

# Tobacco smoking among government employees in six cities in China

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## ABSTRACT

**Objective** Employer-based tobacco control interventions have been highly successful in developed countries, and, recently, Chinese officials announced a focus on quitting among government employees. However, there are few data offering estimates of smoking prevalence among government workers from developing nations. In this study, we investigate smoking behaviours among government workers in six Chinese cities stratified by educational attainment and occupational grade.

**Design** Individual-level study of Chinese government employees.

**Data sources** Tobacco-Free Cities Initiative of China Tobacco Control Partnership.

**Analysis** Employed adults aged 18–61 at government worksites in six cities were included (N=6176). Prevalence of current and former smoking across educational (postgraduate, graduate, high school, secondary school or less) and occupational (senior executives, mid-level managers, workers) groups were compared.

**Results** Overall prevalence of male current smoking was 40.7% (95% CI 39.1% to 42.4%). Age-adjusted smoking prevalence was lowest among those with a postgraduate degree (26.2% (95% CI 21.0% to 31.4%)) compared with those with lower levels of education (college (39.8%; 37.7% to 41.8%); high school (51.0%; 95% CI 45.0% to 57.0%); secondary or less (45.1%; 95% CI 40.3% to 49.8%)). There was no evidence of an association between current smoking and occupational grade. Prevalence of smoking was low in women (1.5%).

**Conclusions** Smoking prevalence among male government employees at all levels of education was high and patterned by educational attainment. Government initiatives to address tobacco control among employees should consider targeted interventions for different educational levels.

## INTRODUCTION

In 2010, smoking and second-hand exposure to tobacco accounted for 6.3 million or 12% of all deaths worldwide.<sup>1</sup> Tobacco was the leading risk factor for global death and disability among men and was second highest among women.<sup>2</sup> With over 300 million smokers,<sup>3 4</sup> China accounts for much of the world's tobacco-related morbidity and mortality. In 2005, an estimated 673 000 deaths among adults aged 40 or above in China were attributed to cigarette smoking.<sup>5</sup> Along with diet and hypertension, cigarette smoking is estimated to be a leading cause of disability-adjusted life years lost in 2010 for China.<sup>6</sup>

China is the world's largest producer of tobacco products.<sup>7</sup> The Chinese Communist Party recently announced that government workers are to lead by example in their efforts to quit smoking—specifically, officials should not smoke in public or purchase tobacco using public funds, and smoking has been banned at many workplace offices, meeting rooms and cafeterias, with stricter fines, shaming and enforcement promised.<sup>8 9</sup> Although China had signed the WHO's Framework Convention on Tobacco Control (FCTC), policies to address tobacco were not widely implemented and enforced in China.<sup>10</sup> China scored poorly in a recent WHO report on FCTC implementation,<sup>11</sup> and these new government mandates may be in response to this pressure.

Epidemiological analyses that investigate the risk factors for tobacco use are helpful in developing appropriate prevention and control policies and programmes. For example, very little is known about smoking levels among government employees in China—specifically, what was the prevalence before these top-down policies were announced, and how does prevalence in this group compare with prevalence in the general population? In addition, examining the prevalence of tobacco use in different socioeconomic groups helps to prioritise intervention approaches. Previous studies from many high-income countries have shown higher prevalence of tobacco use in lower socioeconomic status groups.<sup>12–14</sup> Studies focusing on low- and middle-income countries also often document a negative association between socioeconomic status and smoking prevalence, although there appears to be more heterogeneity in the magnitude and direction of this association than in high-income countries.<sup>15 16</sup>

The two largest sources of national-level data on smoking in China are the World Health Survey (2002–2003) and the Global Adult Tobacco Survey (GATS, 2008–2010). Studies based on these data indicate that smoking is negatively associated with education and an asset-based index.<sup>16 17</sup> Studies from rural China have demonstrated higher tobacco use and second-hand exposure among tobacco farmers compared with individuals in other occupations or farming other products, less-educated individuals, and poorer communities.<sup>18 19</sup>

Little is known about patterns of tobacco use across different urban employment sectors in China. An understanding of patterns in this specific employment sector will help guide employer-based tobacco control programming, which has been shown to be highly effective.<sup>20 21</sup> We collected and



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analysed data from large government sector employers in six cities in China. We focus on two distinct, yet related, dimensions of socioeconomic position (SEP): educational attainment and occupational status.<sup>22–23</sup> Education, set relatively early in life, influences one's human and social capital, including cognitive factors that can influence lifetime behavioural choices. Occupational status is associated with one's social networks and material resources, both of which may also be related to behavioural choices. These recent data will also be of particular interest given the rapid socioeconomic, demographic and health transitions occurring in China.

## METHODS

### Data and sample

Data were from the Tobacco-Free Cities Initiative of Emory University's Global Health Institute–China Tobacco Control (GHI–CTC) Partnership.<sup>24</sup> The aim of the partnership, which was established in 2008, is to reduce the health, social, environmental and economic burdens of tobacco through several initiatives implemented in 17 Chinese cities.<sup>25</sup> The 17 grantee cities were allowed to decide where to focus their efforts based on each city's unique context. Each city conducted a systematic situational analysis to better understand the extent of tobacco use problems and existing tobacco control efforts and to identify potential interventions and partners. The grantees selected the programme goals based on their perceived ability to achieve the greatest initial impact and the potential for social norm change, and each grantee had to demonstrate impacts of their programme through monitoring and evaluation.

Our analysis was limited to six of the 17 Chinese cities. These were the six cities that addressed tobacco control in government offices: Changchun, Kelamayi, Nanning, Suzhou, Tangshan, Yinchuan. Baseline pre-intervention data were collected at selected worksites in each city in 2011–2012. Potential participants were identified using stratified cluster sampling at each site. Response rate ranged from 75% to 91%: Changchun, 91%; Kelamayi, 84%; Nanning, 77%; Suzhou, 75%; Tangshan, 85%; and Yinchuan, 87%. A total of 7251 respondents were surveyed at worksites. We excluded from our analysis 1075 (14.8%) respondents who had missing data on at least one covariate used in the analysis, and the final analytical sample included 6176 respondents (3321 male and 2855 female).

Using interviewer-administered questionnaires, data were collected to ascertain sociodemographic characteristics, smoking behaviours, worksite smoking policies, and knowledge, attitudes and perceptions about smoking risks. Data were collected by local grantees, which were most commonly city-level Centers for Disease Control (CDCs) and Health Education Institutes. Further details about the GHI–CTC Partnership and data-collection methods have been published separately.<sup>25</sup>

The project received institutional review board approval from Emory University and from local institutional review boards in China. This study was a secondary analysis of deidentified data.

### Smoking and SEP measures

Smoking status at the time of survey was assessed from questions about current and past tobacco smoking behaviour. Current smokers were defined as those who reported current smoking daily or less than daily. Former smokers were those who reported not being current smokers, but who had smoked tobacco in the past. Educational attainment was defined by the highest level achieved: secondary school or less, high-school graduate, college graduate, or postgraduate. Three occupational

categories were assessed: worker, mid-level manager, and senior executive or leader.

### Statistical analysis

Data were pooled from the six cities. Descriptive statistics of the sample, including smoking status, were presented by sex. We then limited the analysis to men because of the low prevalence of current smoking among women (1.5%). Separately, we estimated the proportion of current smokers within each educational category and each occupational category. These estimates were age-adjusted using as a standard the mean age distribution of the men in the sample (using the following age groupings: 18–29, 30–49 and 50–61 years). Statistical comparisons were made using  $\chi^2$  tests for the differences in proportions. The 95% CIs shown account for clustering at both the city and worksite level. Statistical significance was defined as a two-tailed  $p < 0.05$ . All analyses were conducted using SAS (V9).

## RESULTS

**Table 1** provides descriptive characteristics of the sample by sex. The mean age of the men was 39.2 years, and the mean age of the women was 36.4 years. The majority of the sample (76.7% of men and 81.7% of women) had at least a college degree (college graduate or postgraduate), reflecting the high educational level of the sample. Despite the high educational level of the sample, 67.8% (men) and 82.3% (women) were classified as workers. Only 5.5% of men and 1.9% of women were senior executives/leaders.

**Table 1** also provides the prevalence of different smoking statuses. The prevalence of current smoking was low among women (1.5%). For men, 40.7% of respondents were current smokers. Only 5.7% of men and a small percentage (0.4%) of women were former smokers.

**Table 2** presents educational and occupational gradients for current smoking prevalence among men. Focusing on the age-adjusted estimates, the highest smoking prevalence was recorded for those who were high-school graduates (51.0% (95% CI 45.0% to 57.0%)); however, this prevalence was similar to that of the lowest educational category (those with secondary school or less, 45.1% (95% CI 40.3% to 49.8%)). Those with a postgraduate education had the lowest smoking prevalence (26.2% (95% CI 21.0% to 31.4%)). The difference in smoking prevalence between the lowest and highest educated groups was statistically significant ( $p < 0.001$ ). We did not detect statistically significant differences ( $p > 0.05$ ) across the three lowest educational groups, thus most of the gradient is attributable to the lower smoking prevalence among those with a postgraduate degree compared with the three other educational categories. Age-stratified results revealed a similar pattern among those aged less than 40 compared with those aged 40 and above (data not shown).

In contrast with the pattern across educational groups, gradients in current smoking prevalence were not evident across occupational groups (about 40% current smoking prevalence for each group). Multivariate models adjusting for age, marital status and knowledge about whether smoking causes serious disease produced substantively similar results to the patterns we report here (data not shown). Online supplementary appendix 1 provides the distribution of smoking status in individual cities. Online supplementary appendix 2 shows educational and occupational gradients by city and highlights that the gradients were generally similar across cities.

**Table 1** Descriptive characteristics of the sample by sex; ages 18–61

Characteristic	Male (N=3321)		Female (N=2855)	
	% or mean	95% CI	% or mean	95% CI
Age, mean (SD)	39.2 (9.7)	37.6 to 40.8	36.4 (8.8)	34.8 to 38.0
Smoking status, %				
Current	40.7	39.1 to 42.4	1.5	1.1 to 2.0
Former	5.7	4.9 to 6.5	0.4	0.2 to 0.6
Never	53.6	51.9 to 55.3	98.1	97.6 to 98.6
Education, %				
Secondary school or less	14.1	12.9 to 15.3	10.1	9.0 to 11.2
High-school graduate	9.2	8.2 to 10.2	8.2	7.2 to 9.2
College graduate	66.6	65.0 to 68.2	73.4	71.8 to 75.0
Postgraduate	10.1	9.1 to 11.1	8.3	7.3 to 9.3
Occupation, %				
Worker	67.8	66.2 to 69.4	82.3	80.9 to 83.7
Mid-level manager	26.7	25.2 to 28.2	15.8	14.5 to 17.1
Senior executive or leader	5.5	4.7 to 6.3	1.9	1.4 to 2.4
Marital status, %				
Married	83.7	82.4 to 85.0	79.3	77.8 to 80.8
Single	16.3	15.0 to 17.6	20.7	19.2 to 22.2

Source: Global Health Institute–China Tobacco Control (GHI–CTC) Evaluation Data, 2011–2012.

## DISCUSSION

These 2011–2012 survey data from six different cities in China show a high prevalence of current smoking among men working in the government sector. Smoking was rare among women (<2%). Among male government employees, the lowest educated groups were nearly twice as likely to be current smokers as the highest educated; however, when stratified by occupation, there were no differences between workers, managers and executives in smoking prevalence.

Our findings suggest that smoking status is associated with educational level, but not occupational grade, among male government employees. However, we did not find significant differences in prevalence among the three lowest educational groups, which represented about 90% of the sample. It is clear that

those with a postgraduate degree, representing about 10% of the sample, had the lowest levels of smoking among all groups. These findings are consistent with a study of 19 969 industrial workers and their family members across 10 sites in India.<sup>26</sup> In that study, prevalence of tobacco smoking was associated with education, but not occupational grade.

Our estimates for current smoking prevalence were similar to findings from the 2010 GATS conducted in China. In those high-response-rate household surveys which used a global standardised methodology and recruited 13 354 participants, smoking prevalence among urban men and women was 49% and 3%, respectively.<sup>4</sup> This comparison suggests that smoking levels among male government employees in our study are almost 10 percentage points lower than among men in the overall population. Notably, across occupational groups, GATS data showed a prevalence of tobacco smoking that was almost 70% among machine operators, while about 41% of government workers smoked in our study. Similarly, from GATS, just over 50% of leaders of organisations smoked, which is similar to 40% of individuals in senior leader and executive roles in government who smoked from our data.

Differences in smoking prevalence between those with and without a postgraduate education in our data were of the order of 10–20 percentage points. However, interventions for the most educated are still needed, as more than a quarter of the highest-educated male government employees are current smokers. In addition, in the GATS data, it was found that 53% of current smokers reported initiating tobacco use before the age of 20. This suggests that greater emphasis on tobacco prevention may be necessary, perhaps during teenage and early adulthood through educational institutions.

In addition to health burdens, tobacco use has major economic impacts, especially among lower SEP groups, imposing high health expenditures and opportunity costs on households. This has sequentially broader impacts and potentially stifles micro- and macro-economic development.<sup>27–28</sup> Higher tobacco smoking among the least educated may also reinforce health inequalities across generations.<sup>28–29</sup>

**Table 2** Age-unadjusted and age-adjusted prevalence of current smoking among male government employees by education and occupation status; ages 18–61 (N=3321)

Sector	Age-unadjusted		Age-adjusted	
	Per cent	95% CI	Per cent	95% CI
Education				
Secondary school or less	46.1	41.5 to 50.6	45.1	40.3 to 49.8
High-school graduate	52.5	46.8 to 58.1	51.0	45.0 to 57.0
College graduate	40.2	38.2 to 42.3	39.8	37.7 to 41.8
Postgraduate	25.9	21.2 to 30.6	26.2	21.0 to 31.4
Occupation				
Worker	40.3	38.3 to 42.3	40.7	38.7 to 42.8
Mid-level manager	42.2	38.9 to 45.4	42.3	37.8 to 46.8
Senior executive or leader	38.8	31.7 to 45.9	40.1	30.5 to 49.7

Note: age-standardised estimates were standardised using the mean age distribution of all men in the sample (using the following groupings: 18–29, 30–49 and 50–61 years). Source: Global Health Institute–China Tobacco Control (GHI–CTC) Evaluation Data, 2011–2012.



Advocacy at the employer level, especially mandated and enforced strictly by the Chinese government with regard to their own employees, can have major impacts. In countries such as the USA, there is a large literature on the excess absenteeism, presenteeism, smoking breaks, healthcare, and pension costs borne by employers for smoking employees.<sup>30</sup> The economic argument that tobacco use among employees is costly for employers has resulted in tobacco-free workplaces, tobacco-free hiring practices, nicotine screenings, financial penalties for smoking employees, and encouraging smokers to register and attend cessation programmes.<sup>21 30 31</sup>

Since the tobacco industry itself has strong influences in China, and the Chinese government has a stake in the industry, tobacco regulation in China remains challenging, especially in provinces where tobacco sales contribute to government revenues.<sup>32</sup> As such, this government employee mandate comes at a good time. It is also another example of 'policy experimental gradualism' in China.<sup>33</sup> China has long used the approach of implementing policies and evaluating on-the-ground impacts, feeling its way through policy reforms, rather than rigorously assessing policies before implementation.<sup>34</sup> Similarly here, implementation precedes analysis, and our timely data can serve as a baseline before the government employee mandates regarding tobacco. Repeated surveys at these worksites in the years to come, in a quasi-experimental fashion, may at least provide data and lessons that could be learned from the experimental approach to China's policy innovation and implementation.

There are some limitations that must be considered in interpreting our findings. Our data were not collected from representative population samples in the cities surveyed; these data were from respondents in a specific employment sector and included a mix of random and convenience sampling across cities and worksites. Data for this study were all self-reported. However, most adult tobacco surveys, such as GATS, use interviewer-administered questionnaires to assess prevalence of tobacco use and these have been correlated with serum cotinine levels.<sup>35–37</sup> Also, most studies evaluating the reliability of self-reported smoking behaviours have been conducted in western countries. However, cultural-specific norms as well as gender differences may play a role in reporting behaviours. Social norms in China may have kept smoking prevalence low among women relative to men.<sup>38</sup> Norms discouraging smoking among women may lead to under-reporting of smoking. The similar levels of female smoking observed in GATS and our study (around 2–3%) may therefore be an underestimate of the actual prevalence. We did not have data regarding second-hand smoke exposure, which is common in China.

To provide greater details, data stratified by city are presented in online appendices, although sample sizes precluded a cross-city comparison. Our analyses involved categorising individuals into SEP groups, and could not account for possible heterogeneity within the SEP groups defined. Furthermore, educational status and occupation do not comprehensively characterise all the social and economic factors that influence tobacco use. In particular, cultural practices, parents' smoking habits, peer group pressures among teens, the addictive properties of tobacco, availability and costs of tobacco products, climate, work environment and conditions, and governmental policies all probably influence uptake and use. Future studies should collect data that reflect these different aspects and investigate these further.

The limitations are counterbalanced by some important strengths. Data for this study were collected from six cities, and the analysis included a large sample size, providing some

generalisability to all Chinese government workers. Data were collected using a standardised questionnaire across all work sites and cities. Finally, we used multiple indicators of SEP.

## CONCLUSIONS

Prevalence of tobacco smoking is high among male government workers at all educational levels, and is lower among those with a postgraduate degree compared with all others. To address high tobacco use, especially among lower-educated individuals, appropriate prevention and cessation programmes or enforcement of new policies are needed. In addition, further implementation research is needed to evaluate programmes and policies that have recently been, or are being, implemented in China. In particular, it will be important to identify factors associated with successful tobacco prevention and cessation (eg, enforcement) for all SEP groups.

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