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Approval Sheet

Smoking behaviors, implementation of smoke-free policy and determinants among hotel and restaurant employees in Hangzhou, China

By

Zongshuan Duan

Degree to be awarded: Master of Public Health

Global Health

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Abstract Cover Page

Smoking behaviors, implementation of smoke-free policy and determinants among hotel and restaurant employees in Hangzhou, China

By

Zongshuan Duan

Bachelor of Art

Peking University Health Science Center

2011

Thesis Committee Chair: Solveig A. Cunningham, PhD

An abstract of

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Abstract

Objective To investigate smoking prevalence, implementation of smoke-free policy and corresponding determinants among employees from thirty hotels and restaurants in Hangzhou, China

Methods Data were collected from baseline and post-intervention surveys from employees from thirty hotels and restaurants in Hangzhou (n=2768) by convenience sampling, through the Emory University Global Health Institute China Tobacco Control Partnership (GHI-CTP) Tobacco-Free Cities (TFC) program conducted by the Hangzhou TFC office at Hangzhou Center for Disease Control and Prevention (CDC). We used principal component analysis to group influencing variables including employees' knowledge and attitudes towards tobacco use and smoke-free policies, and performed multivariate logistic regression models to measure the associations between employees' tobacco use related behaviors, including smoking status and implementation of smoke-free policy in their workplaces, and influencing factors.

Results Of the 2768 sampled hotels and restaurants employees in Hangzhou, the current smoking prevalence of male employees was 42.0%, compared with that of female employees as 1.47%. Among all employees who reported seeing smoking behaviors in the last 7 days at their workplaces, 76.8% tried to discourage the smokers at their workplaces. After adjusting for age groups, gender, education, marital status and peer effect, factors significantly associated with current smoking status included attitudes towards smoking in public areas [OR=0.27, 95% CI (0.21, 0.35)], smoking in hotel business areas [OR=3.5, 95% CI (2.4, 5.2)], smoking in hotel nonbusiness areas [OR=2.3, 95% CI (1.7, 3.3)], smoking outside hotels [OR=1.7, 95% CI (1.3, 2.1)], smoking in restaurant business areas [OR=4.2, 95% CI (2.8, 6.3)], smoking in restaurant nonbusiness areas [OR=3.2, 95% CI (2.2, 4.6)], smoking outside restaurants [OR=2.0, 95% CI

(1.6, 2.6)]; factors that were significantly associated with behavior of discouraging smokers in workplace included the knowledge factors as smoking causing serious illness [OR=1.8, 95% CI (1.0, 3.3)], secondhand smoke causes serious illness [OR=1.8, 95% CI (1.1, 3.0)], and common knowledge [OR=1.5, 95% CI (1.1, 2.2)] including smoking may cause stroke, heart attack, emphysema, male impotence, and secondhand smoking may cause heart attack in adults.

Conclusion Employees' attitudes towards tobacco use and exposure to secondhand smoke in public places and workplaces were significantly associated with their current smoking status, while their knowledge of serious illness caused by smoking and secondhand smoke exposure was significantly associated with their behaviors to discourage others from smoking at their workplaces. In addition, the smoke-free policies were not strictly implemented at the catering industry in Hangzhou, and smoking and secondhand smoke exposure remained public health problems for staff employed in hotels and restaurants.

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Chapter 1: Introduction

1. Introduction and rationale

Smoking prevalence and cost in China

According to the Global Adult Tobacco Survey (GATS) in 2010, an estimated 28.1% of adults in China were current smokers. The prevalence of smoking among men was significantly higher among rural residents (56.1%), as compared with inhabitants of urban areas (49.2%). Of all current smokers, 85.6% smoked daily. Smokers of manufactured cigarettes smoked an average of 14.2 cigarettes per day (14.3 for men and 10.6 for women). GATS China 2010 also showed that among those in China who had smoked at some time, 57.5 million (16.9%) had quit smoking and were not smoking currently, while 112.8 million (33.1%) had quit smoking in the past but were currently smoking. Among those who had smoked at some time that had attempted to quit during the 12 months before the survey, 91.8% did not use any method to assist with smoking cessation and the rest relied on medications, counseling, and other methods (Yang GH, et al., 2010).

In 2010, there were an estimated 301 million current smokers in China, making this country the largest consumer of tobacco in the world. If the high smoking prevalence among Chinese adults persists, China will suffer from a heavy disease burden and incur serious socioeconomic losses in the 21st century (G. Yang et al, 2011). The total economic cost attributable to smoking in China amounted to $17.1 billion in 2003 and $28.9 billion in 2008. Direct smoking-attributable healthcare costs in 2003 and 2008 were $4.2 billion and $6.2 billion, respectively. Indirect

economic costs in 2003 and 2008 were $12.9 billion and $22.7 billion, respectively. Compared to 2000, the direct costs of smoking rose by 72% in 2003 and 154% in 2008, while the indirect costs of smoking rose by 170% in 2003 and 376% in 2008 (L. Yang, 2011).

Tobacco control implementation in China

China became a signatory to the WHO Framework Convention on Tobacco Control on October 11, 2005. However, tobacco control policies had emerged more slowly in China than in many other countries in the region. Until March 2014, Chinese cigarette packages carried obscure health warnings printed on the side of the pack with the vague text-only message that, 'Smoking may harm your health'. Although tobacco advertisements had been banned from mass media, such as TV, radio and newspapers, tobacco companies have successfully used sponsorships and promotions to maintain a visible marketing presence. In short, both the state of existing tobacco control regulations in China and their enforcement remained at an early stage.

To date, China does not have a national law to restrict smoking in workplaces and other indoor public venues, while smoking remains common in healthcare facilities and educational facilities. Legislation bans smoking in specific places. The Tobacco Monopoly Law requires that smoking be prohibited or restricted in public places and public transportation in general, and the Ministry of Health Implementation Rules on the Regulations on Public Places Sanitation Administration prohibits smoking in the 28 indoor public places listed in the State Council Regulations. These places include restaurants, bars, and pubs. In addition, the Ministry of Health has issued a decision requiring all medical facilities to be smoke free. A national law bans tobacco advertising on film, television, radio, and in newspapers and magazines. Local jurisdictions have

the authority to regulate outdoor tobacco advertising and some have banned it. Tobacco companies can advertise their products at point of sale, through sponsored events and branded schools, on billboards, online, and through extensive advertising of affiliated companies with the same names as tobacco brands. Even though hotels and restaurants were among the sites designated by law, studies showed smoke-free policies were not fully implemented and enforced.

As for Large-scale international events such as World Expos and Olympic Games which had the potential to strengthen smoke-free norms globally, China missed the opportunities to comprehensively implement the smoke-free policy and adopt the non-smoking social norm. A survey evaluating implementation of tobacco control policies at the 2010 World Expo in Shanghai showed that although 80.3% of visitors were aware of the smoke-free policy at the World Expo and 92.5% of visitors supported the policy, still 4.5% of visitors observed smoking in outdoor nonsmoking areas (Li Xiang et al, 2013).

Secondhand smoke exposure and attitudes towards smoke-free regulation among employees in hotels and restaurants in China

It is well known that inhaling second-hand smoke (SHS) is harmful. There is no risk-free level of exposure to SHS. Smoke-free legislation is the most effective method of reducing exposure to SHS. (GATS, 2010)

One study was conducted on the restaurant and bar owners' exposure to secondhand smoke and attitudes regarding smoking bans in five Chinese cities, including Beijing, Wuhan, Xi'an, Kunming and Guiyang. A convenience sample of 814 restaurants and bars was selected in five

Chinese cities and all owners of these venues were interviewed in person by questionnaire in 2007. Eighty six percent of current nonsmoking subjects had at least one-day exposure to secondhand smoke (SHS) at work in the past week. Only 51% of subjects knew SHS could cause heart disease. Only 17% and 11% of subjects supported prohibiting smoking completely in restaurants and in bars, respectively, while their support for restricting smoking to designated areas was much higher. Fifty three percent of subjects were willing to prohibit or restrict smoking in their own venues. Of those unwilling to do so, 82% thought smoking bans would reduce revenue, and 63% thought indoor air quality depended on ventilation rather than smoking bans. These results showed that there was support for smoking bans among restaurant or bar owners in China despite some knowledge gaps (Ruiling Liu et al., 2011). The study suggested that to facilitate smoking bans in restaurants and bars, it is important to promote health education on specific hazards of SHS, provide country-specific evidence on smoking bans and hospitality revenues, and disseminate information that restricting smoking and ventilation alone cannot eliminate SHS hazards.

Importance of smoke-free policy implementation in hotels and restaurants

It had been proved that an introduction of a legislative smoking ban had the potential to lead to a reduction in exposure to passive smoking. Hospitality workers experienced a greater reduction in exposure to secondhand smoke after implementing the ban compared to the general population. Even though there was limited evidence about the impact on active smoking, the general trend was downwards. There was evidence showing an improvement in health outcomes for employees working in catering service industry settings. The strongest evidence was the reduction seen in admissions for acute coronary syndrome. An increase in support for and

compliance with smoking bans after the legislation had been observed worldwide. (Lu S. et al., 2013)

A cross-country comparison of secondhand smoke exposure among adults based on the findings of GATS concluded that a large proportion of adults living in low and middle-income countries were exposed to secondhand smoke in their homes, workplaces, and other public places. The authors concluded that countries could enact and enforce legislation requiring 100% smoke-free public places and workplaces, and could also conduct educational initiatives to reduce secondhand smoke exposure in homes (Brian A King, et al., 2013).

Hotels and restaurants were very important public places for many people, and they were also workplaces for hotels and restaurant employees. In addition, workers in the catering industry were at greater risk of exposure to secondhand smoke (SHS) when smoke-free workplace policies were not in force. According to a measuring the exposure of catering workers to SHS in Hong Kong and their risk of death from heart disease and lung cancer, partial smoking restrictions were of no value in significantly reducing exposures and risks to workers (Hedley, 2006). The researchers showed that in general, population samples with a history of exposure to passive smoking had strongly associated risks, with a dose–response relationship of cardiovascular and respiratory diseases and cancers. Another cross-sectional study conducted in Hong Kong during a 1.5-year exemption of licensed catering premises from smoke-free legislation showed that Lung function is inversely associated with workplace SHS, while workplace exemptions and delays in implementing smoke-free policies and current moves to relax legislation were a major threat to the health of workers (Hak-Kan Lai et al. 2014).

2. Problem statement

Cigarette smoking had been identified as the most important source of preventable morbidity (disease and illness) and premature mortality (death) worldwide. Smoking-related diseases claimed an estimated 3 million lives in China each year, including those affected indirectly, such as babies born prematurely due to prenatal maternal smoking and victims of "secondhand" exposure to tobacco's carcinogens. Smoking cost the China over $28.9 billion in 2008, including $6.2 billion in direct healthcare expenditures and $22.7 billion in indirect expenditures.

In addition, a research showed that SHS exposure in restaurants and bars alone could impose high lifetime excess risks of lung cancer death and ischemic heart disease deaths to both servers and patrons, and could cause a significant number of deaths each year in China. These health risks and deaths could be prevented by banning smoking in restaurants and bars and effectively implementing these smoking bans (Ruiling Liu et al., 2014).

3. Purpose statement

This study was designed to evaluate the effectiveness of Hangzhou smoke-free hotels and restaurants intervention as part of Tobacco-Free City Program (TFC) funded by the Emory Global Health Institute-China Tobacco Control Partnership (GHI-CTP), and to identify the determinants on respondents' current smoking status and their behaviors to discourage others smoking as a means of implementing smoke-free policy at their workplaces. The hypothesis was that employees' knowledge and attitude towards smoking were associated with their current

smoking status and their behaviors to discourage others from smoking. The associations would be tested in this study.

4. Research question

This study would answer the following questions:

- What were the current tobacco use and secondhand smoke exposure status among employees working at hotels and restaurants in Hangzhou, China?
- What were the knowledge level and attitudes towards smoking and secondhand smoking exposure among employees working at hotels and restaurants before and after the Hangzhou intervention in Hangzhou, China?
- Whether the employees' knowledge level, attitudes and working environment would affect their smoking status and behavior of discouraging smokers?

5. Significance statement

Although Chinese Government had signed the World Health Organization Tobacco Control Framework Convention (FCTC) in 2005, China's domestic tobacco control efforts had experienced great difficulty and dissatisfaction. Domestic research showed that public places were always the most serious places for secondhand smoke exposure, and dining places were the most serious places for secondhand smoke exposure among all public places. Hotels and restaurants were servicing establishments with strong periodical population aggregation, and tobacco control in hotels and restaurants had strong public health significance. A survey showed that 26.1% of Chinese urban residents choose to eat out every day; and the second hand smoking pollution was not only harmful to consumers, but also had a more serious health impact on hotel

and restaurant staff. However, due to the influence of the long-term traditional social norms, the tobacco control efforts at hotels and restaurants had always been a global problem. Hangzhou is a famous international tourism city, with well-developed hotel and restaurant industry, for instance, there are over 40 five-star restaurants in the downtown area. Tobacco control efforts in Hangzhou hotels and restaurants not only demonstrated public health significance to protect the public from harmful secondhand smoke, but also possess social influence as constructing a tobacco control model in catering service industry for other cities in mainland China. Therefore, tobacco control efforts in hotels and restaurants of Hangzhou have good external validity and the potential for engaging catering industry in China to adopt smoke-free workplace policy and developing the smoke-free hotels and restaurants model for the whole China.

Moreover, there was no thorough analysis about the relationships between indicators of hotels and restaurants employees' characteristics and their implementation of smoke-free policy. Even though many researches and studies offered general recommendations as education, training, publicity, and stricter law enforcement, no direct evidence was available to provide detailed direction on which aspects should be emphasized on and whether those efforts mentioned above would work or not. In the present study, we examined data from a recent tobacco control program targeting employees of hotels and restaurants in Hangzhou. Our main purpose was to investigate the prevalence of, and variables associated with, smoking and secondhand smoke exposure among employees of hotels and restaurants and their practice of smoke-free policy enforcement. We aimed to evaluate the tobacco control efforts of Hangzhou TFC program, and provide evidence-based recommendations regarding what influencing factors were significantly associated with smoking patterns and implementation of smoke-free policies.

Chapter 2: Review of the Literature

1. Studies concerning current smoking and secondhand smoke exposure status among employees in hotels and restaurants in China

Two independent cross-sectional surveys were conducted on random samples from adults aged 18 - 64 years in three districts of Hangzhou city between two periods: October 2008 to August 2009 and June 2011 to February 2012, To examine the changes in tobacco related knowledge, smoking habit and the amount if environmental tobacco smoke (ETS) among urban population before and after the enforcement of the Smoke Control Ordinance in Public Places of Hangzhou in March 2010 (He PP, 2013). This study found out that the overall smoking prevalence had declined for all the participants (22.4% vs. 17.7%, $P < 0.001$) and men (44.2% vs. 37.3%, $P = 0.004$). And The proportions of individuals who had noticed anyone smoking in the previous 30 days demonstrated statistically significant declines in nine types of places, including restaurant (67.0% vs. 61.3%, $P = 0.002$) and workplace (49.7% vs. 38.3%, $P < 0.001$. (He PP, 2013) Positive changes were noticed among urban population with respect to tobacco related knowledge, prevalence of smoking, and the environmental tobacco smoke (ETS) after the enforcement of the Smoke Control Ordinance in Public Places of Hangzhou.

A survey was conducted to evaluate the effects of smoke-free legislation in Guangzhou and found that in full smoking ban places, overall self-reported SHS exposure has declined significantly from 58.8% to 50.3% ($p<0.05$) with greater drops in cultural venues, government offices and commercial venues. The Guangzhou smoke-free policy did not alter secondhand

smoke exposure in hotels, workplaces, restaurants, cafes/bars/nightclubs and amusement parks, secondhand smoke continued to be high in those areas (Li, Q., et al., 2010).

One survey conducted in 2007 in Beijing showed that overall 86% of nonsmokers had been exposed to secondhand smoke in restaurants for at least one day in the past week. And another study showed that the secondhand smoke exposures in hotels and restaurants in 2009 in Guangzhou were 70.1% and 84.5% respectively. In addition, even after a 2-year city-wide tobacco control intervention in public places, the prevalence remained high, as 61.5% and 78.3% (Liu R., et al., 2014)

In addition, a cross-sectional study conducted in 2009 in Shanghai showed that 49.0% and 60.7% of employees in hotels and restaurants were exposed to secondhand smoke at their workplaces. Although some research has showed that SHS is a particular occupational health hazard for food-service workers, for most smoking restrictions in China exclude restaurants and bars. Even in some public places which have been covered by smoking restriction regulations, ineffective strategies such as smoking zones (rooms) still expose employees to SHS (Liu R., et al., 2010).

According to a four-year follow-up study in Beijing, China, in evaluating the efficacy of different smoking policies in restaurants and bars, even though there was a trend for more restaurants and bars to accept smoke-free policy, as smoking was nominally prohibited or restricted in 18% of restaurants and bars monitored in 2006, in 11% of venues in 2007, in 83% of venues in 2008, and in 69% of venues in 2010, however, smoking was observed in more than 40% of the nominal nonsmoking venues/sections in 2008 and 2010. The study also suggested that

Voluntary smoking policy is rarely adopted and cannot protect people from SHS exposure in restaurants and bars. The 2008 Beijing governmental smoking regulation failed to significantly reduce SHS exposure shortly or two years after its implementation. Restricting smoking to designated sections cannot eliminate SHS exposure (Ruiling Liu, et al., 2013).

2. Studies concerning current tobacco control policy in hotels and restaurants and its implementation in China

Since China ratified the WHO FCTC in 2005, several initiatives to reduce exposure to SHS in public places were taken, including restaurants and bars. However, there is still no law on the national level for banning smoking in public indoor places and workplaces. On May 1st, 2008, the Beijing government passed a law requiring restaurants within the city to prohibit or restrict smoking (only allowing smoking in designated sections of dining areas). And several other large cities, including Shanghai, Guangzhou, Hangzhou, and Yinchuan, have taken steps to reduce SHS exposure by regulations, restrictions on smoking in restaurants and bars are mostly voluntary, as was true in Beijing before May 2008. In January 2007, when China CDC called for voluntary smoking prohibition to thousands of restaurant owners, 86% of the respondents showed their support for prohibiting or restricting smoking in restaurants, but 52% of the respondents also expressed their concern about the potential negative influence on their revenue.

According to Ruiling Liu et al., 2013, worldwide studies show that, after the implementation of complete smoke-free laws, airborne nicotine concentrations have decreased more than 90% in both restaurants and bars in Italy and Guatemala, 83% in Irish bars, and 82–98% in various hospitality venues in Uruguay, Sweden, Chile, and Norway. Similarly, concentrations of indoor

particulate matter have decreased more than 85% in restaurants, bars or various hospitality venues in Germany, Scotland, Wales and England, Argentina, Ontario, and some U.S. cities/states, such as Boston, Austin, Delaware, Western New York, Massachusetts, and Minnesota. However, partial smoking restrictions that exempt some hospitality venues lead to only limited reduction or non-significant changes of airborne nicotine or indoor particulate matter concentrations in hospitality venues in Finland, Chile and Rome.

Protection gaps in smoke-free indoor air laws often result from fear of revenue loss, particularly in the hospitality industry (Eriksen & Chaloupka, 2007). Numerous economic-impact studies and meta-analyses of local and statewide smoke-free indoor air policies around the United States have found no adverse economic changes for bars, restaurants, and other hospitality industries resulting from smoke-free air legislation (John A. Tauras et al., 2014). Various studies on international settings also showed that hotel revenues and international tourism would remain stable or even increase after passage of smoke-free restaurant ordinances. One study conducted in the US three states of US (California, Utah, and Vermont) and 6 cities (Boulder, Colo; Flagstaff, Ariz; Los Angeles, Calif; Mesa, Ariz; New York, NY; and San Francisco, Calif) found that Smoke-free ordinances do not appear to adversely affect, and may increase, tourist business (Stanton A. Glantz et al., 1999). On the contrary, one study on the economic impact of a non-comprehensive smoke-free air law, as the Pennsylvania's 2008 Clean Indoor Air Act (CIAA) that allowing for certain venue exemptions among eating and drinking establishments, found that the establishment exemptions were not economically beneficial and more efforts should be taken to make the smoke-free policies more comprehensive (John A. Tauras et al., 2014).

3. Underlying factors of employees' smoking status and behavior of discouraging smoking at workplace

Tobacco use varied a lot among populations with different demographic backgrounds, such as age, gender, marital status, and education. Data from the Global Adult Tobacco Survey (GATS), which is a nationally representative survey across countries including China, showed that the smoking prevalence differs significantly among different age groups. Males aged 25-44 and 45-64 years old have higher prevalence, which is 59.3% and 63.0%, than other age groups. The female smoking prevalence increased with age. In China, 33.5% of people aged 15 years and older were using or had ever used tobacco, among which over 95% were men in 2010. Data from GATS also showed that smoking prevalence decreased with the increasing of education level both in females and males. In males, the smoking prevalence was 63.2% and 44.0% for people who had middle school education and college or higher education, respectively. And the smoking prevalence was 4.3% among females who had primary school or lower education, and 0.6% among females who have college or higher education. There are no direct evidence showing that smoking prevalence are associated with marital status in China, however, a study done is Idaho, US, showed that "there was wide variation in the smoking prevalence" between marital types. In Idaho, adults who were married were statistically less likely to be cigarette smokers than those who were divorced or separated.

Adults' knowledge, attitudes and perceptions towards smoking were unsatisfactory. Only 23.2% adults believe that smoking causes stroke, heart attack, and lung cancer, 24.6% adults believe that exposure to tobacco smoking causes heart disease and lung cancer in adults and lung illness

in Children, and only 14% adults are aware that low tar cigarettes are as harmful as general cigarettes.

One study was conducted on the restaurant and bar owners' exposure to secondhand smoke and attitudes regarding smoking bans in five Chinese cities, including Beijing, Wuhan, Xi'an, Kunming and Guiyang. A convenience sample of 814 restaurants and bars was selected in five Chinese cities and all owners of these venues were interviewed in person by questionnaire in 2007. Eighty six percent of current nonsmoking subjects had at least one-day exposure to secondhand smoke (SHS) at work in the past week. Only 51% of subjects knew SHS could cause heart disease. Only 17% and 11% of subjects supported prohibiting smoking completely in restaurants and in bars, respectively, while their support for restricting smoking to designated areas was much higher. Fifty three percent of subjects were willing to prohibit or restrict smoking in their own venues. Of those unwilling to do so, 82% thought smoking bans would reduce revenue, and 63% thought indoor air quality depended on ventilation rather than smoking bans. These results showed that there was support for smoking bans among restaurant or bar owners in China despite some knowledge gaps (Ruiling Liu et al., 2011). The study suggested that to facilitate smoking bans in restaurants and bars, it is important to promote health education on specific hazards of SHS, provide country-specific evidence on smoking bans and hospitality revenues, and disseminate information that restricting smoking and ventilation alone cannot eliminate SHS hazards.

Second hand smoke exposure is also very severe in China. Data from GATS showed that 63.3% respondents reported that they had seen people smoking in indoor workplaces, and 72.7%

respondents reported that they had seen people smoking in public areas, where restaurants had the highest rate, 88.5%. The implementation rate of smoke-free policy at workplace is still very low. Only 31.0% workplaces had implemented full smoke-free policy in 2010, and 37.7% workplaces had no smoke-free policy at all.

4. Summary of literature review

In conclusion, various biological, clinical and epidemiological studies showed that smoking and SHS were harmful to health. However, there were few specific studies concerning hotel and restaurant employees' tobacco use and SHS exposure patterns, as well as the implementation of smoke-free policies in their workplaces in mainland China. Employees' knowledge of harmful effects of smoking was superficial and incomprehensive, and many people still lack the correct attitudes towards smoke-free policy and tobacco control in their workplaces. Even though some studies showed the support rate of smoke-free policy among the public and employees in hotels and restaurants was relatively high, lack of knowledge and attitudes, and widespread smoking behaviors and SHS exposure indicated that it is important to promote health education on specific hazards of SHS, provide country-specific evidence on smoking bans and hospitality revenues, and disseminate information that restricting smoking and ventilation alone cannot eliminate SHS hazards. Rigid and comprehensive tobacco control policy was necessary to curb the smoking and SHS exposure epidemic in China.

Chapter 3: Data and Methods

1. Project background

The Emory Global Health Institute – China Tobacco Control Partnership (GHI-CTP) was established in 2008 by a five-year grant from the Bill and Melinda Gates Foundation with the purpose of reducing the health, social, environmental, and economic burdens of tobacco use in China. In 2009, the Tobacco-Free Cities program was created to fund the establishment of comprehensive city-wide tobacco control programs in 17 selected cities throughout China, and Hangzhou was in the city list. The program supports the overall goal of preventing smoking initiation, promoting smoking cessation, and protecting non-smokers from exposure to secondhand smoke.

In 2011, Hangzhou launched Smoke-Free Hotels and Restaurants Initiative and took the lead in China's tobacco control efforts in hotels, restaurants and other public places. Since the launch of this project, with the technical guidance of GHI-CTP and ThinkTank Research Center for Health Development, Hangzhou Center for Disease Control and Prevention had organized a series of tobacco control campaigns, educational activities and capacity building sessions for the attendants of hotels and restaurants, by means of large-scale outdoor activities, TV station, newspaper, radio broadcasting and Internet, in order to construct the smoke-free environment in hotels and restaurants of Hangzhou.

2. Sample and data

The study sample was drawn from a survey conducted between October 2011 and October 2012 among employees of 30 hotels and restaurants in a China's major city: Hangzhou. Hangzhou is a city in the east coastal part of China with a population of 8.8 million. Hangzhou is among the 17 city grantees of the Emory Global Health Institute-China Tobacco Control Partnership Program launched in 2009 with the support of the Bill & Melinda Gates Foundation with the aim of changing the social norms on tobacco use in China. Each city grantee determined the focus of its tobacco control efforts based on its unique resources and situation. Hangzhou was the only city that targeted on smoke-free hotels and restaurants.

Hangzhou TFC office requested the Hangzhou Catering Industry Association, which was a government-affiliated organization to basically manage hotels and restaurants in Hangzhou, to select thirty 30 well-known hotels and restaurants as the intervention objects of the Smoke-Free Hotels and Restaurants Initiative, including 24 consolidated hotels, and 6 dining hotels. Because those hotels and restaurants were basically selected for purpose of enlarging the influence of TFC program, the all the participating units had high popularity and brand awareness to tourists all over China. In addition, within each participating unit, simple random sampling method was applied to choose 50 respondents from each hotel or restaurant in accordance with the employee numbers. For any units with less than 50 employees, all servicing staff members were investigated. Baseline survey was carried out at the end of October 2011, and the post-intervention evaluation survey was carried out in October 2012.

The unified self-administered questionnaire concerning attendants of hotels and restaurants was developed by the Emory Global Health Institute, which served as the management department of

Gates Foundation TFC program. The major investigating indicators included: smoking behaviors, quitting smoking trials, support rate for smoke-free environment policy, knowledge and awareness of hazard effects of tobacco use and secondhand smoke exposure, attitudes and behaviors towards tobacco control and smoke-free workplace policy, and personal information.

Surveys were approved by the Hangzhou IRB and informed consent was obtained from all participants. No personal identification information was used in this study. There were 2855 hotels/restaurants employees in total participating in either of the baseline or post-intervention survey, of which 2768 were used in this study. Cases with invalid values or missing values for variables used in this study were excluded from the analysis.

3. Variables

Dependent variables

The dependent variables in this study are current smoking status of employees of hotels and restaurants and their behaviors to discourage others smoking (implementation of smoke-free policy). Current smoking status of hotels and restaurants employees was measured with the following question: Do you currently smoke tobacco on a daily basis, less than daily or not at all? Daily smokers and occasional smokers were coded as "Yes" for current smokers and employees who never smoked or were former smokers were coded as "No". Provision of smoking discouragement was identified by asking the following question: In the past 7 days, have you seen any smoking behaviors in the smoke-free areas of your workplace? In the past 7 days, have you ever discouraged any smoking behaviors in the smoke-free areas of your workplace?

Employees who saw and discouraged others smoking in their workplaces in the past seven days were coded as "Yes" and employees who saw others smoking in their workplaces but did not discourage were coded as "No". Only employees who saw others smoking in their workplaces were included in the analysis of their behaviors to discourage others smoking.

Independent variables

Independent variables included multiple variables measuring employees' knowledge and attitudes towards tobacco use and secondhand smoke. In the survey, questions were asked regarding hotels and restaurant employees' health knowledge of the harms of active and passive smoking—Based on what you know or believe, does smoking cause serious illness or specifically the following problems: stroke, heart attack, lung cancer, emphysema, yellow teeth, impotence in male smokers or premature ageing? And based on what you know or believe, does secondhand smoke cause serious illness or specifically the following diseases: heart attack in adults, lung illnesses in children or lung cancer in adults? Employees responded yes, no, or do not know on whether smoking or second hand smoking causes serious illness or each of the ten diseases or medical symptoms. Employees who answered "Yes" to each of these questions were believed to have a better awareness of the harms of smoking or second hand smoking and the "Yes" answer was recoded as "1" in this study, and "No" and "Do not know" answers were recoded as "0".

Questions were also asked regarding hotels and restaurant employees' attitudes towards the approval of smoking in certain public areas or places inside or outside of the buildings of hotels or restaurants—would you support or oppose if the following indoor public places allowed

smoking: hospitals, work settings, restaurants, bars, elementary and middle schools, colleges, public transportations, religious institutions, and hotels; with regard to hotels, do you think smoking should be permitted in the following spaces: lobby, guest room, meeting/banquet room, cafeteria, bar/lounge, office, restroom, hallway, stair, elevator, and outside the building; with regard to restaurants, do you think smoking should be permitted in the following spaces: waiting/reception area, dining room, banquet room, private dining room, bar/lounge, office, restroom, hallway, stair, elevator, and outside the building. Only "Yes" and "No" answers are available for respondents. "Yes" meant that this employee thought it should be approved to smoke in certain area and was recoded as "1"; on the contrary, "No" meant that this employee thought it should not be approved to smoke in certain area and was recoded as "0".

Control variables

Control variables include respondents' gender, age, education, marital status, smoking policy of workplace, and the existence of peer smoking. Age was categorized into three groups as <25, 25–34, 35 years and older. Education was coded into three levels: middle school and below, high school and college and above. Marital status was categorized as married versus single/divorced/widowed. Smoking policy was categorized as "Smoking is not allowed in any indoor areas" and "other options" (including Smoking is allowed anywhere, smoking is allowed only in some indoor areas, there is no policy, and don't know). Existence of peer smoking was measured by the following question: During the past 30 days, did any of your coworkers smoke in indoor areas where you work? Employees who saw coworkers smoking in indoor areas where they worked were treated as "yes" for existence of peer smoking, and those who did not see were treated as "no" for existence of peer smoking.

4. Statistical analysis

All statistical analyses were conducted using SAS ® Propriety Software 9.3 (Copyright © 2002-2010 by SAS Institute Inc., Cary, NC, USA.). Background information for hotel and restaurant employees recruited in either survey of baseline and after intervention was described. The knowledge and attitude towards smoking of hotel and restaurants employees in baseline study and after intervention survey were also described, and chi-square tests were performed to show whether there was significant change before and after intervention for each indicator. In addition, t-tests and Chi-square tests were performed to test the crude differences of employees' knowledge and attitudes towards smoking in current smokers vs. current non-smokers, and in employees who discourage others from smoking vs. those who do not perform so. Logistic regression models were built to calculate the adjusted odds ratios between employees' knowledge and attitude towards smoking and their behaviors (current smoking status and to discourage others from smoking). The odds ratios with 95% confidence intervals were reported, and the two tailed significance level was set at 5% ($p<0.05$).

Principal Component Analysis (PCA) was utilized to groups the variables measuring employees' knowledge regarding the harms of smoking and secondhand smoke, as well as attitudes towards smoking inside certain public places or areas inside the building of hotels or restaurants. All indicators representing employees' knowledge and attitudes were dichotomous. Pearson or Spearman correlations tended to underestimate the true correlation between a set of observed categorical variables as correlation coefficients were calculated as if the variables were continuous. An analytic approach that could generate unbiased correlations among a set of

categorical variables was therefore needed. This problem was remedied by using polychoric PCA. This technique proceeds by first estimating the polychoric (tetrachoric, specifically in this study) correlation between theorized normally distributed continuous latent variables generated from observed ordinal variables (Jöreskog, 1994). The resultant polychoric correlation matrix was then analyzed using factor analysis with SAS® System's PROC FACTOR procedure, utilizing the VARIMAX rotation. The polychoric PCA was very appropriate for the current investigation as all tetrachoric coefficients were stronger than both the Pearson and or Spearman correlation coefficients for all variables.

The polychoric PCA with varimax rotation divided these ten indicators of knowledge regarding the harms of smoking and second hand smoking into two groups (there are two eigenvalues larger than 1). Based on the proportion of respondents who had acquired certain knowledge, the two groups were defined as uncommon knowledge and common knowledge in the following analysis. The first group (uncommon knowledge), which included five measured variables (smoking may cause stroke, smoking may cause heart attack, smoking may cause emphysema, smoking may cause male impotence, and secondhand smoking may cause heart attack in adults), accounted for 69.11% of the variance in the model; and the second group (common knowledge), which included another five observed variables (smoking may cause lung cancer, smoking may cause yellow teeth, smoking may cause premature ageing , secondhand smoking may cause lung illness in children and secondhand smoking may cause lung cancer in adults), accounted for another 11.21% of the variance. As shown in Appendix, the observed variables had a rotated factor loading ranging from 0.604 to 0.924 for the first group (uncommon knowledge) and from

0.642 to 0.923 for the second group (common knowledge). All the loadings were considered strong compared with the commonly used cut-off point of 0.5 or 0.6.

Similarly, nine indicators of attitude towards smoking in certain public places were divided into one group, which accounted for 81.8% of the variance and the factor loading before rotation ranged from 0.791 to 0.987. Ten indicators of attitude towards smoking in areas inside the building of hotels were divided into two groups. The first group (business areas), which included cafeteria, meeting/banquet room, bar/lounge, guest room, office, and lobby, accounted for 62.54% of the variance; and the second group (private areas), which include stair, hallway, restroom, and elevator, accounted for another 11.64% of the variance. The observed variables had a rotated factor loading ranging from 0.691 to 0.871 for the first group and from 0.543 to 0.890 for the second group. Ten indicators of attitude towards smoking in areas inside the building of restaurants were divided into two groups. The first group (business areas), which included banquet room, dining room, bar/lounge, private dining room, waiting/reception area, and office, accounted for 65.13% of the variance; and the second group (private areas), which include stair, hallway, restroom, and elevator, accounted for another 12.43% of the variance. The observed variables had a rotated factor loading ranging from 0.583 to 0.870 for the first group and from 0.756 to 0.926 for the second group.

Since all indicator of attitude towards smoking in certain public place had similar loading, one dummy variable was created to represent all indicators. Employees who oppose any public places to be allowed smoking were categorized into one group and who support any public places to be allowed smoking were categorized into the other group. For indicators representing

knowledge regarding the harms of smoking and attitude towards smoking in certain area inside the building of hotels or restaurants, factor analysis were performed to assign a value to each group of indicators of each respondent. Factor analysis was a statistical method used to describe variability among observed or correlated variables with the aim reducing the number of measure variables into unobserved variables, which is also called factors (Kline, 1993). The objective of factor analysis in this study was to study the variable aggregation patterns that exist in the data set and to measure the association between “knowledge and attitude” and “behavior” in a simple way. The factor values retained were then used as independent variables to measure their association with employee’s behaviors. Higher factor values of knowledge regarding the harms of smoking indicate that respondents are aware of more harms of smoking (better knowledge), and higher factor values of attitude towards smoking indicate thinking that more spaces should be permitted to smoke (worse attitudes).

Chapter 4 Results

1. Sample background information

The overall smoking prevalence of male employees was 42.0%, compared with that of female employees as 1.47%. Among all employees who reported seeing smoking in workplaces, 76.8% tried to discourage the smokers. Regarding the effect of their action, 49.8% reported the smoker had been very cooperative, 44.89% reported the smoker cooperated anyway with unwillingness, leaving only 5.25% reported smoker refuse to cooperate. Employees' behavior to discourage others' smoking is not associated with their own smoking status [OR=0.89, 95% CI (0.63, 1.25), p=0.484] (only employees who saw people smoking at areas where smoking is forbidden were included, N=937). Of these employees in hotels and restaurants, 44.4% reported that they had peers who smoked in indoor areas where they worked. Most employees recognized that smoking and breathing secondhand smoke would cause serious diseases, as 90.65% and 86.75% respectively. A high proportion of employees were aware that smoking can cause lung cancer (92.8%) and yellow teeth (90.9%), and that secondhand smoke can cause lung cancer in adults (86.3%) and lung illness in children (80.1%). Relatively fewer employees working in hotels and restaurants were aware that smoking can cause stroke (44.1%), emphysema (70.9%), heart attack (46.6%), premature ageing (69.6%) and impotence in male smokers (38.4%) and that secondhand smoke can cause heart attack in adults (51.2%).

Only 54.3% of employees in hotels and restaurants believed that the smoke-free policy at their workplace was implemented completely among employees. Even fewer (48.1%) believed that the policy was implemented completely among customers and visitors. When asked about the

smoke-free regulation in the indoor workplace, of the employees in hotels and restaurants, only 42. 7% reported that smoking was banned in all the indoor areas, even more employees (44.2%) reported that smoking was allowed in some particular indoor areas, and others reported smoking was allowed everywhere, there was no smoking policy and missing, accounting for 2.19%, 6.0% and 5.1% respectively.

Table 1 presents characteristics of the sample population before and after the Hangzhou Tobacco Free City intervention. Among the 1403 hotel and restaurant employees before intervention, 18.4% were current smokers and 12.3% smoked daily (not shown on Table 1); after intervention, 17.7% of them were current smokers and 11.4% smoked daily (not shown on Table 1). A larger proportion of employees after the intervention was female compared than that before (60.1% vs. 57.9%), and the age distribution was relatively consistent. The proportion of marital status didn't changed too much, as almost half were married and the other half were single, divorced or widowed. Education level was significantly changed before and after the intervention. More respondents sampled after the TFC intervention had middle school or lower education compared to those before the intervention (30.6% vs. 26.2%), while fewer respondents sampled after the TFC intervention had college and higher education (37.8% vs. 34.5%). The awareness of smoke-free policy in their workplaces didn't change much, as 42.2% of respondents reported nowhere was allowed to smoke in their workplaces before intervention compared with 43.2% after intervention. In addition, the demographic information was also listed in Table 3, including gender, age, marital status and education level.

Table 1 Background information of hotel and restaurant employees before and after TFC the intervention, Hangzhou (n=2768)

Characteristics	Before intervention (N=1403)	After intervention [a] (N=1365)
Gender		
Male	591 (42.1%)	545 (39.9%)
Female	812 (57.9%)	820 (60.1%)
Age		
<24	472 (33.6%)	461 (33.7%)
25-34	533 (38.0%)	476 (34.9%)
>34	398 (28.4%)	428 (31.4%)
Marital status		
Married	704 (50.2%)	710 (52.0%)
Single/divorce/widow	699 (49.8%)	655 (48.0%)
Education*		
Middle school and lower	368 (26.2%)	418 (30.6%)
High school	505 (36.0%)	476 (34.9%)
College and higher	530 (37.8%)	471 (34.5%)
Smoking policy in work place		
Nowhere allowed to smoke	592 (42.2%)	589 (43.2%)
Others	811 (57.8%)	776 (56.9%)
Peer Smoking		
Yes	558 (39.8%)	552 (40.4%)
No	845 (60.2%)	813 (59.6%)
Currently smoking		
Yes	258 (18.4%)	242 (17.7%)
No	1145 (81.6%)	1123 (82.3%)

[a] This is not the same sample group as the baseline study.
* Chi-square $p<0.05$.

2. Knowledge of harms of smoking and secondhand smoke

Table 2 presents comparison of awareness of serious disease caused by smoking and secondhand smoking. Generally, hotel and restaurant employees gained a better awareness of the harms of smoking and second hand smoking after the intervention. After the intervention, the awareness of smoking causing serious illness was higher (91.6% vs. 89.7%), with a borderline significant odds ratio [OR=1.2, 95% CI (1.0, 1.6)].

For specific diseases, the awareness of smoking causing stroke increased from 33.1% to 47.0%. After the intervention, hotel and restaurant employees were 1.8 times more likely to recognize that smoking would cause stroke compared with those before the intervention [OR=1.8, 95% CI (1.5, 2.1)]. The awareness of smoking causing heart attack increased from 34.9% to 49.6%. After the intervention, hotel and restaurant employees were 1.8 times more likely to recognize that smoking would cause heart attack compared with those before the intervention [OR=1.8, 95% CI (1.6, 2.1)]. The awareness of smoking causing lung cancer increased from 81.7% to 86.7%. After the intervention, hotel and restaurant employees were 1.5 times more likely to recognize that smoking would cause lung cancer compared with those before the intervention [OR=1.5, 95% CI (1.2, 1.8)]. The awareness of smoking causing emphysema increased from 64.0% to 79.2%. After the intervention, hotel and restaurant employees were 2.1 times more likely to recognize that smoking would cause emphysema compared with those before the intervention [OR=2.1, 95% CI (1.8, 2.5)]. The awareness of smoking causing yellow teeth increased from 80.8% to 84.0%. After the intervention, hotel and restaurant employees were 1.3 times more likely to recognize that smoking would cause yellow teeth compared with those before the intervention [OR=1.3, 95% CI (1.1, 1.5)]. The awareness of smoking causing impotence in male smokers increased from 31.9% to 37.7%. After the intervention, hotel and restaurant employees were 1.3 times more likely to recognize that smoking would cause impotence in males smokers compared with those before the intervention [OR=1.3, 95% CI (1.1, 1.5)]. The awareness of smoking causing premature aging increased from 61.6% to 64.5%, but the comparison was not significant at 95% significant level [OR=1.1, 95% CI (1.0, 1.3)].

The awareness of secondhand smoke causing serious diseases increased from 84.1% to 89.5%. After the intervention, hotel and restaurant employees were 1.6 times more likely to recognize that secondhand smoking would cause serious diseases compared with those before the intervention [OR=1.6, 95% CI (1.3, 2.0)]. The awareness of secondhand smoke causing heart attack in adults increased from 40.6% to 48.4%. After intervention, hotel and restaurant employees were 1.4 times more likely to recognize that secondhand smoking would cause heart attack in adults compared with those before the intervention [OR=1.4, 95% CI (1.2, 1.6)]. The awareness of secondhand smoke causing lung illnesses in children increased from 65.5% to 75.2%. After the intervention, hotel and restaurant employees were 1.6 times more likely to recognize that secondhand smoking would cause lung illness in children compared with those before the intervention [OR=1.6, 95% CI (1.4, 1.9)]. The awareness of secondhand smoke causing lung cancer in adults increased from 69.8% to 80.2%. After the intervention, hotel and restaurant employees were 1.7 times more likely to recognize that secondhand smoking would cause lung cancer in adults compared with those before the intervention [OR=1.7, 95% CI (1.5, 2.1)].

In summary, the prevalence for most variables indicating employees' awareness of smoking and secondhand smoke causing serious illnesses was significantly higher after the TFC intervention, except for awareness of smoking causing serious illness and smoking causing premature aging, of which the differences were not significant at 95% level.

Table 2 Comparison of knowledge of harms of smoking and secondhand smoking among hotels and restaurants employees before and after the TFC intervention, (n=2768) [a]

	Before Intervention (N=1403) N (%)	After Intervention (N=1365) N (%)	OR (95% CI)	p-value
Awareness of smoking causing serious illness				
Yes	1269 (89.7%)	1250 (91.6%)	1.2 (1.0, 1.6)	0.0968
No	144 (10.3%)	115 (8.4%)		
Awareness of smoking causing the following diseases:				
Stroke				
Yes	464 (33.1%)	642 (47.0%)	1.8 (1.5, 2.1)	<0.0001
No	939 (66.9%)	723 (53.0%)		
Heart attack				
Yes	490 (34.9%)	677 (49.6%)	1.8 (1.6, 2.1)	<0.0001
No	913 (65.1%)	688 (50.4%)		
Lung cancer				
Yes	1146 (81.7%)	1183 (86.7%)	1.5 (1.2, 1.8)	0.0003
No	257 (18.3%)	182 (13.3%)		
Emphysema				
Yes	898 (64.0%)	1081 (79.2%)	2.1 (1.8, 2.5)	<0.0001
No	505 (36.0%)	284 (20.8%)		
Yellow teeth				
Yes	1133 (80.8%)	1147 (84.0%)	1.3 (1.1, 1.5)	0.0238
No	270 (19.2%)	218 (16.0%)		
Impotence in males smokers				
Yes	448 (31.9%)	515 (37.7%)	1.3 (1.1, 1.5)	0.0014
No	955 (68.1%)	850 (62.3%)		
Premature ageing				
Yes	864 (61.6%)	881 (64.5%)	1.1 (1.0, 1.3)	0.1068
No	539 (38.4%)	484 (35.5%)		
Awareness of secondhand smoke causing serious illness				
Yes	1180 (84.1%)	1221 (89.5%)	1.6 (1.3, 2.0)	<0.0001
No	223 (15.9%)	144 (10.6%)		
Awareness of secondhand smoke causing the following diseases:				
Heart attack in adults				
Yes	569 (40.6%)	660 (48.4%)	1.4 (1.2, 1.6)	<0.0001
No	834 (59.4%)	705 (51.7%)		
Lung illnesses in children				
Yes	919 (65.5%)	1027 (75.2%)	1.6 (1.4, 1.9)	<0.0001

No	484 (34.5%)	338 (24.8%)		
Lung cancer in adults				
Yes	979 (69.8%)	1094 (80.2%)	1.7 (1.5, 2.1)	<0.0001
No	424 (30.2%)	271 (19.9%)		

[a] OR and 95% CI were calculated, and chi-square p-value was displayed to show significance for each indicator.

3. Attitudes towards smoking and smoke-free polices

As shown in Table 3, regarding the attitudes towards tobacco use and smoking behaviors in public places, hotels and restaurants before and after the intervention, more respondents became against smoking in certain public area, except for "smoking in public place bar", "smoking in hotel bar", "smoking outside the hotels" and "smoking outside the restaurants", as shown in Table 3. Among all of those, the changes of attitudes towards the following variables were significant at 95% level, which included "smoking should not be allowed in hospital" changing from 96.6% to 98.7%, "smoking should not be allowed in work settings" changing from 95.2% to 96.7%, "smoking should not be allowed in elementary and middle schools" from 97.0% to 98.9%, "smoking should not be allowed in colleges" changing from 96.2% to 97.7%, "smoking should not be allowed in religious institutions" changing from 95.9% to 97.8%, "smoking should not be allowed in guest room of hotels" changing from 83.5% to 86.7%, "smoking should not be allowed outside the hotel" changing from 52.8% to 49.1%, "smoking should not be allowed in the dining hall of restaurants" changing from 93.5% to 95.2%, and "smoking should not be allowed outside the dining hall" changing from 61.2% to 55.5%. However, the absolute differences for all the mentioned significant changes were relatively small.

Table 3 Comparison of attitudes towards tobacco use and smoke-free policy in public places, hotels and restaurants before and after the TFC intervention (n=2768) [a]

	Before intervention (N=1403)	After intervention (N=1365)
Respondents opposing smoking inside the following public places		
Hospitals	1355 (96.6%)	1347 (98.7%)**
Work settings	1336 (95.2%)	1320 (96.7%)*
Restaurants	1305 (93.0%)	1294 (94.8%)
Bars	1170 (83.4%)	1115 (81.7%)
Elementary and middle schools	1361 (97.0%)	1350 (98.9%)**
College	1350 (96.2%)	1334 (97.7%)*
Public transportation	1324 (94.4%)	1307 (95.8%)
Religious institutions	1345 (95.9%)	1335 (97.8%)**
Hotels	1266 (90.2%)	1231 (90.2%)
Respondents opposing smoking in the following places of hotels		
Lobby	1290 (92.0%)	1267 (92.8%)
Guest room	1172 (83.5%)	1184 (86.7%)*
Meeting room	1310 (93.4%)	1283 (93.4%)
Cafeteria	1288 (91.8%)	1265 (92.7%)
Bars	1199 (85.5%)	1163 (85.2%)
Office	1310 (93.4%)	1296 (95.0%)
Restroom	956 (68.1%)	965 (70.7%)
Hallway	1222 (87.1%)	1210 (88.6%)
Stairs	1237 (88.2%)	1214 (88.9%)
Elevators	1350 (96.2%)	1324 (97.0%)
Outside of building	741 (52.8%)	670 (49.1%)*
Respondents opposing smoking in the following places of restaurants		
Waiting area	1290 (92.0%)	1256 (92.0%)
Dining hall	1312 (93.5%)	1300 (95.2%)*
Banquet hall	1321 (94.2%)	1276 (93.5%)
Private room	1199 (85.5%)	1162 (85.1%)
Bars	1206 (86.0%)	1178 (86.3%)
Office	1330 (94.8%)	1304 (95.5%)
Restroom	951 (67.8%)	918 (67.3%)
Hallway	1244 (88.7%)	1196 (87.6%)
Stairs	1261 (89.9%)	1197 (87.7%)
Elevators	1360 (96.9%)	1321 (96.8%)
Outside of dining hall	859 (61.2%)	757 (55.5%)**

*Chi-square test $p<0.05$ significant;

**Chi-square test $p<0.01$ significant;

***Chi-square test was performed to show the significance for each indicator.

4. The association between employees' knowledge and attitude towards smoking

Employees who were aware that smoking and second hand smoking may cause serious illness were more likely to oppose smoking in public areas [OR=1.84, 95% CI (1.40, 2.42); and OR=1.77, 95% CI (1.40, 2.25), respectively]. In addition, employees who had better common knowledge about the harms of smoking and second hand smoking were also more likely to oppose smoking in public areas [factor value difference=-0.09, 95% CI (-0.13, -0.05)].

Employees who were aware that second hand smoking may cause serious illness tended to be against allowing smoking in more hotel private areas than those who were not [Factor value difference=0.05, 95% CI (0.01, 0.08)]. Employees with better common knowledge about the harms of smoking and second hand smoking also tended to be against allowing smoking in more hotel private areas (coefficient=-0.09, $p<0.001$). Additionally, employees' with better common and uncommon knowledge about the harms of smoking and second hand smoking tended to be against allowing smoking in more restaurant private areas (coefficient=-0.08, $p<0.001$, for both).

5. Factor value difference between employees' with different behaviors

Employees' level of common knowledge and uncommon knowledge towards smoking and second hand smoking, and their attitude towards smoking in the business and private areas in hotels and restaurants, were represented by factor values obtained from factor analysis. Compared to current smokers, employees who were not current smokers tended to have better common knowledge towards harms of smoking and second hand smoking [Factor value difference=0.14, 95% CI (0.10, 0.18)]. What's more, employees who were not current smokers

also tended to agree fewer places that should be approved to allow smoking in both business and private areas in hotels and restaurants. The Figures were -0.12, -0.11, -0.13, -0.13, respectively, and they were all significantly different from zero at the 95% level. [See Table 4] Additionally, employees who discouraged others smoking in their workplaces tended to have better common knowledge towards harms of smoking and second hand smoking than employees who did not discourage others smoking in their workplaces. [See Table 5]

Table 4: Difference of factor values of hotel and restaurant employees' knowledge and attitude towards smoking between groups with different smoking status [a]

Indicators	Current smoking status Factor value difference (95% CI)
Knowledge	
Uncommon Knowledge	-0.04 (-0.08, 0.00)
Common Knowledge	0.14** (0.10, 0.18)
Attitude	
Smoking in business areas in hotels	-0.12** (-0.15, -0.09)
Smoking in private areas in hotels	-0.11** (-0.15, -0.07)
Smoking in business areas in restaurants	-0.13** (-0.16, -0.09)
Smoking in private areas in restaurants	-0.13** (-0.16, -0.09)

**T-test p-value<0.01 significant;
[a] Absolute difference and 95% CI were calculated to display the difference and t-test was performed to show the significance. Factor value difference = factor value of not current smoker – factor value of current smoker.

Table 5: Difference of factor values of hotel and restaurant employees' knowledge and attitude towards smoking between groups with different behaviors to discourage others smoking [a]

Indicators	Discourage others smoking Factor value difference (95% CI)
Knowledge	
Uncommon Knowledge	0.00 (-0.07, 0.08)
Common Knowledge	-0.07* (-0.13, -0.01)

Attitude	
Smoking in business areas in hotels	0.04 (-0.01, 0.09)
Smoking in private areas in hotels	-0.02 (-0.07, 0.04)
Smoking in business areas in restaurants	0.04 (-0.01, 0.08)
Smoking in private areas in restaurants	-0.01 (-0.06, 0.04)

*T-test p-value<0.05 significant;
[a] Absolute difference and 95% CI were calculated to display the difference and t-test was performed to show the significance. Factor value difference = factor value of employees who do not discourage others smoking – factor value of employees who do discourage others smoking.

6. Associations between indicators of employees' knowledge and attitude towards smoking and their current smoking status

Before adjustment, employees who were aware that smoking could cause serious illness were 36% less likely to be current smokers [OR=0.64, 95% CI (0.47, 0.87)]; employees who were aware that second hand smoking could cause serious illness were 32% less likely to be current smokers [OR=0.68, 95% CI (0.52, 0.89)]. With one digit increase of the factor value representing common knowledge towards harms of smoking and second hand smoking, employees were 52% less likely to be current smokers [OR=0.48, 95% CI (0.38, 0.59)]. After adjusting for gender, age, education, marital status, smoke policy at workplace, and existence of peer smoking, variables of employees' knowledge towards smoking became not associated with their current smoking status any more. [See Table 4 and Table 5]

All indicators of employees' attitude towards smoking were significantly associated with their current smoking status before and after adjustment. Employees who were not current smokers tended to agree fewer places that should be approved to allow smoking inside hotels/restaurants than those who were current smokers. Before adjusting for control variables, employees who

opposed smoking in any public areas were 75% less likely to be current smokers [OR=0.25, 95% CI (0.20, 0.31)]. With one unit increase of the factor value representing attitude towards business and private areas in hotels that should be approved to allow smoking, employees were 4.4 and 2.4 times more likely to be current smokers [OR=4.4, 95% CI (3.2, 6.1); OR=2.4, 95% CI (1.9, 3.1), respectively]. In addition, with one unit increase of the factor value representing attitude towards business and private areas in restaurants that should be approved to allow smoking, employees were 4.8 and 3.3 times more likely to be current smokers [OR=4.8, 95% CI (3.5, 6.6); OR=3.3, 95% CI (2.5, 4.4), respectively]. Employees who supported smoking outside the building of hotel or restaurant were more likely to be current smokers [OR=1.8, 95% CI (1.5, 2.2); and OR=2.0, 95% CI (1.7, 2.5), respectively]. [See Table 6]

After adjustment for gender, age, education, marital status, smoke policy at workplace, and existence of peer smoking, the variables for attitudes towards smoking were still significant. Employees who opposed smoking in any public areas were 73% less likely to be current smokers [OR=0.27, 95% CI (0.21, 0.35)]. With one unit increase of the factor value representing attitude towards business and private areas in hotels that should be approved to allow smoking, employees were 3.5 and 2.3 times more likely to be current smokers [OR=3.5, 95% CI (2.4, 5.2); OR=2.3, 95% CI (1.7, 3.3), respectively]. In addition, with one unit increase of the factor value representing attitude towards business and private areas in restaurants that should be approved to allow smoking, employees were 4.2 and 3.2 times more likely to be current smokers [OR=4.2, 95% CI (2.8, 6.3); OR=3.2, 95% CI (2.2, 4.6), respectively]. Employees who supported smoking outside the building of hotel or restaurant were still more likely to be current smokers [OR=1.7, 95% CI (1.3, 2.1); and OR=2.0, 95% CI (1.6, 2.6), respectively]. [See Table 6]

7. Associations between indicators of employees' knowledge and attitude towards smoking and their behaviors to discourage others smoking

Employees who were aware that smoking could cause serious illness were 1.8 times more likely to stop others smoking than employees who lacked the awareness before and after adjustment [95% CI (1.0, 3.2) before adjustment, and 95% CI (1.0, 3.3) after adjustment]. Employees who were aware that second hand smoking could cause serious illness are also 1.8 times more likely to stop others smoking than employees who lacked the awareness before and after adjustment [95% CI (1.1, 2.9) before adjustment, and 95% CI (1.1, 3.0) after adjustment]. With one unit increase of the factor value representing common knowledge of the awareness of harms of smoking and second hand smoking, employees were 1.5 times more likely to discourage others smoking in their workplaces [95% CI (1.0, 2.1) before adjustment, and 95% CI (1.1, 2.2) after adjustment]. Indicators of attitude towards smoking were all not significantly associated with employees' behavior to discourage others smoking before and after adjustment. [See Table 7]

Table 6: Crude and adjusted associations between hotel and restaurant employees' knowledge and attitude towards smoking and their current smoking status (n=2368) [a]

	Currently smoking	
Indicators	Crude OR (95% CI)	Adjusted OR (95% CI)
Knowledge		
Smoking cause serious illness		
Yes	0.64** (0.47, 0.87)	0.95 (0.67, 1.35)
No	Reference	Reference
Second hand smoking cause serious illness		
Yes	0.68** (0.52, 0.89)	1.04 (0.77, 1.41)
No	Reference	Reference
Uncommon Knowledge	1.21	1.03

	(0.99, 1.48)	(0.80, 1.32)
Common Knowledge	0.48** (0.38, 0.59)	0.80 (0.62, 1.04)
Attitude		
Oppose smoking in any public areas		
Yes	0.25** (0.20, 0.31)	0.27** (0.21, 0.35)
No	Reference	Reference
Smoking in business areas in hotels	4.4** (3.2, 6.1)	3.5** (2.4, 5.2)
Smoking in private areas in hotels	2.4** (1.9, 3.1)	2.3** (1.7, 3.3)
Smoking outside hotel buildings		
Should be approved	1.8** (1.5, 2.2)	1.7** (1.3, 2.1)
Should not be approved	Reference	Reference
Smoking in business areas in restaurants	4.8** (3.5, 6.6)	4.2** (2.8, 6.3)
Smoking in private areas in restaurants	3.3** (2.5, 4.4)	3.2** (2.2, 4.6)
Smoking outside restaurant buildings		
Should be approved	2.0** (1.7, 2.5)	2.0** (1.6, 2.6)
Should not be approved	Reference	Reference

*p<0.05
**p<0.01
[a] logistic regression model was built to calculate the crude and adjusted OR and 95% CI, Wald chi-square test was performed to show the significance.

Table 7: Crude and adjusted relationships between respondents' knowledge and attitude towards smoking and their behaviors to discourage others smoking (n=932) [a]

	Discourage others smoking	
Indicators	Crude OR** (95% CI)	Adjusted OR (95% CI)
Knowledge		
Smoking cause serious illness		
Yes	1.8* (1.0, 3.2)	1.8* (1.0, 3.3)
No	Reference	Reference
Second hand smoking cause serious illness		
Yes	1.8* (1.1, 2.9)	1.8* (1.1, 3.0)
No	Reference	Reference
Uncommon Knowledge	0.98 (0.71, 1.35)	0.99 (0.72, 1.37)
Common Knowledge	1.5* (1.0, 2.1)	1.5* (1.1, 2.2)
Attitude		

Oppose smoking in any public areas		
Yes	1.06 (0.76, 1.48)	1.04 (0.73, 1.47)
No	Reference	Reference
Smoking in business areas in hotels	0.67 (0.42, 1.08)	0.64 (0.39, 1.04)
Smoking in private areas in hotels	1.14 (0.74, 1.74)	1.15 (0.75, 1.79)
Smoking outside hotel buildings		
Should be approved	1.20 (0.89, 1.63)	1.21 (0.89, 1.64)
Should not be approved	Reference	Reference
Smoking in business areas in restaurants	0.67 (0.41, 1.11)	0.63 (0.38, 1.06)
Smoking in private areas in restaurants	1.13 (0.70, 1.82)	1.12 (0.68, 1.83)
Smoking outside restaurant buildings		
Should be approved	1.23 (0.91, 1.67)	1.23 (0.90, 1.67)
Should not be approved	Reference	Reference

*p<0.05

[a] Logistic regression model was built to calculate the crude and adjusted OR and 95% CI, Wald chi-square test was performed to show the significance.

Chapter 5: Discussion, Conclusion and Recommendations

Major findings

In this study, we found that the smoking prevalence (18.1%) and secondhand smoke exposure rate (40.4%) were still high among hotels and restaurants employees in Hangzhou. Even though employees' awareness of harmful effects of smoking and secondhand smoke had improved significantly after the Tobacco Free City (TFC) intervention, their knowledge was still superficial and incomprehensive. In addition, even though most employees held correct attitudes towards prohibiting smoking at most indoor public places and workplaces, they still lacked understanding towards outdoor smoking areas and some particular indoor areas where smoking used to happen as a norm, such as restrooms and elevators. In addition, most employees (76.8%) tried to discourage the smokers at their workplaces, and most smokers (94.8%) would cooperate.

Furthermore, our results revealed that employees' attitudes towards tobacco use and exposure to secondhand smoke in public places and workplaces were significantly positively associated with their current smoking status, while their knowledge of serious illness caused by smoking and secondhand smoke exposure was significantly positively associated with their behaviors to discourage others from smoking at their workplaces.

Smoking prevalence and secondhand smoke exposure rate

We found that the overall smoking prevalence among hotels and restaurants employees in Hangzhou was relatively high. However, the findings from Hangzhou TFC intervention were consistently lower compared with the overall smoking prevalence in China, as estimated 28.1% of adults in China were current smokers (GATS, 2010). The reason for the lower tobacco use and

second hand smoke exposure rates could include that Hangzhou was a tourism city and there were various previous and ongoing health intervention programs. The overall smoking prevalence had slightly declined from 18.4% to 17.7% after the intervention.

The overall prevalence of exposure to secondhand smoke had slightly increased from 39.8% in 2011 to 40.4% in 2012, and change was not statistically significant. The overall smoking prevalence and prevalence of exposure to secondhand smoke were lower than the GATS findings and most rates reported by previous studies conducted in other China cities, such as Guangzhou and Beijing. Although the possibility cannot be excluded that smoking rate and prevalence of secondhand exposure had declined over years with the development of Chinese people's awareness of healthy living, given the high smoking prevalence and secondhand smoke exposure rates, our study suggested that the Hangzhou Smoke-Free Hotels and Restaurant Policy had not been strictly implemented among hotels and restaurants employees as well as the customers or visitors in particular, as data showed that only 45.1% of employees knew that there were smoke-free workplace policy after one-year intervention of TFC program. One survey conducted in 2007 in Beijing showed that overall 86% of nonsmokers had been exposed to secondhand smoke in restaurants for at least one day in the past week. Another study showed that the secondhand smoke exposures in hotels and restaurants in 2009 in Guangzhou were 70.1% and 84.5% respectively. In addition, even after a 2-year city-wide tobacco control intervention in public places, the prevalence remained high, at 61.5% and 78.3%. The differences may reflect regional differences in smoking prevalence and different sampling methods. In our study, almost all the participating hotels and restaurants were relatively larger and more upscale, which might result

in a lower prevalence of smoking and prevalence of exposure to secondhand smoke compared with smaller or regular hotels and restaurants in Beijing and Guangzhou, China.

Knowledge and attitudes

Our study suggests that although the majority of hotels and restaurants employees believed that smoking may cause many serious illnesses such as lung cancer, many of them were not fully aware of the hazards of cigarette smoking and secondhand exposure. For example, overall, only 44.1% of respondents believed that smoking can cause stroke and heart attack, while only 46.6% believed that smoking can cause heart diseases among adults, and only 38.4% of respondents believed that smoking can cause impotence in male smokers. It is obvious that the awareness of dangers of tobacco was still insufficient among the hotels and restaurants employees in Hangzhou. In addition, our study suggested that the awareness of serious illness caused by smoking and secondhand smoke exposure was significantly associated with their behaviors to discourage others from smoking in their workplaces. The mechanism could be that employees who possessed the common knowledge towards tobacco use would be more obligated and confident to discourage others from smoking to protect themselves from exposure to secondhand smoke. And the TFC intervention might also have enhanced their sense of responsibility to maintain clean air in their workplaces. In addition, findings in this study also suggested that the uncommon knowledge of employees defined in this study, didn’t show statistically significant impact on their implementation of smoke-free policy. Even though other studies showed that the employees in other service industries with better knowledge were less likely to smoke, and the employees who did not smoke themselves were more likely to discourage others from smoking in their workplaces, the two scenarios did not happen to the catering industry as hotels and

restaurants in Hangzhou, and the results for associations between common knowledge and smoking, and between smoking and discouraging others were not significant, as listed below respectively [OR=0.80, 95% CI (0.62, 1.04)], [OR=0.89, 95% CI (0.63, 1.25)].

Given the accumulated evidence and our own finding that employees working in hotels and restaurants lacked strong awareness and comprehensive knowledge about the harms of active and passive smoking, and given that common knowledge may promote their implementation of smoke-free policy by discouraging smokers in their workplaces, the need to address this issue in the catering service industry in Hangzhou was urgent. Educating hotels and restaurants employees about the nature and the scope of the danger of tobacco use and secondhand smoke exposure as well as promoting cessation services will hopefully improve the health of the employees and equip them to better address the smoking behaviors in their workplaces. In addition, our study showed only common knowledge was significantly positively associated with employees' smoking behaviors or discouraging other smokers, which suggested that for the purpose of smoke-free policy implementation, training employees with common knowledge only was sufficient, and employees didn't have to be tobacco control experts.

In this study, we also found that employees' attitude towards smoking in indoor public areas and their workplaces were associated with their current smoking status. In addition, employees' knowledge towards the harms of smoking and second hand smoking were associated with their attitude towards smoking in indoor public areas and private areas in hotels and restaurants in this study. It was believed that people's knowledge would impact their attitude and then further

change their behaviors; however, it was also possible that employees who were currently smoking tended to argue that more areas should allow smoking.

Smoke-free policies

Researches showed that smoke-free policy in public places and workplaces, particularly hotels and restaurants, could be self-enhanced and implemented. A study measured the public opinion on smoke-free policies in restaurants and bars in Hong Kong showed most people (68.9%) supported smoke-free policy in catering business, especially for non-smokers (OR=4.9), people who ate three times or less (OR=2.1), people who had previous experience of discomfort from exposure to second hand smoking in restaurant (OR=2.8), and people who had avoided restaurants in the past due to second hand smoking. (T H Lam, 2002) Various studies in global settings had shown that smoke-free policy not only had no adverse effect to business and profit, but might increase business performance by a considerable margin. In addition, smoke-free policies were more and more favorable and popular among Chinese consumers. One representative survey was done to examine levels of support for comprehensive smoke-free policies in six large Chinese cities including Beijing, Shanghai, Guangzhou, Shenyang, Yinchuan and Changsha in 2006. It showed that considerable support for smoke-free policies existed in these six large cities in China, and greater public education about the dangers of SHS might further increase the support rate from public. In addition, experiencing the benefits of smoke-free indoor entertainment places and/or workplaces increases support for these policies and suggests that some initial smoke-free policy implementation might hasten the diffusion of these public health policies. To maximize the implementation of smoke-free policy by discouraging smokers in workplace by employees in hotels and restaurants, it would be

necessary to provide tobacco control resources in addition to improving their awareness of the hazards of smoking. (Q Li, et al. 2009)

Admittedly, to create smoke-free hotels and restaurants, China faces many social and cultural challenges. For example, smoking is especially difficult to address because of the tradition of offering cigarettes as a social courtesy and a sign of respect at dining table; Chinese people value the individual relationship and wanted to maintain harmony with others, which would make employees remain reluctant to discourage their smoking customers. However, China was not the only country facing such cultural barriers in initiation of establishing smoke-free hotels and restaurants. Antismoking and smoking cessation initiatives had often been effective in reducing morbidity in other countries despite certain cultural differences, suggesting the possibility of modifying such approaches in a culturally feasible manner in China.

In addition, the smoke-free policies were not strictly implemented at the catering industry in Hangzhou, and smoking and secondhand smoke exposure remained public health problems for staff employed in hotels and restaurants. A holistic approach, including a stricter implementation of the smoke-free policy, comprehensive education on the hazards of smoking which emphasize on the common knowledge defined in this study, were needed to curb the smoking epidemic among hotels and restaurants employees and to promote smoke-free workplaces in China. The inference for focusing on common knowledge education among hotels and restaurants employees was that employees didn’t have to acquire very complex and detailed knowledge for them to have the awareness and sense of responsibility to discourage smokers.

Strengths and limitations

There are several strengths in this study. First, the study was well designed and included a large sample size. There were over 2,700 employees enrolled in either the baseline or the after-intervention survey, which would lead to more representative and significant results. Second, except the association between employees' knowledge and attitude and their behaviors, the changes of their knowledge level, attitude, and behaviors before and after the intervention were also examined, which would provide more information on the effectiveness of the intervention. Third, polychoric principle component analysis (PCA) was performed to group variables of employee' knowledge and attitude towards smoking and secondhand smoking, and factor analysis was performed to reduce the number of variables observed. Results displayed using composite variable were more simple and intuitive to understand. Fourth, this study thoroughly examined the association between indicators of employees' knowledge and attitude towards smoking and second hand smoking and their behaviors. Logistic regression models were built to obtain both crude and adjusted odds ratios and 95% CIs.

The limitations of this study should be addressed. First, our findings are based on data from 30 typical hotels and restaurants in Hangzhou, not a district or national representative sample of the catering service industry. Therefore, our study may lack external validity to represent the conditions which catering industry in other cities was facing with. However, we could reasonably argue that due to the large sample size, our study sample population was still somewhat representative, particularly for the setting of large and advanced hotels and restaurants in tourist areas in Hangzhou, and we could detect more significant associations. Second, the smoking behavior and implementation of smoke-free policy by discouraging smokers in

workplaces were self-reported, which may be subject to underestimation of smoking prevalence and overestimation of provision of discouragement. Typically, we may assume that respondents tend to under-report their tobacco use and over-report their behaviors of discouraging others from smoking in the last 7 days. We would assume that the misclassification would be likely to lead to bias in both directions. Moreover, given the nature of a cross-sectional design of the study, any attempt at causal interpretation should be made with caution. Concerning temporality for the associations we reported in this study, it would be tricky to decide whether acquiring knowledge and obtaining attitudes should happen before the behaviors (smoking and discouragement) or not. In addition, regarding the specificity, consistency, biological gradients, and our study alone couldn't provide sufficient evidence to claim meeting any of them.

Based on all the discussion above, we would reach a conclusion that it would be beneficial for Hangzhou to promote educational training on common knowledge towards smoking and secondhand smoke among hotels and restaurants employees. Meanwhile, hotels and restaurants should also implement stricter and more comprehensive tobacco control efforts to maintain clean air in workplace, to protect their employees and customers from exposure to secondhand smoke. Targeted training should also be provided to employees at hotels and restaurants to enhance their capacity and sense to responsibility to establish smoke-free hotels and restaurants in Hangzhou.

Reference

Hedley, A. J., McGhee, S. M., Repace, J. L., Wong, L. C., Yu, M. Y., Wong, T. W., & Lam, T. H. (2006). Risks for heart disease and lung cancer from passive smoking by workers in the catering industry. [Research Support, Non-U.S. Gov't]. Toxicol Sci, 90(2), 539-548. doi: 10.1093/toxsci/kfj110

King, B. A., Mirza, S. A., Babb, S. D., & Group, G. C. (2013). A cross-country comparison of secondhand smoke exposure among adults: findings from the Global Adult Tobacco Survey (GATS). [Comparative StudyResearch Support, Non-U.S. Gov't]. Tob Control, 22(4), e5. doi: 10.1136/tobaccocontrol-2012-050582

Yang GH, Li Q, Wang CX, et al. Findings from 2010 Global Adult Tobacco Survey: implementation of MPOWER policy in China. Biomed Environ Sci 2010;23:422–9.

Li Q, Hsia J, Yang G. Prevalence of smoking in China in 2010. N Engl J Med 2011;364:2469–70.

Lai, H. K., Hedley, A. J., Repace, J., So, C., Lu, Q. Y., McGhee, S. M., . . . Wong, C. M. (2011). Lung function and exposure to workplace second-hand smoke during exemptions from smoking ban legislation: an exposure-response relationship based on indoor PM2.5 and urinary cotinine levels. [Research Support, Non-U.S. Gov't]. Thorax, 66(7), 615-623. doi: 10.1136/thx.2011.160291

Li, Q., Hyland, A., O'Connor, R., Zhao, G., Du, L., Li, X., & Fong, G. T. (2010). Support for smoke-free policies among smokers and non-smokers in six cities in China: ITC China Survey. [Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't]. Tob Control, 19 Suppl 2, i40-46. doi: 10.1136/tc.2009.029850

Li, X., Zheng, P., Fu, H., Berg, C., & Kegler, M. (2013). Results from an evaluation of tobacco control policies at the 2010 Shanghai World Expo. [Research Support, Non-U.S. Gov't]. Tob Control, 22 Suppl 2, ii21-26. doi: 10.1136/tobaccocontrol-2012-050816

Liu, R., Hammond, S. K., Hyland, A., Travers, M. J., Yang, Y., Nan, Y., . . . Jiang, Y. (2011). Restaurant and bar owners' exposure to secondhand smoke and attitudes regarding smoking bans in five Chinese cities. [Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't]. Int J Environ Res Public Health, 8(5), 1520-1533. doi: 10.3390/ijerph8051520

Liu, R., Jiang, Y., Li, Q., & Hammond, S. K. (2014). An assessment of health risks and mortality from exposure to secondhand smoke in Chinese restaurants and bars. [Research Support, Non-U.S. Gov't]. PLoS One, 9(1), e84811. doi: 10.1371/journal.pone.0084811

Liu, R., Jiang, Y., Travers, M. J., Li, Q., & Hammond, S. K. (2014). Evaluating the efficacy of different smoking policies in restaurants and bars in Beijing, China: a four-year follow-up study. [Research Support, Non-U.S. Gov't]. Int J Hyg Environ Health, 217(1), 1-10. doi: 10.1016/j.ijheh.2013.02.011

Liu, R. L., Yang, Y., Travers, M. J., Fong, G. T., O'Connor, R. J., Hyland, A., . . . Jiang, Y. (2010). A cross-sectional study on levels of second-hand smoke in restaurants and bars in five cities in China. [Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't]. Tob Control, 19 Suppl 2, i24-29. doi: 10.1136/tc.2009.029959

Lu, S. Q., Fielding, R., Hedley, A. J., Wong, L. C., Lai, H. K., Wong, C. M., . . . McGhee, S. M. (2011). Secondhand smoke (SHS) exposures: workplace exposures, related perceptions of SHS risk, and reactions to smoking in catering workers in smoking and nonsmoking premises. [Research Support, Non-U.S. Gov't]. Nicotine Tob Res, 13(5), 344-352. doi: 10.1093/ntr/ntr001

Yang, T., Abdullah, A. S., Li, L., Rockett, I. R., Lin, Y., Ying, J., . . . Li, M. (2013). Public place smoke-free regulations, secondhand smoke exposure and related beliefs, awareness, attitudes, and practices among Chinese urban residents. [Research Support, Non-U.S. Gov't]. Int J Environ Res Public Health, 10(6), 2370-2383. doi: 10.3390/ijerph10062370

Ye, X., Yao, Z., Gao, Y., Xu, Y., Xu, Y., Zhu, Z., . . . Yang, Y. (2014). Second-hand smoke exposure in different types of venues: before and after the implementation of smoke-free legislation in Guangzhou, China. BMJ Open, 4(2), e004273. doi: 10.1136/bmjopen-2013-004273

Zheng, P., Li, W., Chapman, S., Zhang, Z., Gao, J., & Fu, H. (2011). Workplace exposure to secondhand smoke and its association with respiratory symptoms--a cross-sectional study among workers in Shanghai. [Research Support, Non-U.S. Gov't]. Tob Control, 20(1), 58-63. doi: 10.1136/tc.2010.036921

Appendix
Principle Component Analysis (PCA) [Tetrochoric PCA]
1) Knowledge
Eigenvalues

	Eigenvalue	Proportion
1	6.91063113	0.6911
2	1.12139951	0.1121
3	0.82574601	0.0826
4	0.47027135	0.0470
5	0.30386096	0.0304
6	0.14662567	0.0147
7	0.08536156	0.0085
8	0.06982332	0.0070
9	0.04662440	0.0047
10	0.01965608	0.0020

There are two eigenvalues larger than 1.

Rotated Factor Pattern:

	Factor1	Factor2
smoke_heart	0.92383	0.25696
smoke_stroke	0.91013	0.24569
smoke_impotence	0.81280	0.39366
second_heart	0.66174	0.34318
smoke_emphysema	0.60376	0.57194
second_cancer	0.20527	0.92279
second_lung	0.24332	0.88913
smoke_teeth	0.48921	0.77448
smoke_cancer	0.52256	0.76454
smoke_aging	0.55542	0.64208

Knowledge towards smoking could be grouped into two categories as below;
Uncommon knowledge: awareness that smoking could cause heart attack, stroke, male impotence, and emphysema, and that second hand smoking could cause adult heart attack.

Common knowledge: awareness that second hand children lung diseases and adult lung cancer, and smoking could cause yellow teeth, lung cancer, and rapid aging.

2) Attitude;

(1) Attitude towards smoking at different public areas
Engenvalues

	Eigenvalue	Proportion
1	7.36259655	0.8181
2	0.55890039	0.0621
3	0.36363347	0.0404
4	0.25628115	0.0285
5	0.20168080	0.0224
6	0.13726517	0.0153
7	0.11475784	0.0128
8	0.03086097	0.0034
9	-.02597634	-0.0029

There is only one eigenvalue larger than 1. This group could be treated as one dimension.

Factor Pattern	
	Factor1
smoke_school	0.98662
smoke_college	0.94120
smoke_work	0.93029
smoke_religion	0.92328
smoke_hospital	0.91890
smoke_public	0.90010
smoke_restau	0.89908
smoke_hotel	0.83437
smoke_bar	0.79143

(2) Attitude towards smoking inside hotels

Eigenvalue

	Eigenvalue	Proportion
1	6.25433420	0.6254
2	1.16358169	0.1164
3	0.66227163	0.0662
4	0.52523597	0.0525
5	0.42485451	0.0425
6	0.30890890	0.0309
7	0.25183790	0.0252
8	0.18820370	0.0188
9	0.14995770	0.0150
10	0.07081381	0.0071

There are two eigenvalues larger than 1.

Rotated Factor Pattern

	Factor1	Factor2
hotel_cafe	0.87084	0.24565
hotel_meet	0.83269	0.33638
hotel_bar	0.83163	0.25733
hotel_guest	0.79214	0.18168
hotel_office	0.69727	0.47283
hotel_lobby	0.69087	0.45804
hotel_stair	0.30939	0.88956
hotel_hall	0.29768	0.88233
hotel_restroom	0.20954	0.77482
hotel_eleva	0.53355	0.54259

Places inside the hotel could be grouped into two categories based on the loadings: (1) Cafeteria, meeting room, bar, guest room, office, and lobby; (2) stair, hall, restroom, and elevator.
(3) Attitude towards smoking inside restaurants

Eigenvalue

	Eigenvalue	Proportion
1	6.51300138	0.6513
2	1.24346917	0.1243
3	0.60223792	0.0602
4	0.45891515	0.0459
5	0.36272102	0.0363
6	0.26364459	0.0264
7	0.20234716	0.0202
8	0.17717106	0.0177
9	0.11573508	0.0116
10	0.06075746	0.0061

There are two eigenvalues larger than 1.

	Factor1	Factor2
restau_banquet	0.86989	0.31239
restau_dining	0.86563	0.29495
restau_bar	0.84095	0.28549
restau_private	0.83630	0.25264
restau_waiting	0.59830	0.49567
restau_office	0.58342	0.53751
restau_hall	0.24274	0.92625
restau_stair	0.25310	0.92219
restau_eleva	0.43571	0.75907
restau_restroom	0.33384	0.75641

Places inside the restaurants could be grouped into two categories based on the loadings: (1) Banquet, dining room, bar, private room, waiting area, and office; (2) stair, hall, restroom, and elevator (same as hotels).