

# Determinants of smoking-induced deprivation in China

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## ABSTRACT

**Objective** Spending on cigarettes may deprive households of other items like food. The goal of this study was to examine the prevalence of and factors associated with this smoking-induced deprivation among adult smokers in China.

**Methods** The data came from Waves 1–3 of the International Tobacco Control (ITC) China Survey, conducted from 2006 to 2009 among urban adults aged 18 years or older in China. We focus on the samples of current smokers from six cities (N=7981). Smoking-induced deprivation was measured with the survey question, “In the last six months, have you spent money on cigarettes that you knew would be better spent on household essentials like food?” We examined whether sociodemographic factors, smoking intensity and price paid per pack of cigarettes were associated with smoking-induced deprivation using generalised estimating equations modelling.

**Findings** 7.3% of smokers reported smoking-induced deprivation due to purchasing cigarettes. Low-income and middle-income smokers were more likely to have smoking-induced deprivation compared with high-income smokers (adjusted OR (AOR)=2.06, 95% CI 1.32 to 2.31; AOR=1.44, 95% CI 1.10 to 1.69); smokers living in Shenyang (AOR=1.68, 95% CI 1.25 to 2.24) and Yinchuan (AOR=2.50, 95% CI 1.89 to 3.32) were more likely to have smoking-induced deprivation compared with smokers living in Beijing. Retired smokers were less likely to have smoking-induced deprivation compared with employed smokers (AOR=0.67, 95% CI 0.52 to 0.87). There was no statistically significant relationship between smoking intensity, price paid per pack of cigarettes and smoking-induced deprivation.

**Conclusions** Our findings indicate that certain groups of smokers in China acknowledge spending money on cigarettes that could be better spent on household essentials. Tobacco control policies that reduce smoking in China may improve household living standards by reducing smoking-induced deprivation.

## INTRODUCTION

Smoking has a long-term negative impact on health, causing illness, disability, premature deaths and productivity losses that lead to substantial economic burden.<sup>1</sup> In addition, smoking may also have a short-term negative impact on household finances and living standards, affecting not only the smoker but the rest of the family members as well.<sup>2</sup> Spending on cigarettes may crowd-out or deprive households of other expenditures such as food, housing and education, meaning that money is spent on cigarettes instead of other household essentials.

Several studies report this effect in developed countries. A study of low-income British families found that smoking was a strong predictor of financial hardship and low income.<sup>3</sup> Similarly, after controlling for several indicators of socioeconomic status and demographic factors, Siahpush *et al*<sup>4</sup> found that households reporting tobacco expenditures were more likely to experience financial stress in Australia. Using data from the USA, Busch *et al*<sup>5</sup> found that smokers spend less on housing than non-smokers.

For developing countries, impact of smoking on crowding out or depriving of other expenditures may be especially alarming because the proportion of the population living under the poverty line is larger and smoking prevalence is higher than in developed countries.<sup>6</sup> Efroymsen *et al*<sup>7</sup> reported that in Bangladesh, tobacco expenditures exacerbate the effects of poverty and cause substantial deterioration in nutritional status and living standards among the poor. In India, John *et al*<sup>8</sup> found that expenditures on tobacco were associated with increased rural and urban poverty rates by 1.5 and 0.7%, respectively. John also found that households with tobacco consumption had lower consumption of certain commodities including milk, education and entertainment.<sup>9</sup> A recent study conducted in Cambodia found that spending on tobacco crowds out expenditures on food for low-income and middle-income households.<sup>10</sup>

The impact of smoking on crowding out or depriving of other household expenditures in China is particularly important because China is the largest consumer of tobacco in the world. Several studies have documented the impact of tobacco expenditures on crowding out other household spending in China. A study conducted in Shanghai in 1995 reported that current smokers spent 17% of their household income on cigarettes.<sup>11</sup> The average daily household income for a middle-class family in China was about \$9.80 in 2010.<sup>12</sup> Thus, one pack of the most popular brand of cigarette (Yuxi, \$2.90/pack) would account for 30% of the family's daily income. In the USA, by contrast, daily income averages \$137.33 and a typical pack of cigarettes costs \$5.72, or 4% of daily income.<sup>13 14</sup> Two studies conducted in China found that purchasing cigarettes reduces household expenditures on food, housing, clothing, education and durable goods consumption.<sup>1 15</sup> Liu *et al*<sup>16</sup> found that household spending on cigarettes in China resulted in an increase in the poverty rate in urban and rural areas of 6.4 and 1.9%, respectively. However, none of these studies in China examined the proportion of adult smokers who experienced

smoking-induced deprivation, which was first defined based on subjective perception by Siahpush *et al.*<sup>17 18</sup> using survey question (“In the last six months, have you spent money on cigarettes that you knew would be better spent on household essentials like food?”). In addition, while studies conducted in the USA, Canada, the UK, Australia and Mexico have examined the factors associated with smoking-induced deprivation among adult smokers in those countries,<sup>17 18</sup> little research has addressed the correlates of smoking-induced deprivation among Chinese smokers. This study will fill that gap by (1) examining the proportion of adult smokers who reported that their cigarette purchases deprived them of essential household expenditures, and (2) identifying the factors associated with smoking-induced deprivation among adult current smokers in China. This information will help policymakers to make the case that quitting smoking would enhance family welfare in China.

## METHODS

### Data source and study design

The data from Wave 1 (April–August 2006), Wave 2 (October 2007–January 2008) and Wave 3 (May–October 2009) of the International Tobacco Control (ITC) China Survey were analysed, which is a prospective longitudinal survey of adults aged 18 years or older in six cities in China: Beijing, Shanghai, Guangzhou, Changsha, Shenyang and Yinchuan. Starting from Wave 3, Kunming has been added in the ITC China Survey, but we did not include the Kunming sample in this study. These cities were judiciously selected based on their size, geographical representations and levels of economic development.<sup>19</sup> Using a multistage cluster random sampling design, a representative sample of approximately 800 current smokers and 200 non-smokers who were registered residents were selected within each city at each wave. Current smokers are defined as those who have smoked 100 cigarettes in their lifetime and are currently smoking at least once a week at the time of interview. Through face-to-face interviews, information on individual’s demographic characteristics such as age and gender, smoking behaviour and cigarette purchasing behaviour was collected. The response rates ranged from 39.4% in Yinchuan to 61.3% in Shanghai.<sup>20</sup> A more detailed description of the survey methods can be found in Wu *et al.*<sup>20</sup>

### Study sample

The samples used for this study were restricted to current smokers who participated in all three waves of the ITC China Survey in each city. After excluding observations with missing information on smoking-induced deprivation, sociodemographic characteristics, smoking intensity and price paid per pack of cigarettes. Our final study sample size was 7981 observations.

## Measures

### Dependent variable

The dependent variable in this study is smoking-induced deprivation, which was measured by the ITC China Survey question: ‘In the last six months, have you spent money on cigarettes that you knew would be better spent on household essentials like food?’ Those who responded ‘yes’ to the question were considered to have smoking-induced deprivation, whereas those who responded ‘no’ were not. Those who refused to answer or reported unknown status were coded as missing and excluded from our sample as stated above.

### Independent variables

In this study, three groups of independent variables were included: (1) sociodemographic characteristics, (2) smoking intensity and (3) price paid per pack of cigarettes. Sociodemographic characteristics are gender, age, marital status, education, monthly household income, employment status and city of residence. Age was categorised as 18–24 years, 25–39 years, 40–54 years and 55 years or older. Marital status was classified as married or living together, divorced or separated or widowed, and single. Education was categorised as low (less than high school degree), middle (high school graduate) and high (more than high school degree). Using the income categories for urban areas from the 2010 China Statistics Yearbook,<sup>21</sup> monthly household income was classified into three categories: low income (<1000 Yuan, equal to US\$147, using the 2009 exchange rate of 6.8 Yuan per dollar<sup>21</sup>), middle income (1000–2999 Yuan, equal to US\$147–441) and high income (>3000 Yuan, equal to US\$441). Household size in China varies little due to the one-child policy, so the classification of income categories in our study is based on the size of a typical urban family in China—three persons. Employment status was classified as employed, unemployed and retired. Smoking intensity was categorised as light ( $\leq 10$  cigarettes per day (CPD)), moderate (11–20 CPD) and heavy ( $\geq 21$  CPD). Price paid per pack of cigarettes was assessed by the question: “On average, how much did you pay for each pack of cigarettes you bought last time?” and classified into four groups using quartiles: <3.5 Renminbi (RMB)/pack, 3.5–10 RMB/pack, 10–40 RMB/pack and  $\geq 40$  RMB/pack.

### Statistical analysis

Because of the correlated nature of the longitudinal ITC China Survey data within respondents across survey waves, we used the method of generalised estimating equations (GEE)<sup>22–24</sup> to examine the factors associated with smoking-induced deprivation among smokers. In the GEE model, the dependent variable was whether or not smokers had experienced smoking-induced deprivation in the last six months (yes/no). The independent variables were sociodemographic characteristics, smoking intensity and price paid per pack of cigarettes. In GEE modelling, gender and city of residence were treated as time-invariant, whereas the other independent variables were treated as time-varying variables. We specified the GEE model with binomial distribution and a logit link. We also specified an unstructured within-subject correlation structure based on the lowest ‘quasi-likelihood under the independence model criterion (QIC)’ among various structures of the covariance matrix of the error terms (independent, autoregressive, exchangeable, 1-dependent and unstructured). All analyses were conducted with STATA, V.11.0<sup>25</sup> and were also weighted to ensure that results were representative of smokers in the six cities included.<sup>20</sup> Adjusted ORs (AOR) and the corresponding 95% CIs were computed to assess the strength of association. A two-tailed p value of <0.05 was considered statistically significant.

## RESULTS

**Table 1** shows the characteristics of the study sample. Only 4.6% of smokers in our sample were female. Most smokers in our sample were aged 40 and older (84.4%) and married or living together (90.8%). Sixteen per cent of the sample reported low income, while 46.2 and 37.8% reported middle and high income, respectively. 19.9% of them had achieved high education status, and a majority of the sample were employed (59.9%). Nearly half of the sample were moderate smokers

**Table 1** Characteristics of smokers in our sample in Waves 1–3 of the ITC China Survey (N=7981)

Characteristic	n	%
Gender		
Male	7611	95.4
Female	370	4.6
Age		
18–24	55	0.7
25–39	1188	14.9
40–54	4024	50.4
55+	2714	34.0
Marital status		
Married or living together	7247	90.8
Divorced or separated or widowed	466	5.8
Single	268	3.4
Monthly household income		
Low	1274	16.0
Middle	3687	46.2
High	3020	37.8
Education		
Low	930	11.7
Middle	5462	68.4
High	1589	19.9
Employment status		
Employed	4780	59.9
Unemployed	1012	12.7
Retired	2189	27.4
City of residence		
Beijing	1577	19.8
Shenyang	991	12.4
Shanghai	1673	21.0
Changsha	1414	17.7
Guangzhou	1139	14.3
Yinchuan	1187	14.9
Smoking intensity (cigarettes per day)		
Light (0–10)	2785	34.9
Moderate (11–20)	3933	49.3
Heavy (21+)	1263	15.8
Price paid per pack of cigarette		
<3.5 RMB/pack	1716	21.5
3.5–10 RMB/pack	5164	64.7
10–50 RMB/pack	1061	13.3
≥40 RMB/pack	48	0.6
Total	7981	

ITC, International Tobacco Control.

(49.3%), and 64.7% reported paying 3.5–10 RMB for a pack of cigarette.

### Model selection

As we considered the model with the lowest QIC to be the most parsimonious, we chose the model with unstructured working correlation matrix (see Table 2).

### Smoking-induced deprivation and associated factors

The percentage of smokers who reported that they spent money on cigarettes that they knew would be better spent on household essentials like food was 7.3% (see Table 3). After controlling for other covariates, the GEE model results indicate that smoking-induced deprivation was more likely among

**Table 2** QIC of each working correlation matrix

Working correlation matrix	QIC
Independent	3952.999
AR(1)	3952.114
Exchangeable	3952.110
1-Dependent	3952.117
Unstructured	3952.103

low-income and middle-income than high-income smokers (AOR=2.06, 95% CI 1.32 to 2.31; AOR=1.44, 95% CI 1.10 to 1.69). In terms of the marginal effects, the probability of reporting smoking-induced deprivation increased significantly by 4.3% higher among adults with low income ( $p<0.05$ ) and 2.3% higher among those with middle income ( $p<0.05$ ) compared with the high-income group. The results also show that retired smokers were less likely to have smoking-induced deprivation than employed smokers (AOR=0.67, 95% CI 0.52 to 0.87). Smokers living in Shenyang and Yinchuan were more likely to have smoking-induced deprivation than smokers living in Beijing (AOR=1.68, 95% CI 1.25 to 2.24; AOR=2.50, 95% CI 1.89 to 3.32). No statistically significant relationship was found between smoking intensity, price paid per pack of cigarettes and smoking-induced deprivation. We have also checked the interaction effects between (1) income and city, (2) income and employment status, and (3) income and price paid per pack of cigarettes, and found that none of them was statistically significant.

### DISCUSSION

Our findings that lower income smokers were more likely to have smoking-induced deprivation are consistent with previous findings from a study conducted in developed countries<sup>17</sup> and a study conducted in Mexico.<sup>18</sup> This emphasises the need to implement tobacco prevention and cessation programmes that specifically target low-income smokers in order to reduce smoking-induced deprivation of household essentials.

Our study also found that smokers residing in Shenyang and Yinchuan were more likely to have smoking-induced deprivation than smokers living in Beijing. This might be because these cities are less economically developed than Beijing.<sup>12</sup>

We found no statistically significant relationship between smoking intensity and smoking-induced deprivation. This differs from the findings of two previous studies conducted by Siahpush *et al.*<sup>17</sup> One of their studies found that smokers who had higher levels of nicotine dependence had higher odds of smoking-induced deprivation. Our results may differ because smoking intensity was measured differently in our study than in this study. In our study, smoking intensity was based on number of cigarettes smoked per day, while Siahpush *et al.*<sup>17</sup> measured nicotine dependence using the Heaviness of Smoking Index based on a composite of time to first cigarette smoked after waking and number of cigarettes smoked per day. The other study found that smoking five or more CPD was associated with higher odds of smoking-induced deprivation. We reanalysed our data using the same cut-off value (five CPD) for smoking intensity in our model, but we still found no statistically significant relationship between smoking intensity and smoking-induced deprivation. Future studies are needed to provide a better understanding of the relationship between smoking intensity, dependence and smoking-induced deprivation in China. In

**Table 3** Percentages of smokers who reported smoking-induced deprivation by characteristics and adjusted ORs from the GEE model

Characteristic	% Reporting smoking-induced deprivation	Adjusted OR	95% CI
Total	7.3		
Gender			
Male	7.2	Reference	
Female	10.0	1.40	0.99 to 1.95
Age			
18–24	5.5	0.61	0.17 to 2.12
25–39	7.1	0.98	0.71 to 1.34
40–54	8.2	1.22	0.96 to 1.54
55+	6.1	Reference	
Marital status			
Married or living together	7.2	Reference	
Divorced or separated or windowed	10.7	1.35	0.90 to 1.83
Single	4.9	0.61	0.41 to 1.72
Monthly household income			
Low	13.9	2.06*	1.32 to 2.31
Middle	7.5	1.44*	1.10 to 1.69
High	4.3	Reference	
Education			
Low	10.4	1.56	0.96 to 1.85
Middle	7.4	1.19	0.94 to 1.51
High	5.2	Reference	
Employment status			
Employed	7.1	Reference	
Unemployed	12.5	1.01	0.80 to 1.27
Retired	5.4	0.67*	0.52 to 0.87
City			
Beijing	5.0	Reference	
Shenyang	10.2	1.68*	1.25 to 2.24
Shanghai	3.9	0.88	0.64 to 1.20
Changsha	8.0	1.29	0.96 to 1.74
Guangzhou	6.2	1.18	0.88 to 1.58
Yinchuan	12.9	2.50*	1.89 to 3.32
Smoking intensity (cigarettes per day)			
Light (0–10 CPD)	6.9	Reference	
Moderate (11–20 CPD)	7.0	1.01	0.83 to 1.23
Heavy (21+CPD)	8.9	1.23	0.95 to 1.58
Price paid per pack of cigarette			
<3.5 RMB/pack	9.6	Reference	
3.5–10 RMB/pack	8.4	0.99	0.80 to 1.24
10–40 RMB/pack	7.3	0.99	0.79 to 1.24
≥40 RMB/pack	5.9	0.90	0.70 to 1.15

QIC score of unstructured working correlation matrix: 3952.103.

\*p<0.05 (two-tailed).

CPD, cigarettes per day; GEE, generalised estimating equations.

addition, we found price paid per pack of cigarettes had no association with smoking-induced deprivation, which is consistent with the study conducted in Mexico by Siahpush *et al*<sup>18</sup> This might be because smokers may reduce their cigarette consumption when cigarette prices increase.<sup>26</sup>

While no previous studies have examined the association between employment status and smoking-induced deprivation from cigarette expenditures, our study found that retired smokers are less likely to report smoking-induced deprivation than employed smokers. Possible explanations include that retirees are collecting pensions that are adequate to cover their

expenses or that the household size of retired people is smaller and so expenses are reduced. Another reason could be this survey was conducted in big urban cities in China, where people including retirees are much wealthier than people in other cities. Further research is needed to explore this association.

The percentage of smokers who reported having smoking-induced deprivation (7.3%) in this study was lower than that reported in Australia (33%), the UK (20%), the USA (28%) and Canada (28%).<sup>17</sup> China differs from these countries in that there is huge price variation (from less than US\$1 per pack to more than US\$30 per pack) among cigarettes brands in China so that smokers have multiple price points to choose from what might not appear to be 'cheaper cigarettes' than usual. Another explanation might be that our data were limited to six large urban areas, which may have a lower percentage of smokers reporting smoking-induced deprivation compared with rural China, where incomes tend to be lower. One more explanation could be the survey question (Have you spent money on cigarettes that you knew would be better spent on household essentials like food?) was asked for expenditure patterns 6 months ago, so there might be recall bias and then underestimate the percentage of smoking-induced deprivation.

Our data came from the ITC China Survey, which did not collect household expenditures data on other household essentials like food, housing and education, so it does not allow us to compare the household expenditure patterns of smokers and non-smokers. In addition, the ITC China Survey is not a nationally representative sample, although it is a representative sample of adults living in the selected urban cities covering about 10% of the total population in China.<sup>20</sup> Given that the vast majority of the smoking population still lives in rural areas in China, caution needs to be exercised in generalising the findings to rural areas.

The findings of our study imply that reducing smoking could result in greater household expenditures available for spending on food and other household essentials among certain Chinese smokers, especially those of lower income and those living in Shenyang and Yinchuan. Thus, in addition to health benefits, smoking cessation and reduction might also lead to an improvement in living standards in China.

### What this paper adds

- ▶ In China, spending on cigarettes may deprive households of other household items such as food.
- ▶ Low-income smokers and smokers living in Shenyang and Yinchuan are more likely than high-income smokers and smokers living in Beijing, respectively, to report that they had experienced smoking-induced deprivation. Retired smokers were less likely to report smoking-induced deprivation than employed smokers in China.
- ▶ Tobacco control policies that reduce smoking in China may improve household living standards by reducing smoking-induced deprivation.

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**Competing interests** None declared.

**Patient consent** Obtained.

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