

Cigarette smoking and poverty in China

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Abstract

Drawing on the 1998 China national health services survey data, this study estimated the poverty impact of two smoking-related expenses: excessive medical spending attributable to smoking and direct spending on cigarettes. The excessive medical spending attributable to smoking is estimated using a regression model of medical expenditure with smoking status (current smoker, former smoker, never smoker) as part of the explanatory variables, controlling for people's demographic and socioeconomic characteristics. The poverty impact is measured by the changes in the poverty head count, after smoking-related expenses are subtracted from income.

We found that the excessive medical spending attributable to smoking may have caused the poverty rate to increase by 1.5% for the urban population and by 0.7% for the rural population. To a greater magnitude, the poverty headcount in urban and rural areas increased by 6.4% and 1.9%, respectively, due to the direct household spending on cigarettes. Combined, the excessive medical spending attributable to smoking and consumption spending on cigarettes are estimated to be responsible for impoverishing 30.5 million urban residents and 23.7 million rural residents in China. Smoking related expenses pushed a significant proportion of low-income families into poverty in China. Therefore, reducing the smoking rate appears to be not only a public health strategy, but also a poverty reduction strategy.

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Introduction

Despite the overwhelming evidence of the harmful effects of smoking, tobacco use has increased in developing countries and become one of the most profound global health challenges (Jha & Chaloupka, 1999). With more than 320 million smokers consuming 30% of the world's cigarette production and three million of whom are new smokers each

year, China is the world's largest producer and consumer of tobacco (Mackay, 1997). It is estimated that the upward spiral of tobacco consumption in China will result in three million tobacco-related deaths per year in China by 2025, about 30% of the world's total number of tobacco deaths (Jin, Lu, & Yan, 1995). There is an estimated two million deaths per year from tobacco use for the entire developed world combined (Peto, Lopez, Boreham, Thun, & Heath, 1994).

Recently, China has made efforts to ban tobacco advertising and vending machines by ratifying the

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World Health Organization Framework Convention on Tobacco Control. However, due to the economic benefits (e.g. tax revenues) perceived by many policy makers, governments in developing countries like China are often reluctant to take decisive tobacco control measures. Hence, systematic studies on the economic consequences of smoking are critically important in informing and prompting policy makers and the public to take action.

Smoking can negatively affect income in several ways through productivity loss due to smoking-related diseases and deaths (Efroymson et al., 2001; Kiiskinen, Vartianen, Puska, & Pekurinen, 2002; Tsai, Wen, Hu, Cheng, & Huang, 2005) and missed days of work, smoking-attributable medical spending (Centers for Disease Control and Prevention, 2003), and direct spending on tobacco products (Gong et al., 1995). Furthermore, smokers have increased risks of incurring diseases, including lung cancer, emphysema, and cerebral vascular disease (US Department of Health and Human Services, 1989), which can result in increased health expenditure. In addition to these health-related consequences, smoking can impose other direct economic costs. For example, tobacco expenditures represent a significant financial burden for low-income families (Hu, 2002), and smoking may decrease productivity on the job. While the impact of smoking expenditures on household consumption has been examined in China (Hu, Mao, Liu, de Beyer, & Ong, 2005; Wang, Sindelar, & Busch, 2006), further analysis on the impoverishing effect of smoking has not been made.

Primarily based on analysis of the 1998 China national health services survey data, the impact of smoking on poverty is estimated from: (a) the impoverishing effect of smoking-attributable medical spending and (b) the impoverishing effect of direct spending on cigarettes. Since the poverty line is calculated in different ways for urban and rural

residents in China, the poverty impact of cigarette smoking for urban and rural populations is estimated separately. Poverty is defined as earning less than 54 Yuan (US \$0.22 per day) monthly capita in urban areas and less than 143 Yuan (US \$0.60 per day) monthly capita in rural areas (Li, 1997).

The 1998 national health services survey

Using a multi-stage stratified random sampling framework, the 1998 national health services survey was conducted by the Chinese Ministry of Health. It included household interview surveys of 56,994 representative families (216,101 individuals) with a response rate of 99.9% (Gao, Tang, Tolhurst, & Rao, 2001). As China is still a developing country with about 70% of its population living in rural areas and primarily engaged in agriculture, the household sample included 16,784 households from urban cities and 40,210 households from rural areas. In addition to demographic and socioeconomic data, the interviewers, who are trained medical professionals, also collected comprehensive information on self-reported health status, health care utilization (including outpatient and inpatient services), medical expenditures, and behavioral factors such as smoking and drinking.

Smoking rate and frequency

Based on the analysis of the 1998 China national health services survey data, the overall smoking rate is higher in rural than urban China, with the rural female smoking rate being slightly lower than that of the urban sample, as shown in Table 1. The percentage of male and female adults from the rural sample who are current smokers are 56.5% and 3.4%, respectively, slightly lower than from the most comprehensive study of tobacco use, the 1996 China national prevalence survey (Yang et al.,

Table 1
The rate (%) of smoking and quitting in China by region and gender

Region of China	Smoking male (%)	Smoking female (%)	Quitting male (%)	Quitting female (%)
Urban (<i>n</i> = 16,784)	51.7	5	10.7	15.6
Rural (<i>n</i> = 40,210)	56.5	3.4	5.5	7.9

Data source: 1998 China national health services survey.

Note: 1. *n* = sample size (households). 2. Urban is defined as predominantly in the formal sector. 3. Rural is defined as predominantly in the informal and agricultural sectors.

1999), which shows 63% men and 4% of women are current smokers. The percentages of male and female adults from the urban sample who are current smokers are 51.7% and 5%, respectively. Moreover, both the male and female rates of former smokers in the rural sample are lower than that of the urban sample; 5.5% of the male smokers and 7.9% of the female smokers in the rural sample quit smoking. By comparison, 10.7% of the male smokers and 15.6% of the female smokers in the urban sample quit smoking. Since the average income of rural residents is lower than that of their urban counterparts, these results are consistent with previous findings in the literature that the smoking rate in lower socioeconomic classes tends to be higher. Furthermore, while 62% of urban smokers reported smoking at least 10 cigarettes a day, the figure for rural smokers is 70%, indicating a higher level of cigarette consumption among rural smokers.

Expenditures on cigarettes

The 1998 China national health services data only have information on the smoker's daily consumption of cigarettes. The smoker is asked to answer with one of the following categories: less than 10, 10–19, or more than 20 cigarettes per day. The group mean was used to approximate the smoker's daily consumption level to calculate his or her annual cigarettes consumption. For example, if the person indicates that he or she smokes 10–19 cigarettes a day, the person's daily cigarettes consumption level is set at 15. Very few people indicated smoking more than 20 cigarettes per day, the mean of which was set at 25. Information on prices of cigarettes was obtained from another household survey conducted in 2001 (Hu, Mao, & Liu, 2003). Since people of different income groups may buy different brand cigarettes, information on price per pack of cigarettes by income quintiles was compiled. Annual cigarette expenditure was estimated by using the 1998 annual cigarette consumption and average price paid by income quintile and regional (urban vs. rural) in 2001, which was adjusted by the annual inflation rate from 1998 to 2001. On average, an urban smoker spent 448 Yuan (12% of the household income) on cigarettes, whereas a rural smoker spent 87 Yuan (5% of the household income) on cigarettes—the higher their income, the more smokers spent on cigarettes.

Medical expenditures and related expenses

In 1998, the reported annual household income was 4342 Yuan (US \$542) per capita in urban areas and 1968 Yuan (US \$246) per capita in rural areas. Per capita medical spending was 247 Yuan (7% of the income) and 134 Yuan (9% of the income) in urban and rural areas, respectively. On average, the ever smokers in urban and rural areas spent 45% more and 28% more, respectively, on medical services than their non-smoking counterparts, indicating a higher need for medical care of the ever smokers. Smoking status is significantly correlated with the rate of chronic illness. But medical expenses are not only related to smoking status. Medical expenditures are found to vary with a number of variables, including age, income, gender, drinking, education, and insurance coverage (Newhouse, 1996). To estimate medical expenditures attributable to smoking, confounding factors were controlled. It is worth noting that the majority of Chinese populations do not have health insurance coverage and that only 42% of the urban residents and 9% of the rural residents reported having any health insurance coverage in this survey.

Data and methods

Estimating medical spending due to cigarette smoking

Of the two main approaches to assess extra medical spending attributable to smoking, *inclusive* and *disease-specific* (Cutler, 2000), our study uses the former. The inclusive approach recognizes that the health effects of smoking are complex and may extend beyond what has been set forth by epidemiological research and thus, assesses the impact of smoking on all relevant types of medical spending, which may include inpatient care, outpatient care, long-term care, and other acute care services.

The excess use of medical services by current and by former smokers can be obtained using methods similar to that of Manning, Keeler, Newhouse, Sloss, and Wasserman (1989, 1991). In particular, the following regression equation of medical care utilization on smoking status (current, former, or never) is estimated:

$$\log[Y + 5] = b_1 * CS + b_2 * FS + XB + e, \quad (1)$$

where Y is the annual medical expenditure, which might be zero (hence we make the dependent variable a positive number by adding 5 in this

log-linear model); CS and FS are dummy variables equal to 1 if the individual is a current or former smoker; and X is the vector of demographic and individual covariates (age, gender, income, education, drinking, and insurance) with coefficient vector B ; and e is a stochastic error term.

Using the coefficient estimates from the regression above, the value of the dependent variable for each individual in the sample within each smoking group (current and former) can be predicted. Now suppose that the current and former smokers had never smoked, what would their medical expenses have been? We estimate their medical expenses by using the same independent variables for each current and former smoker but setting the CS and FS variables to zero. The predicted expenditure of the smokers in the sample assuming they had not smoked is subtracted from the predicted expenditure given that they did indeed smoke. The difference of these two expressions is the predicted effect of smoking on medical care resource utilization:

$$\begin{aligned} &\text{Excess Use of CS} \\ &= \text{Average Predicted Use CS} \\ &\quad - \text{Average Predicted Use CS if NS}, \end{aligned} \tag{2}$$

$$\begin{aligned} &\text{Excess Use of FS} \\ &= \text{Average Predicted Use FS} \\ &\quad - \text{Average Predicted Use FS if NS}, \end{aligned} \tag{3}$$

where NS is a dummy variable equal to 1 if the individual is a never smoker. Thus, rather than taking the average medical care of non-smokers as the counterfactual, Eqs. (2) and (3) explicitly adjust for differences among individuals within each smoking group using the covariates in Eq. (1).

Estimating impact on poverty

The impoverishing effect of excessive medical spending attributable to smoking and direct tobacco expenditures is estimated using a poverty head count. The *head count* measures the number of individuals or households living below the poverty line as a percentage of the total population/households. The impact of a particular expenditure (in this case the excessive medical spending attributable to smoking and direct spending on cigarettes) on poverty is then measured by the change in poverty head count, after that expenditure is subtracted from the income. This method (Pen, 1971) has been used by others in estimating the impoverishing effect of medical expenses (Wagstaff & Von Doorslaer, 2001).

Results

Excessive medical spending and impoverishment

Even though smoking attributable medical spending tends to be higher for the higher income groups, this spending appears to impose higher financial burden on low-income families as shown in Table 2. For the urban sample, medical spending attributable to smoking as a percentage of income is 6.5% for the lowest income quintile, while it is 1.5% for the highest income quintile. A similar trend is also found for the rural sample, when excessive medical spending is compared to income levels. Therefore, it is not surprising to discover that the impoverishing effect of the excessive medical spending is mostly felt by people of low-income groups.

As indicated by Table 3, the urban poverty rate based on reported income alone is 58.3% for the lowest income quintile. After the excessive medical

Table 2
Excessive medical spending attributable to smoking by income quintile and region in China (per capita spending and as percent of household income)

Region	1 (Lowest quintile)	2	3	4	5 (Highest quintile)
Urban ($n = 16,784$)	88 Yuan 6.5%	99 Yuan 3.6%	111 Yuan 2.8%	124 Yuan 2.3%	130 Yuan 1.5%
Rural ($n = 40,210$)	22 Yuan 3.8%	21 Yuan 1.8%	22 Yuan 1.3%	24 Yuan 1%	25 Yuan 0.6%

Data source: 1998 China national health services survey.

Note: 1. n = sample size (households). 2. Urban is defined as predominantly in the formal sector. 3. Rural is defined as predominantly in the informal and agricultural sectors.

spending attributable to smoking has been subtracted from the income, the urban poverty head count increased more than 7%. Similarly, the rural poverty rate based on reported income alone is 29.6% for the lowest income quintile and increased to 32.3%. Given China's urban and rural populations as a percentage of the 1.29 billion total population (30% and 70%, respectively), the number of people who become impoverished because of the excessive medical spending attributable to smoking can be calculated. Each year, according to our estimate, 12.1 million people (5.8 million urban residents and 6.3 million rural residents) may have been driven into poverty due to smoking attributable medical spending.

Spending on cigarettes and impoverishment

Even though the smoking rate is higher for the lower-income groups than that for the higher-income groups, the lower-income smokers spent less (choosing cheaper cigarettes) on cigarettes due

Table 3

Poverty headcount by income quintile and region in China using smoking attributable medical spending (pre-subtraction vs. post-subtraction of medical spending attributable to smoking from income)

Region	1 (Lowest quintile) (%)	2 (Second quintile) (%)
Urban	58.3	0
(<i>n</i> = 16,784)	65.4	0.5
Rural	29.6	0
(<i>n</i> = 40,210)	32.2	0

Data source: 1998 China national health services survey.

Note: 1. *n* = sample size (households). 2. Urban is defined as predominantly in the formal sector. 3. Rural is defined as predominantly in the informal and agricultural sectors.

Table 4

Poverty headcount by income quintile and region in China using direct spending (pre-subtraction vs. post-subtraction of direct cigarette spending from income)

Region	1 (Lowest quintile) (%)	2 (%)	3 (%)	4 (%)	5 (Highest quintile) (%)
Urban	58.3	0	0	0	0
(<i>n</i> = 16,784)	77.0	11	1.3	0.6	0
Rural	29.6	0	0	0	0
(<i>n</i> = 40,210)	37.1	0.1	0	0	0

Data source: 1998 China national health services survey; 2001 household survey on smoking in three provinces (data adjusted by the annual inflation rate from 1998 to 2001).

Note: 1. *n* = sample size (households). 2. Urban is defined as predominantly in the formal sector. 3. Rural is defined as predominantly in the informal and agricultural sectors.

to ability to pay. On average, an urban smoker spent 448 Yuan (12% of the household income) on cigarettes in 1998, whereas a rural smoker spent 87 Yuan (5% of the household income) on cigarettes. However, cigarette spending constitutes a higher financial burden for the lower-income groups than the higher-income groups. Among the urban smokers, cigarette spending represents 7% of the household income for the highest 20 percentile of income groups, while it represents a stunningly 46% of the household income for the lowest 20 percentile of income groups. Among the rural smokers, cigarette spending represents 4% of the household income for the highest 20 percentile of income groups and 11% of the household income for the lowest 20 percentile of income groups.

While cigarette spending impoverished neither from the urban nor rural populations from the highest 20 percentile of income, it caused the poverty rate to increase by 19% and 8% for the lowest 20 percentile of income groups among the urban and rural, respectively, as indicated by Table 4. After cigarette spending is subtracted from income, the urban and rural head counts increased to 18.4% and 9.2%, respectively. Each year 41.8 million people (24.7 million urban residents and 17.1 million rural residents) may have been driven into poverty by cigarette spending.

Discussion

According to our estimation, the excessive medical spending attributable to smoking caused the urban and rural poverty rates to increase by 1.5% (affecting 5.8 million urban residents) and 0.7% (affecting 6.3 million rural residents), respectively. Since the majority of the Chinese populations do not have health insurance coverage and such

coverage is known to be closely correlated with health care utilization, (Ministry of Health, 1994, 1999; Newhouse, 1996), this estimate is likely to indicate a lower bound of the impact. In addition, the direct spending on cigarettes has a remarkable impact on poverty in China. Estimates indicate that cigarette spending caused the urban and rural poverty rates to increase by 6.4% (affecting 24.7 million urban residents) and 1.9% (affecting 11.7 million rural residents), respectively. The incidence of poverty due to excessive medical spending and direct cigarette spending falls disproportionately on low-income families.

From a policy perspective, reducing the smoking rate is not only an important public health issue, but also that of poverty reduction. It is clear from Tables 3 and 4 that the impoverishing effects caused by smoking-related medical expenditures and cigarette spending are mostly suffered by people in the lowest income bracket. Therefore, a lowered smoking rate would mean lower spending on cigarettes and result in less competition for the limited household budget of the low-income people. The lowered smoking rate would also reduce the risk of smoking-related illnesses and lower medical expenditures. Based on the estimates emerging from our analysis, if all else equal and the current smoking rate is halved in China, it may be that 28 million people can be lifted out of poverty.

However, there are several caveats regarding interpretations of our findings. First, as China is a large country with significant variation in income across regions, estimation from regionally adjusted poverty lines might be different from our results. Second, the 1998 China national health services survey did not collect information on household direct spending on cigarettes. Relevant information from another survey was used to calculate the expected spending on cigarettes for the smokers in our study sample. Third, our main results on medical impoverishment relied on the self-reported income data and expenditure data. There might be under-reporting of income and over-reporting of expenditures, which may bias the estimate of smoking-related medical impoverishment in rural China upwards. On the other hand, the “medical expenditures” only include direct expenses for health care services and drugs and not indirect costs such as transportation and lodging costs of the patients and their families, which are substantial in rural China (Ministry of Health, 1994, 1999). Last, but not the least, this study only examined the

partial financial impact of smoking and not the effects of productivity loss due to smoking-related diseases and second-hand smoking, which may suggest an underestimation of results.

While China is the world’s largest consumer and producer of tobacco, this impoverishing effect may also apply to other developing countries, whereby prevention is possible. Many studies have delved into the impact of tobacco consumption on expenditures, but few have looked at the link from smoking to poverty. Effective tobacco control measures, thus serve not only in health improvement purposes, but that of poverty alleviation.

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