused 125 718 deaths in that year, accounting for 13.5% of all-cause deaths. The total economic cost was 305.6 billion Bangladeshi taka (BDT) (equivalent to 1.4% of gross domestic product or US$3.61 billion), including direct costs (private and public health expenditures) of BDT83.9 billion and indirect costs (productivity loss due to morbidity and premature mortality) of BDT221.7 billion. The total economic cost of tobacco more than doubled since 2004.

Conclusion Tobacco use imposes a significant and increasing disease and financial burden on society. The enormous tobacco-attributable healthcare costs and productivity loss underscore the need to strengthen the implementation of tobacco control policies to curb the epidemic.

INTRODUCTION

Tobacco is one of the greatest risk factors for non-communicable diseases (NCDs) including cancers and cardiovascular and respiratory diseases. Globally smoking, chewing tobacco and exposure to secondhand smoke together were responsible for the loss of 8.7 million lives and 230 million disability-adjusted life years in 2019.[1]

The global economic cost of smoking-attributable diseases from health expenditures and productivity losses was estimated at US$1436 billion in 2012, roughly equivalent to 1.8% of the world's annual gross domestic product (GDP).[2] Globally there are 1.1 billion tobacco smokers 15 and older, around 80% of whom live in low-income and middle-income countries (LMICs).[3] Among LMICs, Bangladesh is one of the highest tobacco-burdened countries. The prevalence of tobacco use among adults 15 and older was 35.3% in 2017.[4] There was, however, some progress in reducing tobacco use in the recent past from 43.3% in 2009.[4]

The economic cost associated with the deaths and disease burden of tobacco use has been assessed in numerous country-specific studies, mostly in high-income countries.[2 5] Although an earlier study assessed the cost of tobacco-related illnesses in Bangladesh in 2004, no recent estimate is available to measure the progress in avoiding tobacco-attributable costs on society.[6] The primary objective of the present study was to update the estimates of the direct and indirect health costs attributable to tobacco use and exposure to secondhand smoke and compare with the previous estimates available for 2004. By maintaining the cost-of-illness approach followed in the 2004 study, this study provides a consistent comparison of the economic costs of tobacco over time.

METHODS AND ANALYTICAL FRAMEWORK

Cost-of-illness approach

We followed the prevalence-based, disease-specific, cost-of-illness approach to estimate the annual economic cost of tobacco-related illnesses and deaths caused by both current and past smoking and smokeless tobacco use.[7] Tobacco-caused illnesses may vary from country to country depending on the habits and types of tobacco use.[8–10] We included ischaemic heart disease (IHD), stroke, chronic obstructive pulmonary disease (COPD), pulmonary tuberculosis (PT), lung cancer, laryngeal cancer and oral cancer following the protocol of the previous study in Bangladesh.[6]

For capturing the effects of exposure to secondhand smoke, we included asthma, autism, lower respiratory infection, low birth weight of newborns and sudden infant death syndrome among non-smokers in smokers' households following the comparative risk assessment approach in the existing literature for assessing secondhand smoke exposure at home.[11–15] Non-smokers living with current smokers in the same household where smoking was allowed indoors were identified as regularly exposed to secondhand smoke.

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

- Out-of-pocket expenditure of patients on medical care for treating tobacco-related diseases of tobacco users and those exposed to secondhand smoke.
- Cost of the public healthcare system.

- Loss of productivity and income due to disability and premature mortality from tobacco-related illnesses based on the human capital approach.

The details of the methods of measurement of the cost components are provided in online supplemental appendix A1.

The cost-of-illness approach entails the determination of excess cost that can be attributed to tobacco use. In the first step, we determined the relative risk (RR) based on the ratio of the probability of the outcome (prevalence of disease or mortality from the disease) in the exposed group (tobacco users or those exposed to secondhand smoke) to the probability of the outcome in the unexposed group (non-tobacco users or those not exposed to secondhand smoke).

The RR is used to identify the fraction of the total cost of illness that can be attributed to tobacco use, known as the population attributable risk (PAR), as multiple factors including tobacco can contribute to the disease prevalence and mortality.

To measure the trend in the economic cost of tobacco use in Bangladesh over time, the costs estimated from the present study for 2018 were compared with the costs estimated in the 2004 study, converted to 2018 constant prices using the consumer price index.[16]

Data sources

Primary data

The primary data on tobacco-related diseases and deaths of all household members were collected during January–April 2018 from a nationally representative survey of 10 119 households selected using a multistage clustered sampling design. Based on the disease profile of the sample households, 2600 households were identified with at least one member diagnosed with one of the selected major tobacco-related diseases. Among them, 998 households had confirmed cases of the said diseases, with supporting medical records. They received a health cost questionnaire to collect detailed information on the use of healthcare services and related expenses, employment status and earnings of the patients, along with basic sociodemographic and economic characteristics of the households. There were 39 valid cases of tobacco-related diseases among children younger than 15 in the sample households. Sample weights for households were derived considering the multistage probability sampling design. The details of sample selection and sample characteristics are provided in online supplemental appendix A2. All survey participants gave their informed consent prior to their inclusion in the study.

Secondary data

Since there is a lag between initiation of tobacco use and the incidence of tobacco-induced diseases, the prevalence of tobacco use observed in about a decade earlier in 2009[9 17] was used to estimate the PAR in the current period as of 2018. Data on government expenditures and healthcare utilisation rate on inpatient and outpatient care provided in public healthcare facilities came from the national health sector budget documents.[18 19] The average annual salary per employed person and the employment rate of working-age individuals were drawn from the Labor Force Survey.[20]

Supplementary national-level data on cause-specific mortality, age-specific mortality rates attributable to tobacco and probability of survival between successive age groups were obtained from various national and international databases.[1 21 22] Data on annual tobacco tax revenue were obtained from the Ministry of Finance.

Study population

Because the average age at initiation of daily smoking is below 20 and the health effects of tobacco use result from many years of exposure, the study population in the present case included adults 30 years and older for estimating the direct and indirect costs of tobacco use. Children below age 15 were included in the study population for estimating the health expenditures attributable to secondhand smoke exposure. The costs of mortality due to exposure to secondhand smoke were, however, estimated for all ages. Adults were excluded from the analysis of health expenditures and costs of morbidity attributable to exposure to secondhand smoke due to insignificant RR estimated from the survey data.

RESULTS

Prevalence of tobacco-related diseases

The overall prevalence of tobacco-related diseases was 9.06% among adults (table 1). The most prevalent disease was IHD, followed by stroke, COPD, cancers (lung, laryngeal and oral) and PT. The disease prevalence among children was 0.99%. Approximately 1.6 million patients, including 1.5 million adults and more than 60 000 children, were estimated to be suffering from diseases attributable to tobacco use and secondhand smoke exposure.

Prevalence of tobacco use (adults aged 30 and older)

Among adults, 20.5% were current smokers and 4.1% were former smokers; 25.3% were current smokeless tobacco users

Table 1 Disease prevalence, RR and PAR due to tobacco use among adults aged 30 and above and due to secondhand smoke exposure among children younger than 15

Diseases	ICD-10 code	Prevalence of disease (%)			RR	PAR
		All	Ever tobacco users	Never tobacco users		
All diseases among adults		9.06	11.36	7.24	1.57 (0.0000)	0.22
IHD	I20–I25	5.24	6.14	4.54	1.35 (0.0000)	0.15
Stroke	I60–I69	2.35	2.68	2.08	1.28 (0.0170)	0.13
COPD	J40–J44	1.56	2.48	0.84	2.95 (0.0000)	0.50
Cancer	C00–C14, C32, C33–C34,	0.47	0.67	0.32	2.09 (0.0633)	0.36
PT	A15–A19	0.34	0.48	0.22	2.14 (0.0057)	0.37
All diseases among children	P07, R95	0.99	1.14	0.85	1.34 (0.0505)	0.14

Source: Authors' calculations based on data collected from household survey.
The ICD-10 codes are based on the International Statistical Classification of Diseases and Related Health Problems: 10th Revision, 2nd Edition, WHO 2004.

Two-sided Fisher's exact p values for RRs are provided in parentheses next to the respective RRs. PAR is calculated using the formula $PAR = \frac{(RR-1)P}{1+(RR-1)P}$, where P is the adult tobacco use prevalence used for PAR for all diseases for adults (30 and older), which was 51.1% in 2009.[8] In the calculation of PAR for all diseases for children below age 15, P represents the percentage of children exposed to secondhand smoke, which was 48.7% in 2018, according to the household survey conducted for the present study. Disease-specific RR and PAR for children were not estimated due to small sample size.
COPD, chronic obstructive pulmonary disease; IHD, ischaemic heart disease; PAR, population attributable risk; PT, pulmonary tuberculosis; RR, relative risk.

and 0.7% were former smokeless tobacco users. Overall, 41.5% of adults were current users of any form of tobacco.

Excess risk of tobacco-attributable diseases

Table 1 shows that the prevalence of tobacco-related diseases was significantly larger among ever tobacco users (both current and former) than among never tobacco users, which is reflected in both disease-specific and overall RRs being significantly greater than 1. The overall PAR was 0.22. The highest RR and PAR were observed for COPD. The exposure of children to secondhand smoke at home also significantly increased the risk of tobacco-related diseases (RR=1.34; table 1). The combined PAR was 0.14.

Tobacco-attributable mortality

The death rate from tobacco-related diseases was estimated at 3.9 per 1000 among the population 30 and older. The RR of mortality from tobacco-related diseases was 2.15 and the corresponding PAR was calculated at 0.37. This finding is close to the previous estimates of PAR for men aged 25–69.[23] The annual number of tobacco-attributable deaths among the age group 30 and older was estimated at 100 961.

The death rate from tobacco-related diseases among non-smokers was estimated at 0.8 per 1000. The RR of mortality from tobacco-related diseases among non-smokers living with smokers and hence potentially exposed to secondhand smoke at home relative to non-smokers living in smoker-free households was 1.68. The PAR corresponding to the mortality attributable to secondhand smoke exposure was 0.24. The annual number of deaths attributable to secondhand smoke exposure was estimated at 24 757.

Adding the estimates of deaths attributable to secondhand smoke exposure and tobacco use, the total number of tobacco-attributable deaths was estimated at 125 718, accounting for 13.5% of all-cause deaths in 2018. Although the cause of deaths reported retrospectively in the household survey was not verifiable by verbal autopsy or medical opinion, the mortality estimate obtained from this study differs by only less than 1% from the estimate of 124 547 tobacco-attributable deaths (including 23 726 deaths due to secondhand smoke exposure) in Bangladesh in 2018, available from the Global Burden of Disease Study 2019.[24]

Direct costs of tobacco-attributable illnesses

Out-of-pocket health expenditure

Inpatient care in domestic healthcare facilities

For adults, the average out-of-pocket expenditure per day in inpatient care from domestic healthcare providers was 8238 Bangladeshi taka (BDT); the average length of hospital stay was 9.32 days per hospitalisation and the average number of hospitalisations per patient was 0.50 in the previous 12 months before the survey. Disease-specific averages are reported in table 2. The total tobacco-attributable out-of-pocket health expenditure for inpatient care of adults was estimated at BDT26.7 billion.

For children, the average out-of-pocket expenditure per day in inpatient care from domestic healthcare providers was BDT12 570; the average length of hospital stay was 6.40 days per hospitalisation and the average number of hospitalisations per patient was 0.34 in the 1 year before the survey. The disease-specific averages could not be estimated for this age group due to lack of enough observations. The total tobacco-attributable out-of-pocket health expenditure for children was estimated at BDT0.9 billion.

Outpatient care in domestic healthcare facilities

For adults, the average out-of-pocket expenditure per visit for outpatient care received from domestic healthcare providers was estimated at BDT9358 and the average number of visits for outpatient care per patient was 4. Disease-specific averages are reported in table 3. The total tobacco-attributable out-of-pocket health expenditure for outpatient care for adults was estimated at BDT30.7 billion.

For children, the average out-of-pocket expenditure per visit for outpatient care received from domestic healthcare providers was estimated at BDT4567 and the average number of visits for outpatient care per patient was 3.86. The total out-of-pocket health expenditure for outpatient care for children attributable to secondhand smoke exposure was estimated at BDT0.6 billion.

Treatment received abroad

For adults, the average out-of-pocket expenditure per visit for treatment received abroad was estimated at BDT87 703. The average number of visits per patient in the previous 12 months was 0.06. Disease-specific averages could not be estimated due to an insufficient number or lack of observations. The total tobacco-attributable out-of-pocket health expenditure for treatment received abroad was estimated at BDT4.6 billion.

The sum of the above three components of out-of-pocket health expenditures incurred for inpatient and outpatient care from domestic healthcare providers and for the treatment received abroad provided the national-level total out-of-pocket health expenditure at BDT63.5 billion.

Public health expenditures

The average cost per day in inpatient care was estimated at BDT7055 and the average cost per patient in outpatient care was

Table 2 Tobacco-attributable out-of-pocket health expenditure for inpatient care for patients aged 30 and older

Disease	Average out-of-patient expenditure per day in inpatient care (BDT)	Average number of days per hospitalisation	Average number of hospital episodes per patient	Total number of patients who sought medical care	PAR	Tobacco-attributable out-of-pocket expenditure for inpatient care (billion BDT)
IHD	7289	10.18	0.47	2 023 670	0.15	10.7
Stroke	9325	8.69	0.65	905 244	0.13	6.1
COPD	3972	6.36	0.24	603 698	0.50	1.8
PT	6060	10.10	0.29	129 369	0.37	0.8
Lung cancer	16 596	13.15	0.59	86 820	0.42	4.7
LC	9952	6.14	0.80	78 503	0.21	0.8
Oral cancer	9266	12.00	0.71	36 876	0.62	1.8
All	8238	9.32	0.50	3 864 180	0.22	26.7

Source: Authors' calculations based on data collected from household survey.
BDT, Bangladeshi taka; COPD, chronic obstructive pulmonary disease; IHD, ischaemic heart disease; LC, laryngeal cancer; PAR, population attributable risk; PT, pulmonary tuberculosis.

Table 3 Tobacco-attributable out-of-pocket health expenditure for outpatient care for patients aged 30 and above

Disease	Average out-of-patient expenditure per visit in outpatient care (BDT)	Average number of visits for outpatient care per patient	Total number of patients who sought medical care	PAR	Tobacco-attributable out-of-pocket expenditure for outpatient care (billion BDT)
IHD	8457	4.81	2 023 670	0.15	12.5
Stroke	11 190	3.11	905 244	0.13	4.0
COPD	7433	3.07	603 698	0.50	6.9
PT	3069	3.73	129 369	0.37	0.5
Lung cancer	23 890	2.77	86 820	0.42	2.4
LC	15 640	13.79	78 503	0.21	3.6
Oral cancer	11 801	3.06	36 876	0.62	0.8
All	9358	4.01	3 864 180	0.22	30.7

Source: Authors' calculations based on data collected from household survey.
BDT, Bangladeshi taka; COPD, chronic obstructive pulmonary disease; IHD, ischaemic heart disease; LC, laryngeal cancer; PAR, population attributable risk; PT, pulmonary tuberculosis.

estimated at BDT2396. The average public healthcare cost per hospital day and the average public healthcare cost per patient in outpatient and emergency services were then scaled up, using the health services utilisation rate of patients suffering from tobacco-related diseases, the total number who sought medical care and the overall PAR, to obtain the final estimate of the tobacco-attributable total public health expenditure at BDT20.4 billion.

Combining the out-of-pocket and public health expenditures, the total direct cost of tobacco-attributable illnesses amounted to BDT83.9 billion.

There were no reported health expenditures covered by health insurance, either private or public, in the household survey, which rules out the possibility of overlap between out-of-pocket and public health expenditures. Evidence suggests that any active prepayment or reimbursement system for healthcare services either through social or private insurance is nearly absent in Bangladesh.[25]

Indirect costs of tobacco-attributable illnesses

Costs of morbidity

Value of time of patients aged 30 and older spent in attending healthcare services

The employment rate among adults was 0.47 and the average daily income per employed adult was BDT392.79. Those who were employed lost 7.91 working days on average for attending healthcare services in the year before the survey. The total tobacco-attributable cost due to loss of work days of employed patients for attending healthcare was estimated at BDT1.09 billion. The value of loss of time of non-employed patients for attending healthcare services was estimated similarly at BDT1.20 billion by imputing the average daily income of employed patients as a proxy of the value of their household productivity. The combined value of time of employed and non-employed patients spent attending healthcare services was BDT2.29 billion.

Value of caregivers' time

The total cost of caregivers for domestically received treatment was estimated at BDT2.43 billion and for treatment received abroad was estimated at BDT0.37 billion. The total value of caregivers' time for children was estimated at BDT0.02 billion. The combined value of caregivers' time was BDT2.82 billion.

Expected market productivity loss of employed patients aged 30 and older

The annual productivity loss per employed patient due to morbidity caused by the disease was estimated at BDT38 251. The employment probability was lowered on average by 0.20 among the patients due to their disease condition. The expected market productivity loss per patient was estimated at BDT53 182, which is 44% of the potential expected annual income of BDT120 857 of a person without a disease. The total loss of market productivity due to tobacco-attributable morbidity was estimated at BDT83.82 billion.

Household productivity loss of non-employed patients aged 30 and older

On average, patients reported to be ill for 12.68 days per month in the previous 12 months. The average daily income of employed patients imputed as the daily household productivity of non-employed patients and multiplied by the number of days ill per month for 12 months provided the estimate of the annual household productivity loss per patient at BDT59 787. The total annual household productivity loss due to tobacco-attributable morbidity was estimated at BDT44.02 billion.

The total cost of tobacco-attributable morbidity was estimated at BDT132.95 billion given by the sum of the four subcomponents mentioned above.

Costs of mortality

The total present value of foregone lifetime productivity from tobacco-attributable deaths was estimated at BDT49.44 billion. The total present value of foregone lifetime productivity from premature deaths attributable to secondhand smoke exposure was estimated at BDT39.27 billion.

Comparison of the economic costs and benefits of tobacco

Combining the direct and indirect costs, the total annual economic cost of tobacco in Bangladesh was estimated at BDT305.6 billion in 2018 (US$3.6 billion), which was equivalent to 1.4% of the GDP of Bangladesh in 2017–2018. On top of the direct and indirect health costs, households with tobacco users spent BDT153.23 billion on tobacco products in 2016–2017, which is BDT162.37 billion in 2018 prices.[26] The health costs and tobacco spending of households combined (BDT468.02 billion) far exceeded the tax revenue (BDT197.66 billion in 2016–2017 or BDT209.45 billion in 2018 prices) in 2016–2017. Even the total contribution of tobacco sector to GDP given by the sum of household final consumption expenditure, private and public domestic investment and net export (export minus import), which was BDT216.21 billion in 2016–2017, or BDT229.11 billion in 2018, was BDT76.54 billion short of the estimated total cost of tobacco (BDT305.65 billion).

Tobacco-attributable costs: 2004–2018

Although the prevalence of tobacco-related illnesses among adults aged 30 and older remained at the same level (9.0% in

Table 4 Comparison of the tobacco-attributable cost estimates for Bangladesh between 2004 and 2018 (in billion BDT in 2018 prices)

Components of the costs of tobacco-attributable illnesses	Tobacco use (billion BDT in 2018 prices)		Secondhand smoke exposure (billion BDT in 2018 prices)		Total tobacco-attributable cost (billion BDT in 2018 prices)	
	2004	2018	2004	2018	2004	2018
Direct cost	54.9	82.0		1.9		83.9
Out-of-pocket health expenditure	37.3	62.0		1.5		63.5
Public health expenditure	17.6	20.0		0.4		20.4
Indirect cost	65.4	182.4		39.3		221.7
Cost of morbidity	32.3	132.9		0.0		132.9
Cost of mortality	33.0	49.4		39.3		88.7
Total direct and indirect costs	120.3	264.4	15.5	41.3	135.8	305.6

Source: Authors' calculations based on data collected from household survey and secondary sources.
The components of the costs of tobacco-attributable illnesses in 2004 were adjusted for inflation to express in 2018 constant prices using the consumer price index available from the World Economic Outlook Database of the International Monetary Fund.
BDT, Bangladeshi taka.

2004[5] and 9.1% in 2018), the number of cases with tobacco-related illnesses more than doubled between 2004 and 2018. The estimate of mortality attributable to smoking and smokeless tobacco use increased from 57 583 cases in 2004 to 100 961 cases in 2018. Despite the declining trend in tobacco use prevalence in the recent past, the increase in tobacco-attributable morbidity and mortality likely reflects the continued increase in the number of tobacco users driven by population growth, youth initiation of tobacco use with a bottom-heavy demographic profile of the country and tobacco industry's aggressive marketing targeting youth.

Between 2004 and 2018, the total tobacco-attributable cost more than doubled from BDT135.8 billion in 2004 (expressed in 2018 constant prices) to BDT305.6 billion in 2018 (table 4). The breakdown of total cost by direct and indirect costs indicates that productivity loss in a period of rapid economic growth accounted for most (83%).

DISCUSSION

This study estimated the total tobacco-attributable annual economic cost in Bangladesh at BDT305.6 billion, which more than doubled since 2004. While remaining invisible in national income accounting, these costs are largely incurred by the families of tobacco users suffering from tobacco-related deaths and diseases. For a rapidly growing economy such as Bangladesh, this cost is expected to grow over time and undermine the growth potential of households that fall prey to the scourge of the tobacco epidemic.

Besides, nearly 14% of the population spend more than 10% of household income on out-of-pocket health expenditures and 4.5% of the population are pushed below the poverty line by these expenditures in Bangladesh.[27]

Public health expenditure accounted for 8.9% of the total government health expenditure, which is financed from taxpayers' money irrespective of their tobacco use status. This is a clear case of 'market failure' and calls for immediate government intervention to correct market prices by imposing higher taxes on tobacco products.

The cost of exposure to secondhand smoke was 14% of the total tobacco-attributable cost. It reflects the enormity of the 'negative externality' imposed on non-smokers and makes an obvious case for government intervention to reduce smoking. This component was largely driven by the cost of childhood mortality, which implies longer span of remaining life and greater loss of potential productivity than adults.

A major contribution of this study lies in estimating the RR of tobacco-induced disease incidence using primary data and estimating tobacco-attributable healthcare costs based on this RR. The only epidemiological study that provides RR estimates for Bangladesh is a case–control study on tobacco-attributable mortality in a rural subdistrict.[23] The estimates from this study are, however, far from generalisable required for national-level estimation of the economic cost of tobacco use as the controls in the study do not represent the general population.[28] While estimates of RR for mortality from more representative and cohort studies are available for other countries,[29–40] the present study relied on the estimates obtained from primary data for two reasons. First, the estimates obtained for the population of one country may not be valid for the population of another country with different sociodemographic characteristics, disease profile and stage of the tobacco epidemic. Second, it is the RR of the incidence of disease which is more relevant in estimating healthcare expenses attributable to tobacco use and is not readily available from countries with comparable population characteristics (see, eg, studies in China and India that used RR of mortality as a proxy of the RR for incidence of disease in estimating the economic cost of tobacco use).[32 41]

The study has a few limitations. First, the prevalence of tobacco-related diseases was based on diagnosed cases with proven medical records. Undiagnosed cases or diagnosed cases that were unable to show proven medical records were not included in the counts of tobacco-related diseases. It may have caused underestimation of disease prevalence. Assuming 1% point downward bias, we ran a sensitivity analysis to find that the estimates of out-of-pocket and public health expenditures are highly sensitive to the estimates of disease prevalence. A 1% point increase in the disease prevalence estimate more than doubles the total direct cost and increases the total economic cost by 38% from BDT305.6 to BDT422.3 billion (online supplemental appendix A3 table A.3).

Second, the measurement of excess risk of diseases from tobacco use given by RR in this study can be confounded by the concurrence of multiple risks factors, including obesity or overweight, high blood pressure and high blood glucose, besides tobacco use. Surveillance of all risk factors of NCDs was, however, beyond the scope of this study.

Third, the measurement of exposure to secondhand smoke used in this study was limited to indoor smoking households with smokers. Due to unavailability of information, the measures of secondhand smoke exposure at outdoors, workplaces and in households due to smoking by visitors were excluded from the analysis, which may have introduced a downward bias in the estimation of the effect of secondhand smoke exposure.

Finally, the productivity loss due to presenteeism or working while sick was not explicitly accounted in the estimation of the costs of morbidity, which may cause an underestimation.

Despite these limitations, this study established that tobacco use imposes a significant financial burden in Bangladesh.

CONCLUSION

The enormous tobacco-attributable health cost represents massive drain on the nation's limited resources. Comprehensive and effective tobacco control measures are required to reverse the adverse health and economic consequences of tobacco use on society. Prevention of the deaths and diseases attributable to tobacco use and secondhand smoke exposure can contribute significantly to the Sustainable Development Goals in Bangladesh to eradicate extreme poverty, reduce deaths from NCDs by one-third and achieve universal health coverage to help protect against impoverishment caused by illnesses.

What this paper adds

- Tobacco is one of the greatest risk factors for non-communicable diseases (NCDs), including cancers and cardiovascular and respiratory diseases.
- Tobacco takes heavy toll on human health, lives and national economies, both directly through costs of treating tobacco-induced illnesses and indirectly through loss of productivity owing to morbidity and premature mortality from those illnesses.
- Around 80% of the 1.1 billion smokers in the world currently live in low-income and middle-income countries (LMICs), which are destined to bear the increasing health and economic burden of tobacco use.
- Evidence on the growing health and economic burden of tobacco use is missing for most LMICs.
- Based on primary data collected from a nationally representative survey of patients suffering from major tobacco-related illnesses, this study finds that the health and economic burden of tobacco use more than doubled in Bangladesh, a lower middle-income country, over 2004–2018.
- This evidence indicates limited progress in tobacco control achieved since the ratification of the WHO Framework Convention on Tobacco Control in 2003 and calls for stronger action to fight the epidemic.

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Contributors NN designed the study and led the writing of the manuscript. GMF served as the subject matter expert in disease burden and cancer epidemiology. MA and IH undertook the data analysis and contributed to the preparation of the manuscript. RP, SNW and JD contributed to the writing of the manuscript. AKMGH supervised the survey design and implementation and contributed to data analysis and writing of the manuscript. All authors contributed to the revision of the manuscript.

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