RESEARCH PAPER

The costs of smoking in Vietnam: the case of inpatient care

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Objective: To estimate the social costs of smoking related to inpatient care in Vietnam using 2005 data.

Design: The cost of illness as a result of hospitalisation for three major smoking-related diseases combined with the prevalence-based approach to obtain the costs of smoking in Vietnam for inpatient care.

Main outcome measure: Smoking-attributable costs of inpatient care for lung cancer, chronic obstructive pulmonary disease (COPD), and ischaemic heart disease.

Results: The total cost of inpatient health care caused by smoking in Vietnam reached at least 1 161 829 million Vietnamese dollars (\$VN) (or \$US77.5 million) in 2005. This represents about 0.22% of Vietnam gross domestic product (GDP) and 4.3% of total healthcare expenditure. The majority of these expenses are related to COPD treatment (\$VN1 033 541 million or \$US68.9 million per year) followed by lung cancer (\$VN78 143 million, or \$US5.2 million per year) and ischaemic disease (\$VN50 145 million, or \$US3.3 million per year). The government directly finances about 51% of these costs. The rest is financed either by households (34%) or by the insurance sector (15%).

Conclusions: The social costs of smoking in Vietnam as the percentage of GDP is lower compared to estimates from high-income countries. The true costs would be substantially higher if all smoking-related diseases, outpatient care and mortality-related costs are included. More research is needed to augment the estimates presented in this paper.

Tobacco use is one of the most important contributors to premature death and avoidable morbidity in both low-income and high-income countries.¹ In addition, smoking-attributable costs represent a significant loss for the whole economy.

Studies have found that these costs have reached 2.1%–3.4% of gross domestic product (GDP) in Australia, 1.3%–2.2% of GDP in Canada and 1.4%–1.6% of GDP in the United States.² The economic impact of smoking in low-income and middle-income countries is less documented. A study from China estimated that smoking led to 1.5% GDP loss in 1989.³ A more recent estimate shows that these costs reached about 0.06% of Chinese GDP in 2000.⁴

Smoking-related costs account for 6–15% of health care in high-income countries.⁵ Limited research from low-income and middle-income countries indicates a lower estimate, but there are only a few studies to support this finding. It is possible that the full effect of the large increase in male smoking is not yet evident, because the tobacco epidemic is at its earlier stage.⁶ In addition, access to and quality of medical care in low-income and middle-income countries lead to the underestimation of true smoking costs.⁵ The role of these factors is expected to diminish in the near future and the countries that can least afford it are likely to see their smoking-related healthcare costs rise.⁵ There are predictions, for example, that China will experience a 120–137% increase in cardiovascular diseases between 1990 and 2020, compared to a 30–60% rise in high-income countries.⁷

Owing to differences in healthcare systems, the costs related to smoking depend heavily on local conditions. Therefore, it is important to provide country-specific estimates of the costs of smoking.

This study is the first attempt to estimate at least partial costs of smoking in Vietnam. We employ the society's perspective to calculate the social costs of smoking-related inpatient health care, including the share of private and public contributions to these costs.

METHODS

There are a number of diseases related to smoking. Considering all of them would demand a large amount of resources in terms of time, money and effort. Since this is the first attempt to quantify the costs of smoking in Vietnam, we decided to focus on three diseases that contribute most to the costs of smoking¹: lung cancer, chronic obstructive pulmonary disease (COPD) and ischaemic heart disease.

The economic consequences of tobacco use are both direct (primarily in the form of higher healthcare costs) and indirect (related to productivity losses as a result of morbidity and premature mortality).⁵ These costs can also be categorised as public or private based on whether or not they are covered by the government.

In Vietnam, the government subsidises hospital care by paying for capital investment and depreciation, providing salary for the staff (doctors, nurses, etc) and covering administrative and other operational costs, except for the costs of drug and medical supplies, which are covered by user fees. User fees are paid by either patients or by health insurance. The health insurance is run by the government as a not-for-profit entity, covering about 30% of the population.⁸ About half of the insured are regular salaried employees and their insurance premium represents 3% of their salaries. The employee contributes 1% and the employer (either a private company or the government) pays 2% of the insurance costs. The insurance covers 80% of the user fee and the remaining 20% is covered by the patient. Retirees from the public sector, children under the age of 6 and those who meet the poverty standard represent the other group with health insurance. These individuals are exempt from the co-payment and the government covers 100% of the user fees. Private health insurance companies also exist but their share of the health insurance market is negligible.⁹

Abbreviations: COPD, chronic obstructive pulmonary disease; SAC, smoking-attributable inpatient costs; SAF, smoking-attributable fraction; SES, socioeconomic status

We employed two methodological steps to estimate the social costs of smoking in Vietnam. Firstly, we estimated the social cost for one episode of hospitalisation for the three diagnoses using the cost of illness approach and assigned these costs to three economic entities: the government, a household and the health insurance organisation. Secondly, we employed the prevalence-based approach to estimate 2005 smoking-attributable costs for the whole country by linking the micro-level estimate of treatment costs with macro-level data on total hospital admissions.

The total cost of one hospitalisation was calculated as (equation 1):

$$C_t = C_i + C_f + C_o \quad (1)$$

where C_t is total costs of inpatient care per episode, and C_i , C_f and C_o are costs financed by families, the government and health insurance, respectively. C_t varies because of many factors. We categorised them as service factors, socioeconomic factors and epidemiological factors.

The service factors are related to treatment schemas, which may vary with the referral level. There are four referral levels in Vietnam: central, provincial, district and commune levels. Each level is characterised by different technical capacities and probably also by different treatment schemas. Our study covers the top three referral levels, which provide the majority of inpatient services for patients diagnosed with the condition of interest. The convenience sample of five hospitals participating in this study receives the majority of patients with the selected diagnoses in northern Vietnam and therefore best represents the variety of their treatments. We used the mean costs of treatment independent of referral level in our calculations to take into account the variation in treatment received at different referral levels.

Socioeconomic factors relate to the patient's socioeconomic status (SES), which may influence the treatment schemas (direct cost of treatment) because of factors such as age, education and health insurance status. Indirect costs of treatment also depend on SES, because the loss of income as a result of hospitalisation will vary by salary level. We use the coverage by social insurance as a proxy for having a higher SES, since this type of insurance is available only to employees with a desirable long-term salary contract. The social insurance premium equals 20% of the formal salary, of which employers contribute 15%, while employees contribute 5%.

The epidemiological factor reflects the potential of higher treatment costs for smokers due to co-morbidity.

To evaluate the impact of socioeconomic and epidemiological factors on the cost of treatment, we estimate an ordinary least squares model where C_t is a function of health insurance status, social insurance coverage and smoking status, controlling for other SES characteristics (equation 2).

$$C_t = f(\text{ever-smoker, age, sex, education, health insurance, social insurance}) \quad (2)$$

The micro-level data on the costs of hospitalisation were combined with macro-level information on the total number of admissions for the selected diagnoses in Vietnam during the course of one year.^{8 10 11} Only a fraction of these costs can be

attributable to smoking, because smoking-related diseases occur also among non-smokers. Equation 3 describes the method of calculating the smoking-attributable fraction (SAF) of the inpatient care.

$$SAF_i = N_{si}/N_i \times [N_{si} - N_{ni}] / N_{si} \times [P(H)_i - P(H)] / P(H)_i \quad (3)$$

where SAF_i is the smoking-attributable fraction for disease i ; N_i is the number of patients diagnosed with i ; N_{si} is the number of smokers among the patients diagnosed with i ; N_{ni} is the number of non-smokers diagnosed with i ; $P(H)_i$ is the average social costs per hospitalisation for disease i ; and $P(H)$ is the average amount of healthcare costs in Vietnam.

Smoking prevalence among COPD patients is based on estimates available in the literature,¹²⁻¹⁴ and the smoking rate among lung cancer patients comes from the National Cancer Institute.¹⁵ Smoking prevalence for ischaemic heart disease patients is based on our survey, since one of the surveyed hospitals specialises in the treatment of cardiovascular diseases, receiving the majority of patients diagnosed with ischaemic heart disease in northern Vietnam.

We account for the presence of non-smokers among patients diagnosed with smoking-related diseases. For example, if there are 92 smokers and eight non-smokers with COPD, we assume that eight smokers would have got the disease even if they did not smoke. Therefore, only 91.3% of costs among smokers can be attributed to smoking.

Equation 3 assumes that smokers diagnosed with smoking-related diseases would incur at least average healthcare costs even if they were not diagnosed with a smoking-related disease. Therefore, only the treatment costs in excess of the average healthcare costs¹¹ are included in the costs attributable to smoking.

To calculate the magnitude of smoking-attributable inpatient costs (SAC), we used the formula adopted from Yang *et al*¹⁶ (equation 4).

$$SAC = \sum \{ [P(H)_i \times Q(H)_i] \times SAF_i \} \quad (4)$$

where $Q(H)_i$ is the total number of admissions in Vietnam for disease i , and the rest are defined as above.

The micro-level data collection took six months (January–June 2005) and gathered information from both hospital administrators and patients. Hospital financial records were used to determine operational costs (including salary and fringe benefits) and depreciation covered by the government. These costs were allocated to a diagnostic group based on the number of inpatient days for each diagnosis. Hospital staff provided information on costs of medical treatment during hospital stays paid for out-of-pocket by patients or by health insurance. This information was linked with the data provided by the patients using the patient's registration number.

All patients diagnosed with one of the selected diagnoses were eligible to participate in the study. We approached 390 patients and all of them signed the consent form to provide information on transportation costs, drug expenses, informal hospital fees, smoking history, frequency and number of cigarettes smoked and socioeconomic status. The most challenging was to gather information on patients' informal fees, which include gratitude paid to staff on a voluntary basis in

Table 1 Distribution of patients by diagnosis and referral level

	1 District hospital	1 Provincial hospital	3 National hospitals	Total number of patients	%
Lung cancer	1	2	177	180	46
COPD	76	16	61	153	39
Ischaemic	17	2	38	57	15
Total	94 (24%)	20 (5%)	276 (71%)	390 (100%)	100

Table 2 Average household costs (in thousands of \$VN) per admission

Diagnostic group	Out-of-pocket expenses				Income loss	Total personal costs
	User fees and drugs in hospitals	Drugs bought outside	Non-medical expenses	Subtotal		
Lung cancer	1012.1	1005.6	4742.4	6760.1	1427.8	8187.9
COPD	358.2	17.0	433.7	809.0	371.2	1180.2
Ischaemic	3726.1	193.6	1785.9	5705.5	273.5	5979.0
Average	1152.2	499.1	2620.0	4271.3	844.6	5115.9
%	23	10	51	83	17	100

order to motivate the staff to provide a higher quality of care. Since this is not an official payment, there is a high probability that it would not be reported as a cost of treatment. The question, "How much did the patient and his/her family spend on the hospital stay in addition to formal fees, medicines, food, travel and accommodation?" allowed participants to report these informal fees without explicitly detailing this payment. Patients' opportunity costs and costs of family informal care were estimated based on the number of inpatient days and hours of family care combined with the data on the average salary for the patient's occupation type and the region-specific average income for the self employed.¹⁷

RESULTS

Table 1 shows the distribution of patients according to their diagnosis and hospital referral level. The majority of study participants were treated in one of the specialised national hospitals, particularly those diagnosed with lung cancer.

Most of the patients were in their late 50s. The lung cancer patients were among the youngest (average age of 58), ischaemic and COPD patients were on average 66 and 64 years old, respectively. Similar age distribution has been reported by Man *et al.*¹⁸

Male patients dominated the sample (72%), which reflects their higher smoking prevalence compared to women: 87% of male patients were current or ex-smokers, as opposed to 11% of female patients. The sex difference in smoking rates is statistically significant.

An average hospitalisation episode was 26 days, which is much longer than the average 6.7-day hospital stay in Vietnam.¹⁹ Lung cancer patients had the longest hospital stay (43 days), the longest smoking history (22 years), the highest percentage of ever-smokers (40.6% are current and 37.8% are ex-smokers) and the highest smoking intensity (10 cigarettes per day). COPD patients smoked the least—49% of them never smoked, but this result is driven by the relatively high percentage of females (38.5%) among them.

The household financed costs of hospitalisation are summarised in table 2. The average cost per admission of \$VN5 115 900 (\$US341, \$US1 = \$VN15 000) is dominated by

the out-of-pocket expenditures. Non-medical expenses (for example, travel costs, food, accommodation, informal fees) comprise the largest part of out-of-pocket expenses. The relatively lower expenses for treatment and drugs are the result of government subsidies to health care.

Household expenses constitute about 43% of the total social costs per admission that reaches about \$VN11 762 000 (\$US784). (According to the World Bank, user fees accounted for about 30% of the real cost of health care in Vietnam in the late 1990s.³ Our estimate also includes other costs associated with inpatient treatment, and this could explain the difference in the two estimates.)

The rest is financed by insurance companies (38%) and the government (19%). The highest costs per admission are associated with ischaemic heart disease (\$VN31 400 000, or \$US2093), which exceed those of COPD by almost 10 times. Owing to its high costs, treatment for ischaemic heart disease is mostly covered by health insurance, and is therefore not available to the uninsured. For this reason, the number of ischaemic patients in Vietnam is most likely to be underestimated.

Having social insurance and higher education result in higher social costs of hospitalisation, since these patients have higher opportunity costs of the time spent in treatment. Smoking also increases the social costs of treatment, but the result is not statistically significant. This lack of significance may be the result of the small sample size. However, it does not mean that smoking is not responsible for a certain portion of inpatient care costs in Vietnam, since the majority of these costs come from a higher probability of being hospitalised and not from higher treatment costs once admitted to the hospital.

On the macro-level, 72.5% of hospitalisation costs for the three selected diagnoses can be attributed to smoking (table 3). The SAFs for COPD, lung cancer and ischaemic disease were 79.1%, 54.3% and 32.9%, respectively. The SAF for ischaemic disease is very similar to the recent World Health Organization estimates for the Western Pacific and South East Asia regions,²⁰ and our estimates of SAF for lung cancer are almost identical to those calculated by Ezzati and Lopez²¹ for developing countries. The SAF for COPD exceed those in the literature.²¹ However,

Table 3 Smoking-attributable social costs (in \$VN) of inpatient care

	Number of patients*	Average cost of hospitalisation (in thousands)	Total cost for all admissions (in millions)	Average healthcare expenditures† (in thousands)	Smoking prevalence among patients (%)	% of Smokers diagnosed due to smoking (%)	Healthcare costs in excess of the average healthcare cost (%)	SAF (%)	Total costs attributable to smoking (in millions)
Lung cancer	11 645	12 358	143 909	493	78.3	72.3	96.0	54.3	78 143
COPD	348 992	3744	1 306 626	493	92.0	91.3	86.8	79.1	1 033 541
Ischaemic	4854	31 400	152 416	493	66.7	50.1	98.4	32.9	50 145
Total	7 075 360		1 602 951					72.5	1 161 829

*Source: Ministry of Health 2005, National Cancer Institute

†Average 2005 healthcare expenditures adjusted for inflation and converted to \$VN using PPP index were \$VN492 777.32. Source: International Monetary Fund.⁹

Table 4 Annual smoking-attributable social costs of inpatient care (in \$VN)*

Diagnostic group	Total social costs (in thousands)	Personal costs (in thousands)	Government costs (in thousands)	Insurance sector costs (in thousands)
Lung cancer				
Costs per admission	12 358	819	277	141
Total costs	143 909 000	96 419 030	31 659 980	15 829 990
SAF	78 143 000	52 355 810	17 191 460	8 595 730
COPD				
Costs per admission	3744	1198	2097	449
Total costs	1 306 626 000	418 120 320	731 710 560	156 795 120
SAF	1 033 541 000	330 733 120	578 782 960	124 024 920
Ischaemic				
Costs per admission	31 400	5979	486	24 935
Total costs	152 416 000	28 959 040	3 048 320	120 408 640
SAF	50 145 000	9 527 550	1 002 900	39 614 550
Total costs for three diagnoses	1 602 951 000	543 498 390	766 418 860	293 033 750
SAF for three diagnoses	1 161 829 000*	392 616 480	596 977 320	172 235 200
%	100	34	51	15

*\$VN1 161 829 000 represents about 4.3% of total healthcare expenditures and about 0.22% of the Vietnam GDP in 2005.

this would be consistent with the recent study that identified cigarette smoking as the main cause of mortality among COPD patients in Vietnam and ranked Vietnam as the country with the highest incidence of COPD in the Asia Pacific region.¹⁴

On the macro-level, COPD is the most expensive smoking-related disease owing to the large number of cases per year. It costs society \$VN1 033 541 million (\$US68.9 million) per year, followed by lung cancer (\$VN78 143 million, or \$US5.2 million) and then ischaemic disease (\$VN50 145 million, or \$US3.3 million) (table 4). The total smoking-related costs amount to about \$VN1 161 829 million (\$US77.5 million) annually, or about 0.22% of the 2005 Vietnam GDP and 4.3% of the total healthcare expenditure in Vietnam.²²

DISCUSSION

The results of this study confirm that smoking leads to significant economic losses for society as a whole and that the government finances the majority of these costs. Health insurance also finances some of these costs, but its nature is either private (households) or public (government), depending on who covers the insurance premium.

The survey data among inpatients diagnosed with three smoking-related diseases along with data provided by hospital staff allowed us to estimate the average social costs of inpatient care in Vietnam. We found that this cost is on average \$VN11 761 900 (\$US784) per patient and that ischaemic disease is the most expensive of the three diagnoses examined in this study.

About 72.5% of the social costs of inpatient care can be attributed to smoking. Our estimates of SAF for ischaemic disease and lung cancer are very similar to those estimated for other low-income countries. The estimated SAF for COPD is higher, but there is some research that supports these higher estimates.

The smoking-related costs in Vietnam expressed as the percentage of GDP are lower compared to estimates from higher-income countries. However, we believe that we have underestimated the true costs of smoking in Vietnam because of several limitations of this study.

Firstly, because of the scope of our analysis, we excluded outpatient costs. These costs may reach 35–50% of the total costs of smoking, as suggested in a study from Taiwan.¹⁶

Secondly, we have not included the smoking-related mortality costs owing to the lack of reliable data on the cause of death in Vietnam. The majority of patients with chronic diseases in Vietnam die at home, because their relatives often

request that the patient is sent home if there is a small chance of survival. As a result, our data do not capture mortality among the patients. A recent study from Hong Kong²³ estimates that smoking-related mortality costs represent about 30% of the total social cost of active smoking.

Thirdly, the study covers only three smoking-related diseases, thus excluding other smoking-related conditions. We also focused only on the impact of active smoking, but passive smoking can represent as much as 23% of the total costs of smoking.²³

Fourthly, the hospital data almost certainly underestimate the true cost for health care in Vietnam. The costs in private healthcare facilities would be closer to the true costs, but this information is not available.

Fifthly, unofficial payments to medical staff are likely to be under-reported despite our efforts to collect this information, owing to the informal nature of this expense.

Sixthly, patients' opportunity costs might be underestimated to the extent that their official income does not reflect their true opportunity cost of time. It is very common in Vietnam to be engaged in multiple wage-earning activities.

Finally, our estimates can be downward biased as a result of our sample selection. Even though the majority of patients diagnosed with the three selected diseases in northern Vietnam were treated in the participating hospitals, our data do not capture the difference in costs between the north and the south. The 2002 Vietnam Health Survey showed that the average cost of inpatient care in the southeast region (Ho Chi Minh City) is about twice as large compared to the Red River Delta region where Hanoi is located in the north.²⁴

Future research should focus on refining the estimate of the social costs of smoking in Vietnam. There is a pressing need for rigorous epidemiological study to determine smoking-related mortality rates and the smoker's relative risk of being diagnosed with various smoking-related diseases. An estimate of outpatient costs of smoking is also needed.

Despite the limitations of our study that certainly lead to a gross underestimation of the total costs of smoking, we conclude that tobacco use has a significant economic impact on Vietnamese society. The situation will continue to deteriorate since Vietnam has just entered its second stage of the smoking epidemic, as characterised by future increases in smoking-related costs.²⁵ The acceleration of economic growth experienced in Vietnam in recent years is going to increase the overall spending on health care, which will contribute to the rising costs of smoking. Another important factor is going to be smoking among women. Women in Vietnam have not yet

What this paper adds

- Very little is known about the costs of smoking in low-income countries. This paper partially quantifies these costs in Vietnam, a country with high male smoking prevalence.
- The social cost of inpatient health care is based on costs associated with COPD, lung cancer and ischaemic disease.
- The true costs of smoking would be substantially higher if all smoking-related diseases, outpatient care and mortality-related costs are included.

begun smoking in large numbers, but this may change with the fast-growing economic development.

The negative economic consequences of smoking could be avoided by adopting strong tobacco control measures against the tobacco epidemic.

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