

**Second-hand smoke (SHS) exposures: workplace exposures, related perceptions of SHS risk and reactions to smoking in catering workers in smoking and non-smoking premises**

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**Abstract**

**Introduction** Smoke-free workplace legislation often exempts certain venues. Do smoking (exempted) and non-smoking (non-exempted) catering premises workers in Hong Kong report different perceptions of risk from, and reactions to nearby smoking as well as actual exposure to second-hand smoke (SHS)?

**Methods:** In a cross-sectional survey of 204 non-smoking catering workers, those from 67 premises where smoking is allowed were compared with workers from 36 non-smoking premises in Hong Kong on measures of perceptions of risk and behavioral responses to self-reported SHS exposure, plus independent exposure assessment using urinary cotinine.

**Results:** Self-reported prevalence of workplace SHS exposure was 57% (95%CI=49-65%) in premises prohibiting and 100% (95%CI=92-100%) in premises allowing smoking ( $P<0.001$ ). Workers in premises allowing smoking were more likely to perceive poor workplace air quality (OR=9.3, 95%CI=4.2-20.9) and higher associated risks (OR=3.7, 95%CI=1.6-8.6) than were workers in premises prohibiting smoking. Workers in premises prohibiting smoking were more bothered by (OR=0.2, 95%CI=0.1-0.5), and took more protective action to avoid SHS (OR=0.2, 95%CI=0.1-0.4) than workers in premises that allowed smoking. Non-work exposure was negatively associated with being always bothered by nearby smoking (OR=0.3, 95%CI=0.1-0.9), discouraging nearby smoking (OR=0.5, 95%CI=0.2-1.1) and discouraging home smoking (OR=0.4, 95%CI=0.2-0.9). Urinary cotinine levels were inversely related to workers' avoidance behavior, but positively related to their perceived exposure-related risks.

**Discussion:** Workplace smoking restrictions predicted actual SHS exposure, exposure-related risk perception and protective behaviors. Workers from premises where smoking is allowed perceived greater SHS exposure-related risks but were more tolerant of these than workers in premises where smoking is prohibited. This tolerance might indirectly increase both work and non-work exposures.

## **Introduction**

Second-hand smoke (SHS) is a known toxin that has no risk-free level. No exposure is safe and many are exposed daily. Over 100 million non-smokers in the United States have been exposed to SHS, constituting a major population health threat (U.S. Department of Health and Human Services, 2005). Workplaces are the main exposure sources for catering workers, particularly bar workers, who are less likely than other workers to be protected by smoke-free policies (Maskarinec, Jenkins, Counts, & Dindal, 2000). In Hong Kong in 2002, we estimated about 150 deaths per year from lung cancer and heart attacks would be attributable to SHS exposure among the city's 200,000 catering workers on the basis of a working life exposure (Hedley et al., 2006). The subsequent January 1<sup>st</sup>, 2007 implementation of legislation prohibiting smoking in catering premises allowed exemptions until June 30<sup>th</sup>, 2009 if the business was primarily a bar or drinking establishment, Mah Jong or Karaoke parlour (Hong Kong Department of Health, 2009). Vested interests in the licensed trade and other catering sectors claim that because most catering workers are smokers, risks from second-hand smoke exposures are negligible, and anyway workers can choose between workplace environments. Both of these assertions are false (Hong Kong Occupational Safety and Health Council, 2000) (Lam et al., 2005).

Risk perceptions, rather than the actual hazard, indicate people's likely responses to harmful exposures, such as SHS. Discrepancies between lay perception of environmental risks and measurable hazard probabilities are well documented (Bickerstaff, 2004; Slovic, 1987). People are poor judges of actual hazards but their health risk perceptions are influential. Understanding health risk perceptions is therefore key to the interpretation of public responses to environmental exposures (Elliott, Cole, Krueger, Voorberg, & Wakefield, 1999). Perceived risks from SHS exposures probably mediate how people respond to these exposures. One key factor includes voluntariness of exposure. Low SHS exposure voluntariness in occupational settings suggests that catering workers' perceptions of SHS exposure-associated risk might influence their responses to occupational SHS exposures (Kasperson et al., 1988).

The psychometric paradigm postulates several hazard features that enhance perceived risk (Slovic, 1987). These include dreadfulness, harmfulness, imminence, involuntariness, inequity, invisibility and novelty. Air pollution embodies involuntariness and to some extent invisibility, but air pollution's mundane and ubiquitous nature also embodies hazard familiarity, low imminence, low dread, false perception of low harm, and equity. Moreover, indirect benefits accruing from tolerating occupational exposure include higher income and, for some, higher status. Additionally, the role of optimistic bias and dissonance compounds the formidable array of influences contributing to perceived risk. Thus people often acknowledge air pollution-associated risks, but either minimize or ignore the personal impact therefrom (Bickerstaff, 2004; Wall, 1973).

The psychometric paradigm alone does not explain risk perception. Public responses to air pollution differ by locality and demographics, consistent with elements of social cognitive theory, as behavior is context dependent. Environmental influences modulate behavior change (Alaszewski & Horlick-Jones, 2003). For example, within communities, people often share networks of attachments, norms of behavior and social trust, what might be termed "community orientation" (Wakefield, Elliott, Cole, & Eyles, 2001). Thus when air pollution becomes problematic, people may perceive that community social and economic benefits outweigh individual harms from air pollution (Elliott, et al., 1999). Risk perception heterogeneity across socio-cultural locations has also been observed (Bickerstaff, 2004). However, the literature is contradictory on this. For example, Young Latino males face home smoking restrictions but high workplace SHS exposures (Cook, Lee, & Yang, 2009), Asian American women speaking Chinese or Korean were more likely to report SHS exposure at home than were those speaking English, suggesting that acculturation affects SHS exposure tolerance (Tong, Tang, Tsoh, Wong, & Chen, 2009); SHS exposure tolerance can also be differentiated by smoking status, ethnicity, education and gender (Ma, Shive, Tan & Feeley, 2004). Finally, policies can influence perceptions of air pollution risk. For example, smoking restriction at

work increased workers' concerns about SHS exposure (Thompson, Emmons, Abrams, Ockene, & Feng, 1995). There may be causal confusion in the literature on this point.

Despite this, weaker than expected associations between perceived risk and behavior have been reported (Leventhal, Kelly, & Leventhal, 1999; Wakefield, et al., 2001). Sometimes increased concerns may not translate into action because of environmental or other barriers to action, such as lack of legislation or social norms, whereas under other circumstances, remedial action may be more likely to occur, for example when social norms change. These probably mediate the relationship between environmental risk perception and personal preventive behavior (Wakefield et al., 2001).

Exemptions in the smoking legislation ordinance allow comparison of different smoking environments in Hong Kong catering establishments, which might be associated with different perceptions of risk, and willingness to act against SHS exposure among catering workers. To examine this question we assumed awareness of SHS exposure risks among non-smoking catering workers would reflect dissonance-reduction: perceived risk levels would diminish when high levels of SHS (as in smoking-permitted work environments) were encountered, and vice versa (as in non-smoking work environments). Workers should also display more avoidance behaviour of smoke with higher perceived risk but this protective response would be inhibited by policies allowing smoking in exempted venues, reducing avoidance of SHS exposure at work, and possibly elsewhere. This generated the following hypotheses: 1 ) catering employees working under different types of smoking restrictions will demonstrate different perceptions of risk associated with, and reactions to SHS exposure. 2) workers in smoke-free environments would report more self-protective behaviors both at work and elsewhere, and that 3) Actual SHS exposure among workers would reflect their perceptions of risk from, and reactions to SHS exposures, interacting with workplace smoking policy.

## **Methods**

### *Sample selection*

The Hong Kong Food and Environmental Hygiene Department listed catering licenses and exempted qualified bars, which formed the sampling frame from which we selected non-exempted restaurants and exempted premises, mostly bars. We randomly selected seven target districts from 19 districts in Hong Kong. Within each target district we randomly selected catering facilities which were designated non-exempted and exempted venues. We classified the catering facilities into non-exempted premises: facilities which prohibit smoking entirely; and exempted premises: facilities qualified to be totally exempted from the smoke-free law. We visited sampled premises to seek their agreement to join the survey. When venues refused to participate, replacements were selected, located as close as possible to the original venue. All non-smoking staff serving the table areas or behind the bar were deemed eligible for recruitment. Non-smokers or those claiming to be ex-smokers for more than 3 months were confirmed by testing their expired air carbon monoxide (CO) levels, using a cut-off of 6ppm.

### *Procedure*

Following Institution Review Board approval, data collection was conducted from March to June 2008. Subjects were recruited and interviewed on site during their shift. After approval from managers, all non-smoking employees on shift were invited to interview. Each participating subject received HK\$100 (US\$ 12.8) in compensation. In the interview, each subject completed a questionnaire, derived from a previous study (Hedley, et al., 2006), with additional questions concerning perceptions of risk associated with exposure to SHS and their responses to this. We provided Chinese and English versions of the questionnaire and trained interviewers explained each question to subjects. Following interview, subjects were asked to provide a urine sample for cotinine assay. Each subject was assigned a unique subject code identifying questionnaire, urine sample, venue type and district. Two pilots were conducted before the formal field work

commenced, to evaluate the acceptability and comprehensibility of the questionnaires. The survey was amended to improve performance.

### *Measurement*

#### *Self-reported exposure*

Self-reported tobacco smoke exposure sources were recorded as recent/past SHS exposure in workplace, home and leisure activities. All these exposures were reported by dichotomous options “yes” or “no”. Duration of exposure was estimated by respondents as hours per day or per week.

#### *Risk perception and reaction*

Subjects were asked about their perceptions of risk associated with, and their reactions to SHS.

Three questions (Q1-3 Appendix I) identified reactions to SHS exposure and three further questions (Q4-6, Appendix I) assessed perceived indoor air quality, perceived risk and perceived relative risk (Chen, Lee, Chou, Kuo, & Hsu, 2007; Likert, 1932; Ma, Tan, Fang, Toubbeh, & Shive, 2005; Pilkington, Gray, Gilmore, & Daykin, 2006). Test-retest reliability and validity in the pilot study provided Pearson correlation coefficients for reliability and Cronbach’s alphas for internal consistency all exceeding 0.7.

#### *Cotinine*

Urine is acceptable and reliable matrix for cotinine analysis (Haufroid & Lison, 1998; Hedley, et al., 2006). Following the interview each subject was given a sterile polypropylene container with secured cap and asked to provide a sample of approximately 30ml of urine. All urine samples were then stored at -80°C before shipping to the laboratory. Cotinine was assayed using liquid chromatography-tandem mass spectrometry, with limits of quantitation being 0.05 ng/ml (0.29 nmol/l) for cotinine (Bernert, Harmon, Sosnoff, & McGuffey, 2005; Jacob, Yu, Duan, Ramos & Benowitz, 2009).

*Data management and Statistical analysis*

Respondents claiming to be non-smokers but with cotinine level  $\geq 100$  ng/ml or CO  $\geq 6$ ppm were considered to be possible active smokers and excluded (Zielinska-Danch, Wardas, Sobczak, & Szoltysek-Boldys, 2007). Because there were few responses in the extreme categories of questions on risk perception and avoidance, response categories were reduced to three from seven: for risk perception, “Never”, “Very unlikely” and “Unlikely” categories were recoded as “Unlikely”; while “Likely”, “Very likely”, and “Certain” were recoded as “Likely”; “Evens” (50:50 – equal probability either way/unsure) remained the same. For risk avoidance, the responses “Definitely” and “Always” were recoded as “Always”; “Seldom” and “Never” were recoded as “Seldom”; “Sometimes” remained unchanged. Recoding remedied small numbers in extreme categories.

Demographic characteristics, self-reported exposure and distribution of risk perception and reactions of catering workers to SHS by type of catering facility (non-exempted and exempted) were compared using  $\chi^2$  tests. The binomial proportion confidence intervals of self-reported exposure were calculated using the Wald test. The dependent variables of risk perception and reactions being categorical required multinomial logistic regression and ordinal logistic regression to test differences by venue type with adjustment for covariates. All recorded socio-economic factors (age, gender, type of venue smoking status, income, education levels and ethnicity (all self report, excepting venue status; Hong Kong has a predominantly Chinese population but other ethnic groups, mainly Filipinos and Caucasians work in the catering sector) were *a priori* included as covariates in multinomial logistic regression models, because SES factors are important indicators of the socio-cultural perspectives contextualizing risk perceptions (Bickerstaff, 2004). Odds ratios (OR) were derived to represent variations in risk perceptions and reactions to workplace environment. In ordinal logistic regression models ORs  $>1$  indicated an increased probability that a subject from exempted premises would be observed in a higher category – greater perceived risks associated with, or protective reactions to SHS. To test associations between avoidance of SHS and



self-reported non-work exposure (leisure or home exposure), a logistic model regressed non-work exposure on workers' reactions, adjusting for all socio-economic effects. Associations between cotinine levels and workers' perceptions of risk and behavioral responses to SHS were assessed using multivariable regression models adjusted for age, gender, income, education levels, ethnicity, smoking status and outside work SHS exposure. All analyses were performed using STATA 9.0.

## **Results**

### *Demographic characteristic*

Of 495 visited premises, 67/230 (29%) non-exempted non-smoking and 36/265 (14%) exempted smoking premises consented to allow staff to be interviewed. Of the 163 (71%) non-exempted and 229 (86%) exempted premises that refused our invitation, 31% were "not interested" and the remaining 69% claimed all staff were smokers. A total of 250 catering workers were enrolled in the survey. After excluding potential smokers, the final sample comprised 204 non-smoking catering workers of whom 157 worked in non- and 47 in exempted bars.

Table 1 shows the demographic characteristic of all subjects. Variables age group, income, education level and ethnicity differed significantly between exempted and non-exempted premises. Non-Chinese subjects comprised 14% (29/204) of subjects being mostly Caucasians and Filipinos. Workers in exempted premises were younger (mean=31 years) than those from non-exempted venues (mean=40 years) (two sample t-test:  $p < 0.001$ ). Stratification by ages 15-29, 30-44 and 44+ indicated that 72% of subjects from non-exempted venues were mainly in the 30-44 and 44+ groups. Workers in exempted premises had higher educational achievement and higher income.

### *Source of self-reported SHS exposure and cotinine levels by venue*

Self-reported SHS exposure by venue type is shown in Table 2. Workers in exempted venues were more likely to report SHS exposure from customers ( $p < 0.001$ ) and non-customers ( $p < 0.001$ ) than were workers in non-exempted venues. However in non-exempted venues, 54% still reported SHS

exposure from co-workers despite smoke-free legislation, even though exposures were lower than in exempted venues (92%). More workers in exempted than non-exempted venues reported leisure SHS exposure ( $p=0.006$ ). There was no difference in reported home exposures by venue type. All observed cotinine levels exceeded the detection threshold of 0.05ng/ml. The median cotinine level of workers from exempted premises (12.8 ng/ml) was significantly higher than that of workers from non-exempted premises (1.7 ng/ml) (School of Public Health, 2008).

### *Comparison of workers' risk perception and reactions by venue*

When we compared risk perceptions and reactions by venue (Table 3), more respondents from non-exempted premises reported being bothered by, and discouraging nearby smoking than did respondents from exempted premises, although the latter perceived greater associated risks from occupational SHS exposures. Multinomial logistic models showed trends for ORs across three categorical responses for the six risk perception and reactions questions. We therefore regressed perception of specific workplace risk and reactions on venue type using ordinal logistic regression models to examine those responses ordinally. Workers from exempted premises were more likely to perceive their premise's indoor air quality was poorer than were workers from non-exempted venues (OR=9.3, 95%CI: 4.2-20.9). Workers in exempted venues also perceived higher risks of ill health from poor air quality than did workers in non-exempted venues (OR=3.7, 95%CI 1.6-8.6). Relative to a comparable worker in non-exempted venues exempted venue respondents perceived far greater personal health risks from SHS (Question 6) (OR=21.5, 95%CI: 8.8-52.3). Moreover, non-exempted venue respondents were more likely to report being bothered by smoking (OR=0.2, 95%CI 0.1-0.5) and to discourage nearby smoking (OR=0.2, 95%CI 0.1-0.4) than were respondents from exempted venues.

### *Non-work exposure and reaction to SHS*

The association of non-work (leisure or home) exposure and respondents' reactions to SHS exposure in logistic regression models was examined with exposure as the dependent variable fully

adjusted for all SES factors *a priori*. Reactions to SHS exposure were inversely associated with non-work (leisure or home) exposures. Thus respondents admitting “being sometimes or always bothered by nearby smoking” and “sometimes or always discouraging nearby smoking” were less likely to have non-work exposure than reference groups - those “being seldom bothered by nearby smoking” and “seldom discouraging nearby smoking”. However, only “being always bothered” by nearby smoking (OR=0.3, 95%CI: 0.1-0.9), and “always discouraging home smoking” (OR=0.4, 95%CI: 0.2-0.9) were the only reaction variables significantly associated with less non-work exposure; “always discouraging nearby smoking” showed a similar but not significant trend (OR=0.5, 95%CI: 0.2-1.1).

#### *Cotinine levels and perception of risk*

Table 4 indicates the association of cotinine levels and perception of risk. Cotinine levels showed marked gradients in positive association with different levels of risk perception. Workers who rated their workplace air quality as “poor” had higher cotinine levels than those rating it as “good” ( $p<0.001$ ). Cotinine in those who considered their workplace air a “likely” threat to their health was much higher than those who considered the risk “unlikely” ( $p=0.053$ ), a pattern of association consistent with that seen for relative perceived risk (Q6) ( $p<0.001$ ).

Cotinine levels and SHS exposure avoidance were inversely related in multivariable regression models. Those “always” bothered by SHS evidenced lower cotinine levels than the “seldom” bothered group ( $p=0.01$ ). Workers who would “seldom” ask a smoker to move from their immediate vicinity had higher cotinine levels than workers who reported “always” taking such protective action ( $p<0.001$ ). Appendix II showed median cotinine levels gradient across risk perception.

## **Discussion**

Consistent with our hypotheses, our data show that workers from exempted premises reported poorer air quality and higher perceptions of risk from SHS, and more SHS exposure in their workplace and leisure time than did workers from non-exempted premises. The self-reports of exposure are strongly supported by cotinine levels indicating actual exposures. Although respondents from exempted venues perceived more SHS risks at their place of work, they were less likely to report protective avoidance of SHS than were respondents from non-exempted venues. Furthermore, respondents who reported attempts to actively avoid workplace SHS were also less likely to be exposed to SHS outside work and had lower cotinine levels. Catering workers who perceived higher SHS risk and poor indoor air quality, had higher cotinine levels.

Only 19% of respondents from exempted bars considered that their workplace air was of good quality, and 79% reported health effects attributable to exposure to this air, much higher proportions than were seen among workers from non-exempted venues. The positive associations between perceived risk and perceived indoor air quality, and the correlations between cotinine levels following SHS exposure reported here and elsewhere (Forastiere et al., 1993; Willemsen, Brug, Uges, & Vos de Wael, 1997) are consistent, suggesting perceptions of risk are reasonably reliable reflections of actual air quality. The arguments supporting the licensed trade's operation of venues with unrestricted smoking have centered on the issue of choice for both customers and workers. Our findings clearly show that catering workers perceive risks from smoke exposures. They do not, however, show the same responses to that exposure. Less avoidance behavior among workers in unrestricted smoking environments may reflect the difficulty of achieving this when smoke is ubiquitous, implying they have no choice regarding exposures. As a group these workers were much younger and had a lower prevalence of current and previous respiratory symptoms (School of Public Health, 2008). This demographic difference between the two groups of workers, an apparent cohort effect, possibly reflects the impact of previous workplace exposure and a desire to work in a cleaner environment among the surviving, older catering workers.

Population surveys regarding smoke-free legislation in Hong Kong showed 69% of respondents supported a comprehensive smoke-free workplace policy (Lam et al., 2002). Following such restrictions in California, the proportion of bar workers concerned about SHS health effects doubled from 21.6% to 45.5% (Tang, Cowling, Stevens, & Lloyd, 2004). In our study, most workers in exempted premises rarely indicated annoyance with, and reaction against SHS exposure among.

**There is little such workers can do to avoid SHS at work and exemption means they have no legal basis for asking smokers to stop or move away. In short, they cannot avoid smoke exposure unless**

**they quit their job.** Against this must be considered the benefit of higher income obtained by working in smoking venues, which being a more immediate gain may take precedence over a perceived distant, discounted and possibly uncertain health effect (Francis, Blevin, & Aveyard, 2000). This phenomenon has been described elsewhere when failure to used protective measures occurs despite knowledge of risks (Fuchs et al., 1995; Walters & Haines, 1988). This suggests that optimistic cognitive biases as well as significant discounting influence attitude and behavior. Our findings are consistent with previous research findings that individuals might accept SHS related risks because they would lose valued and more immediate benefits if they adopted lower risk (Walters & Haines, 1988).

Greater non-work exposure among workers in exempted premises indicated that they were more accustomed to living with SHS exposure both at work and elsewhere. Individuals are socially validated and recognized by others when they behave in accordance with, or hold beliefs congruent with group norms (Wakefield et al., 2001). Because such social validation is strongly reinforcing, behaviors, even those harmful to the individual, are easily maintained through social reinforcement and other influences (Forgas & Williams, 2001). Smoke-free policies at work or at home can influence prevailing norms. Bar workers probably regard smoking exposure as part of bar work (Francis, Blevin, & Aveyard, 2000), so norms and social influence among workers in exempted premises likely determine their reactions to SHS. We found reactions to SHS were inversely associated with non-work exposure and urinary cotinine levels. In exempted premises, low levels of

annoyance and reaction against SHS exposure might reflect prevailing norms of acceptance, reducing the motivation of workers to take protective action elsewhere, increasing outside-work exposure and giving higher cotinine levels. Conversely, smoke-free legislation, by changing the prevailing norms and reducing social sanctioning, enables catering workers and their representatives to challenging the acceptability of SHS in the work environment and adopt protective actions without social consequences (Francis, Blevin, & Aveyard, 2000). A before-and-after legislative changes study that assesses the situation once exemptions have been removed would enable a longitudinal analysis to be performed that minimizes some of the bias we faced in this study.

**There are some limitations to this study:** First, sample differences between exempted, mostly bars and non-exempted, mostly restaurant establishments, rather than the smoking patterns within those establishments might have influenced outcomes. Possibly younger people, who might be more tolerant of SHS, may preferentially opt to work in exempt premises such as bars. Younger people tend to perceive less risk from a given threat than older adults. We did not gather data to clarify this possibility. Nonetheless, cotinine levels, and hence SHS exposures, remained higher for exempted-premise workers, even after adjustment for all non-work exposures (School of Public Health, 2008). Second, following the introduction of smoking restrictions, some subjects might have changed their working environment, with those averse to SHS exposure moving to non-exempted establishments and vice versa. If so, this would have biased attitudes towards the exemption status generating a spurious association between exemption status and psychological responses. Lack of data on prior employment prevents testing this possibility. There is evidence that older workers were either self-selected or preferentially recruited into the non-exempted venues (Cook, Lee & Yang, 2009). Third, within establishments self-selection could have contributed to biasing the distribution of questionnaires responses, with workers holding stronger views more likely to participate. As only two participants from each establishment were recruited on average, other workers might have held different views. Little reliable demographic information about catering workers in Hong Kong

could be inferred. Fourth, fiscal constraints and uncooperative employers made sampling difficult. Despite visiting 265 smoking bars, only 36 bars, less than 4% (36/966) of all qualified exempted premises agreed to participate. We attempted to improve representativeness by recruiting subjects from districts with higher and lower density of smoking bars, and in smoking bars, we recruited and interviewed subjects outside peak working hours. The high rejection rate inevitably leads to sampling bias but we consider that our sample probably representative most catering workers. The unpopularity of the smoking control ordinance among catering establishments, overtly reflecting fear of loss of business, is a perception encouraged by the tobacco industry. It is quite likely that some managers therefore exaggerate the smoking rate to avoid study participation and contributing evidence to support the ban.

Our study contributes several findings of importance to occupational health and tobacco control in general. First, smoke-free policies are associated with greater efforts by catering workers to avoid SHS exposure. Second, these protective avoidance efforts appear to produce lower nicotine exposures indicated by lower urinary cotinine levels. Third, associations between perception, reactions and working environment of catering workers regarding SHS exposure suggest that acceptability of SHS exposure is strongly influenced by having to work in a smoking environment, inhibiting those workers intent on avoiding SHS and tending to normalize SHS exposures generally.

Bar workers have the right to protect their health in their workplace. Long term employment in workplaces which permit smoking is a major risk factor for cancer, circulatory and respiratory disease and, to pregnant women, reproductive harm. The comprehensive restriction of smoking in workplaces is critical in not only decreasing occupational SHS exposure, but also improving workers' health awareness and empowerment to protect themselves. Significantly, even in smoke-free premises, more than 50% of subjects reported SHS exposure from co-workers, representing a significant weakness in existing legislation which urgently needs rectifying to enhance the

legislative effectiveness in protecting workers' health. This has not been widely reported. About 60% of catering workers are non-smokers (Hong Kong Occupational Safety and Health Council 1998). However, the hazards of SHS are the same for both smokers and non-smokers (Lam et al., 2005). Catering workers need governments to implement comprehensive smoke-free laws to protect them from SHS exposures from customers and other employees and ensure compliance in their workplace (Hong Kong Census and Statistics Department, 2008). With a trend for younger workers to be employed in smoking bars, smoke-free working environments are an essential strategy to protect young people against both work and non-work SHS exposures.

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**Table 1 Socio-economic characteristics of catering workers by venue**

	Non-exempted Venue %(N)	Exempted venue %(N)	Total %( N)
Total	71 (157)	21 (47)	100(204)
Agegroup*			
15-29	28 (44)	62 (29)	36 (73)
30-44	34 (53)	28 (13)	32 (66)
45-	38 (60)	10 (5)	32 (65)
Gender			
male	29 (46)	43 (20)	32 (66)
female	71 (111)	57 (27)	68 (138)
Smoking status			
Never smoker	87 (136)	79 (37)	85 (173)
Ex-smoker	13 (21)	21 (10)	15 (31)
Education*			
low	12 (19)	2(1)	10(20)
medium	73 (115)	64 (30)	71(145)
high	15 (23)	34 (16)	19(39)
Income*			
<=7000	34(54)	15(7)	30(61)
>7000	66(103)	85(40)	70(143)
Ethnicity*			
Chinese	92(144)	66(31)	86(175)
Non-Chinese	8(13)	34(16)	14(29)
Job nature			
Waiter	75(117)	81(38)	76(155)
Non-waiter	25(40)	19(9)	24(49)

\*Significant differences were found between non-exempted and exempted venues in these factors.

**Table 2 Source of SHS exposure in catering workers**

Exposure	Non-exempted		Exempted		P value for 2*2 Chi-square test
	%(N)	95% CI	%(N)	95% CI	
Workplace exposure	57(89)	49-65	100(47)	92-100	<b>&lt;0.001</b>
Customer exposure	17(27)	12-24	100(47)	92-100	<b>&lt;0.001</b>
Non-customer*	54(85)	46-62	92(43)	80-98	<b>&lt;0.001</b>
Co-worker	50(78)	42-58	92(43)	80-98	<b>&lt;0.001</b>
Break time	29(46)	22-37	62(29)	46-75	<b>&lt;0.001</b>
Non-work exposure	40(63)	32-48	51(24)	36-66	0.184
Home exposure	25(40)	19-33	15(7)	1-28	0.131
Leisure time exposure	22(35)	16-30	43(20)	28-58	<b>0.006</b>
Bus-stops	46(72)	38-54	28(13)	16-43	<b>0.026</b>

\*Non-customer SHS exposure was defined as the exposure from co-workers or break time.

**Table 3 Risk Perception of Catering Workers by Venues ( exempted vs non-exempted )**

	Total catering workers	Non-exempted Venues		Exempted Venues		P value for 3*2 Chi-square test	OR (95%CI)*
	N=204	N=131	%	N=47	%		
Q1. Bothered by nearby Smoking%							
Seldom¶	18	8	5	10	21	<0.001	0.2 (0.1-0.5)
Sometimes	44	25	16	19	40		
Always	142	124	79	18	38		
Q2. Discouraging nearby Smoking%							
Seldom¶	51	24	15	27	57	<0.001	0.2 0.1-0.4
Sometimes	45	35	22	10	21		
Always	108	98	63	10	21		
Q3. Discouraging home Smoking%							
Seldom¶	37	25	16	12	25	0.108	0.8 0.3-1.8
Sometimes	17	11	7	6	13		
Always	150	121	77	29	62		
Q4. Perceived indoor air quality%							
Good ¶	76	67	43	9	19	<0.001	9.3 4.2-20.9
Acceptable	100	81	51	19	40		
Poor	28	9	6	19	40		
Q5. Perceived risk from poor air quality							
Unlikely¶	57	53	34	4	9	<0.001	3.7 1.6-8.6
Even	35	29	18	6	13		
Likely	112	75	48	37	79		
Q6. Perceived relative risk							
Below average¶	66	64	41	2	4	<0.001	21.5 8.8-52.3
About average	82	73	47	9	19		
Above average	56	20	13	36	77		

\*Odds ratios for risk perception using ordinal logistic regression between exempted and non-exempted premises adjusted for age, sex, venue type, smoking status, income, ethnicity and education.

¶ Reference group

<b>Table 4 The association between cotinine levels and risk perception and reactions</b>			
Question	N	Beta(SE)	P value
1. If someone next to you were smoking, would it bother you?			
Seldom	18	1	
Sometimes	44	-1.788468(3.446257)	0.604
Always	142	-8.426869(3.233166)	0.010
2. If someone next to you were smoking, would you ask them to stop or move to another area?			
Seldom	51	1	
Sometimes	45	-6.456701(2.525549)	0.011
Always	108	-7.939457(2.213214)	<0.001
3. If someone was smoking in your home, would you dissuade?			
Seldom	37	1	
Sometimes	17	-1.893527(3.671139)	0.607
Always	150	-1.366698(2.483174)	0.583
4. In general, how would you think about the air quality at your workplace?			
Good	76	1	
Acceptable	100	3.387561(1.848843)	0.068
Poor	28	11.13559(2.719149)	<0.001
5. How possible is that the air quality of your work environment will affect your health?			
Unlikely	57	1	
Even	35	0.5167517(2.669857)	0.847
Likely	112	4.031959(2.073614)	0.053
6. Compared to the workers in other smoke-free catering industry, the influence of air quality of your work environment on health is			
Below average	66	1	
About average	82	1.906198(1.949689)	0.329
Above average	56	11.00216(2.280146)	<0.001

\*Multivariable regression models were adjusted by age, sex, ethnicity, income, education, outside work SHS exposure and smoking status.