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Tobacco Smoke Exposure in Hospitality Spaces - Efficacy of Smoke-Free Legislation

RESEARCH ARTICLE

Second-Hand Smoke in Public Spaces: How Effective has Partial Smoke-Free Legislation Been in Malaysia?

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Abstract

Background: This study was performed to gather data on second-hand smoke (SHS) concentrations in a range of public venues following the implementation of partial Smoke-Free Legislation in Malaysia in 2004. Materials and Methods: $PM_{2.5}$ was measured as a marker of SHS levels in a total of 61 restaurants, entertainment centres, internet cafés and pubs in Kuala Lumpur, Malaysia. Results: Under the current smoke-free laws smoking was prohibited in 42 of the 61 premises. Active smoking was observed in nearly one-third (n=12) of these. For premises where smoking was prohibited and no active smoking observed, the mean (standard deviation) indoor $PM_{2.5}$ concentration was 33.4 (23.8) $\mu g/m^3$ compared to 187.1 (135.1) $\mu g/m^3$ in premises where smoking was observed The highest mean $PM_{2.5}$ was observed in pubs [361.5 (199.3) $\mu g/m^3$]. Conclusions: This study provides evidence of high levels of SHS across a range of hospitality venues, including about one-third of those where smoking is prohibited, despite 8 years of smoke-free legislation. Compliance with the legislation appeared to be particularly poor in entertainment centres and internet cafés. Workers and non-smoking patrons continue to be exposed to high concentrations of SHS within the hospitality industry in Malaysia and there is an urgent need for increased enforcement of existing legislation and consideration of more comprehensive laws to protect health.

Keywords: Hospitality spaces - smoke-free legislation - indoor air pollution - secondhand smoke

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Introduction

Recent work has suggested that Secondhand smoke (SHS) may cause or exacerbate a range of illnesses and disease states (Carey et al., 1999; Jaakkola et al., 2003; Kurahashi et al., 2008; Eisner et al., 2009; Brook et al., 2010). Despite this evidence, tobacco smoking remains as a common habit with the highest incidence of smoking occuring in lower-middle income countries as reported by the World Health Organization (WHO, 2010).

The Framework Convention on Tobacco Control (FCTC) aims to protect present and future generations from the ill-health consequences of tobacco consumption and exposure to SHS. Ratification of Article 8 in the WHO FCTC leads to the introduction of Smoke-Free Legislation (SFL) among its member countries with SFL being introduced in many countries in the last decade (WHO, 2003). In Scotland, SFL has been shown to reduce adults' and children's exposure to SHS exposures (Akhtar et al., 2007; Semple et al., 2007). Comprehensive SFL has been shown to lead to benefits in terms of health improvements to workers (Ayres et al., 2009) and to the general population (Pell et al., 2007).

As a signatory to the treaty under the WHO, Malaysia has similarly introduced steps to control tobacco use in public places under the Food Act (Malaysia Act, 2008). The Control of Tobacco Product Regulations were issued in 2004 and aimed to regulate, among other things, smoke-free environments, tobacco advertising, promotion and sponsorship and tobacco packaging and labelling. Under Regulation 11 partial smoking restrictions were put in place and following the recent amendment in 2010, now specify a total of 21 public-space venue types as smoke-free. Unlike restrictions implemented in Ireland, the UK and many EU countries the smoke-free laws in Malaysia are partial and allow smoking to continue in certain types of enclosed public venues.

Following the implementation of partial SFL in Malaysia, Lee and co-workers (2010) reported $PM_{2.5}$ concentrations in indoor public venues in Melaka, Malaysia measured between May to June 2009 with the average concentration in 22 hospitality-related venues being 46 $\mu g/m^3$; 1.8 times higher than the current air $PM_{2.5}$ standard permitted by the Air Quality Guidelines (WHO, 2005). Since June 2011, Melaka has introduced smoke-free zones in five of its major areas in the city. Elsewhere, further amendments of the SFL in 2010 included smoking restriction in any air-conditioned place of work with centralised air-conditioned system nationwide. This study aims to assess exposure to SHS in public venues and consider the level of compliance with existing smoke-free restrictions in Malaysia.

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Materials and Methods

Selection of venues

Venues were selected for this study based on the categories laid out by the Control of Tobacco Product Regulations 2004 (Malaysia Act, 2008). The hospitality spaces with SFL were selected for inclusion to be compared with indoor environment without any SFL. Table 1 presents the details of SFL introduced in 2004 and the amendments that followed.

Ethical approval was not required for this study as it simply measured air quality and did not gather any human data.

The study locations were based in Kuala Lumpur, Malaysia and consisted of 6 types of premises; pubs or disco; entertainment centres; internet cafés; fast-food chain air-conditioned restaurants; non-franchised air-conditioned restaurants; and non-air conditioned restaurants. A total of 65 premises were visited during this study.

Pubs, entertainment centres and internet cafés were identified using the business addresses generated in the directory obtained from www.yellowpages.com.my. The addresses generated were then randomly selected according to stratified sampling method to identify outlets for inclusion.

Websites of a selection of fast-food chain restaurants operating within the Kuala Lumpur area were reviewed. Addresses located within shopping complexes, outlets containing drive thru services or outlets attached to petrol stations were excluded. Fourteen sites were selected at random for inclusion. The fast-food chain restaurants identified were used as the proxy location for the selection of other non-franchised air-conditioned and non-air-conditioned outlets. Eligible premises located close to (<100m) the selected fast-food establishments were selected randomly and included in the study. This method of selection was performed to enable better comparison to be made in the analysis stage.

Measurement of $PM_{2.5}$

Measurements were performed in March-April 2012. $PM_{2.5}$ was measured as a marker of SHS levels. Data were collected covertly to ensure that the presence of the researcher did not alter smoking behaviour of owners or patrons within the selected public venue. Concentrations of $PM_{2.5}$ were monitored using a TSI SidePak AM510 Personal Aerosol Monitor (TSI, Inc., St. Paul, MN, www.tsi.com) based on a protocol of a previous study (Semple et al., 2007).

The small instrument was placed in a shoulder bag after it was programmed to sample. The measurement was performed at each site for 30 minutes indoors and 10 minutes outdoors. A short length of tygon tubing was attached to the inlet of the pump with one end protruding from the shoulder bag in order to draw the air sample. All measurements were performed by a researcher who visited the venue as a patron/customer.

Collection of information

Other information was collected discreetly by observation while the measurement of $PM_{2.5}$ was performed. This included: time of entry and exit; the number of people in the venue; and the number of burning cigarettes at 10-minute intervals.

Analysis of data

The $PM_{2.5}$ data were downloaded to computer using Trakpro software (TrakPro Version 4.20 ASCII Data) and summary statistics of measured $PM_{2.5}$ concentrations generated using MS Excel software. The data were then transferred to SPSS version 21 for further statistical analysis. The statistical analysis included data distribution and summary. Further statistical tests of difference between groups were performed using Kruskal-Wallis where relevant.

Results

Sixty-five venues were visited in this study. 61 were included in the results with 4 excluded due to incomplete outdoor monitoring data. 29 out of the remaining 61 visits provided indoor monitoring data between 21 to 29 minutes of monitoring. The number of venues where smoking was restricted according to regulations was 42 (68.9%) with 19 (31.1%) venues having no smoking restrictions. Table 2 presents information on the venues where measurement of $PM_{2.5}$ was performed.

$PM_{2.5}$ concentrations by venue type

Table 3 presents the distribution of $PM_{2.5}$ levels across hospitality venues. The average (mean (standard deviation)) $PM_{2.5}$ levels across the hospitality venues where smoking was restricted and no active smoking

Table 1. SFL in Malaysia and its Amendments

Introduction of Smoke-Free Legislation	Premises with smoking restrictions	Premises exempted from smoking restrictions	Date introduced
Control of Tobacco Product Regulations 2004	Entertainment centre or theatre, hospital or clinic, public lift or toilet, air-conditioned eating place or shop, public vehicle or public transport terminal, airport, government premise, area of assembly activity, educational institution, nursery, school bus, floor with service counter, shopping complex, petrol station, stadium, sports complex, fitness centre, gymnasium, religious places, library, internet café	Pub, discotheque, night club, casino, open-air restaurants	September 23, 2004
Control of Tobacco Product (Amendments) Regulations 2008	Inside any shopping complex, in any area of national service training	Same as above	September 15, 2008
Control of Tobacco Product (Amendments) Regulations 2010	Added in any air-conditioned place of work with a centralised air-conditioned system	Same as above	July 20, 2010

Table 2 Distribution of Hospitality Venues (n=61) Across Smoking Restriction

Type of venue	Numbers (n)	Smoker present (Yes/No)	Number of premises with active smokers	Active smoking
Smoking restricted by law (n=42)	68.9%		12	28.6%
Franchised air-conditioned restaurant	14	No	-	
Non-franchised air-conditioned restaurant	8	No	-	
Internet Café	10	Yes	2	20.0%
Entertainment centre (inclusive of snooker/billiard)	10	Yes	10	100.0%
Smoking not restricted (n=19)	31.1%		16	84.2%
Open-air restaurant	9	Yes	8	88.9%
Pub or Disco	6	Yes	6	100.0%
Pub or Disco (Open-air)	4	Yes	2	50.0%
Total	61	-	28	45.9%

Table 3 Distribution of $PM_{2.5}$ ($\mu g/m^3$) Levels Across Hospitality Venues (n=61)

Type of venue	Mean Indoor (sd)	Mean Outdoor (sd)	Min-Max **	I/O ratio	ŧ ŧ Cigs.	ŧ ŧ Patrons
[a] β Smoke restricted and no active smoking observed (n=30)	33.4 (23.8)	30.4 (18.3)	20.2-54.9	1.1	-	16
Franchised air-conditioned restaurant (n=14)	35.0 (22.9)	33.4 (18.9)	25.0-56.3	1.02	-	14
Non-franchised air-conditioned restaurant (n=8)	33.6 (32.8)	27.0 (20.8)	19.1-51.1	1.15	-	7
Internet Café (n=8)	27.4 (17.6)	26.3 (15.5)	12.8-56.1	1.04	-	29
[b]Smoke permitted and no active smoking observed (n=3)	44.3 (16.5)	18.0 (5.1)	11.3-80.6	2.46	-	5
Restaurant (Open-air) (n=1)	12	12	7.0-22.0	1	-	6
*Pub or Disco (Open-air) (n=2)	60.5 (2.1)	21.0 (0)	13.5-110.0	2.88	-	5
[c] ¥ Smoke restricted and active smoking observed (n=12)	187.1 (135.1)	46.6 (33.1)	78.9-314.1	4.02	3.5	14
Internet Café (n=2)	289.5 (194.5)	68.0 (46.7)	69.5-344.0	4.26	1	2
Entertainment centre (inclusive of snooker centre) (n=10)	166.6 (123.7)	42.3 (31.3)	80.8-308.1	3.94	3.97	17
[d] α Smoke permitted and active smoking observed (n=16)	162.4 (196.8)	33.4 (21.3)	103.1-245.6	4.86	3.5	24
Restaurant (Open-air) (n=8)	44.5 (14.3)	47.3 (22.2)	29.5-77.3	0.94	1.9	22
Pub or Disco (n=6)	361.5 (199.3)	19.8 (7.3)	230.3-525.2	18.3	6.1	29
Pub or Disco (Open-air) (n=2)	36.5 (12.0)	18.5 (4.9)	15.5-80.0	1.97	2	16
ŧAverage mean (sd)	98.0 (135.1)	34.0 (22.9)	53.1-157.1	3.98	1.59	17

*Grilled food prepared indoors, ** indoors β: Kruskal Wallis 0.562, p=0.755, PM 2.5 expressed in $\mu g/m^3$, sd: standard deviation, ŧ Average refers to categories within venues a, b, c, d, ŧ ŧ Averaged for 3 observations, α: Kruskal Wallis 10.94, p=0.004 (significant when <0.05), ¥: Kruskal Wallis 1.15, p=0.283

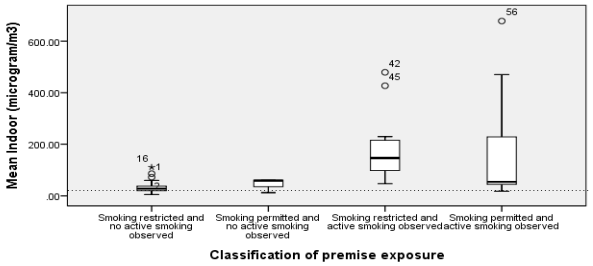

Figure 1. Concentrations of $PM_{2.5}$ Across the Hospitality Venues (n=61). Legend: The dotted line represents WHO AQG 200512 $PM_{2.5}$ Standard Exposure Concentrations for 24 Hours of 25 $\mu g/m^3$

was observed was as follows: indoor: 33.4 (23.8) $\mu g/m^3$; outdoor: 30.4 (18.3) $\mu g/m^3$ with a range of 20.2-54.9 $\mu g/m^3$. These venues included all air-conditioned restaurants.

For premises where smoking was permitted and no active smoking was observed, the levels of $PM_{2.5}$ across open-air restaurants and pubs and venues are as follows: indoor: 44.3 (16.5) $\mu g/m^3$; outdoor: 18.0 (5.1) $\mu g/m^3$ with a range of 11.3 to as high as 80.6 $\mu g/m^3$.

However, for venues where active smoking was observed, the levels of indoor $PM_{2.5}$ were highest in the pub/ disco classification. The level of $PM_{2.5}$ was 362 (199) $\mu g/m^3$ with a range of 230 to 526 $\mu g/m^3$. The corresponding outdoor average was much lower at 19.8 (7.3) $\mu g/m^3$ as the measurements at the pubs or disco were usually performed outside office working hours or at a later time at night when the outdoor traffic density is usually less. The indoor:outdoor ratio was 18.3:1. This was followed by the internet cafés and entertainment centres with an indoor average of 290 (195) and 167 (123) $\mu g/m^3$ $PM_{2.5}$ respectively. Similarly, the corresponding outdoor mean was lower than indoors; 68.0 (46.7) and 42.3 (31.3) $\mu g/m^3$ for internet cafés and entertainment centre respectively while the indoor:outdoor ratio was 4.26:1 and 3.94:1. Figure 1 represents concentrations of $PM_{2.5}$ across the hospitality venues (n=61).

Average number of burning cigarettes and patrons

Data on the average number of patrons and the average number of burning cigarettes observed during the measurements are also included in Table 3.

Discussion

This study measured $PM_{2.5}$ concentrations, as a marker of SHS levels, within 61 public premises in Kuala Lumpur. This is the first study of venues located in Kuala Lumpur and the first to look at SHS levels after the enhancement of SFL in 2010. A previous smaller study has reported data on SHS levels in the hospitality sector in another Malaysian city in 2009 (Lee et al., 2010).

Like most other countries there are no Malaysian guidance or limit values in relation to SHS exposure either in the workplace or for non-occupational exposure within public spaces. The Malaysian Code of Practice for Indoor Air Quality guidelines for non-industrial settings was

introduced by the Malaysian Department of Occupational Safety and Health in 2005 and states that 8-hour Time-Weighted Average for PM_{10} was 150 $\mu g/m^3$ (Malaysia Department of Occupational Safety and Health, 2005). In 2010 the WHO indicated that their AQG 2005 for $PM_{2.5}$ (25 $\mu g/m^3$) could now be applied to indoor settings and we have used this as a benchmark for our findings.

When compared to the previous study in Malaysia (Lee et al., 2010), the observed mean $PM_{2.5}$ levels reported for our study are higher. Lee and co-workers reported $PM_{2.5}$ concentrations in 11 restaurants, 7 cafés and 4 entertainment centres. They reported an average $PM_{2.5}$ concentration of 46 $\mu g/m^3$ while the minimum and maximum concentration was 7-164 $\mu g/m^3$ for these 22 public venues. The indoor mean for the present study was 12-60.5 $\mu g/m^3$ for premises without active smokers while for premises with active smokers, the indoor mean was 44.5-361.5 $\mu g/m^3$.

Comparisons were made with data published in European countries. $PM_{2.5}$ concentrations were measured in 40 hospitality venues in Barcelona two years after the implementation of Spanish SFL and the authors found the levels of indoor $PM_{2.5}$ in places where smoking was permitted was (182 ug/m^3) 5-fold higher compared to venues where active smoking was restricted (Villarroel et al., 2011). The average concentrations measured in the Spanish study are slightly lower than those reported for smoking venues in this present study. A follow-up study on Scottish Bars at 5-year post SFL saw a reduction of $PM_{2.5}$ levels from 20 $\mu g/m^3$ to approximately by half (12 $\mu g/m^3$) from the period immediately after the ban in 2006 to 2011 (Apsley and Semple, 2012). Concentrations of $PM_{2.5}$ in over 90% of bars in Scotland were less than the WHO exposure limit of 25 $\mu g/m^3$ demonstrating the effectiveness of comprehensive SFL.

A recent publication presented data on SHS concentrations in the Pacific Basin inclusive of American Samoa, Commonwealth of the Northern Mariana Islands, and Guam (King et al., 2011). The study included 19 smoke-permitted and 18 smoke-free bars and restaurants. The arithmetic mean SHS levels in venues where smoking was permitted was 300 $\mu g/m^3$.

Nafees and co-workers also reported $PM_{2.5}$ distribution in 20 enclosed public places in Pakistan including restaurants and cafés and entertainment centres however no pubs or discos were included in the study (Nafees et al., 2012). Comparatively, the study observed a higher mean indoor $PM_{2.5}$ level from the entertainment centres (265 $\mu g/m^3$) compared to the present study. Additionally, the present study reported the an indoor:outdoor $PM_{2.5}$ ratio of 3.94:1 for entertainment centres while the study in Pakistan reported a much higher ratio of 10.2:1. Another study in three major cities in Pakistan reported indoor $PM_{2.5}$ concentrations of 689 $\mu g/m^3$ in venues where cigarette smoking was observed (Zaidi et al., 2011). However, the baseline level of PM, presumably from outdoor air pollution, where no smoking was observed was approximately 3-fold higher than the present study (101 $\mu g/m^3$). A similar study in Sri Lanka also reported the levels of $PM_{2.5}$ in 20 public spaces in Colombo where smoking was permitted (Nandasena et al., 2012).The average $PM_{2.5}$ concentrations range observed in the Sri Lankan study were between 33 to 299 $\mu g/m^3$ broadly similar to the present study (36.5-362 $\mu g/m^3$).

Out of the 61 premises measured in this study, almost 45.6% of the venues had smoking behaviour observed and 28.6% of the premises that should have been smoke-free were not. Violation of smoking restriction was not observed in any of the franchised or non-franchised air-conditioned restaurants in the study but all of the entertainment centre venues and a number of the internet cafés. Although the levels of $PM_{2.5}$ in venues where active smoking was observed are among the highest described in the literature for Asia, no smoking restrictions were violated for many of the premises as Regulation 11 in Control of Tobacco Product Regulations 2004 exempts pubs, discothèque, nightclub or casino and open air restaurants from smoke-free restrictions.

According to the article 8 in the FCTC, providing 100% smoke-free indoor workplaces and public places are necessary in order to provide effective or universal protection against SHS exposure. This study demonstrates that patrons and workers in air-conditioned venues where smoking was observed are exposed to high concentrations of indoor air pollution from SHS. As observed from the monitoring, the entertainment centre venues also include premises catering for families with children and when compared to premises where SFL was not violated, entertainment centres had an average $PM_{2.5}$ level some 4.8-fold higher. Thus, the violation of SFL in entertainment centres catering for families should be given priority in terms of enforcement of existing legislation. For internet cafés, compliance with SFL is encouraging but there is clearly a degree of non-compliance and more effort should be given to educating owners, workers and patrons within internet cafés particularly as many of those exposed in these venues are children and young adults.

The evidence shown in this study demonstrates the need for more comprehensive SFL to be implemented to reduce SHS exposure of workers and patrons in Malaysian bars, pubs and clubs. In addition, there is a clear need for measures to improve compliance in terms of the existing regulations and this can be achieved by a dual approach of education and enforcement. Using examples of other countries experiences, successful implementation of SFL in hospitality venues is achievable. Data from Scotland and England indicate that reductions of $PM_{2.5}$ concentrations of the order of 80-90% can be made by introducing comprehensive SFL that includes all hospitality sectors venues (Semple et al., 2007; Gotz et al., 2008). Experience from other countries has also shown that comprehensive SFL that includes bars and pubs becomes well accepted by both workers and clients and that economic impacts tend to be minimal (Pyles and Hahn, 2011; McCalman et al., 2012).

This study has a number of limitations. SHS exposure was measured using a real-time aerosol monitor for $PM_{2.5}$. Indoor PM is not specific to SHS, but can also arise from cooking, aerosol sprays, dusting, human activities, dust re-suspension and combustion-related activity. In order to reduce the influence of other types of PM sources, the location where the monitoring bag was placed in each

venue was as far as possible from any cooking areas (if present), doors or ventilation system and were at least 1 meter from the ground. Furthermore, the outdoor background concentration of PM for each monitoring session was measured for at least 30 minutes. This was carried out to determine the indoor:outdoor ratio and remove the contribution from outdoor-generated PM such as traffic pollution.

Air exchange rates and smoking density values were not calculated for this study. In order to obtain the data for the calculation of these two parameters permission from the venue owner would need to be formally obtained and this may have had an impact on patron/owner behaviour in terms of engaging in/permitting smoking or use of ventilation.

This study also attempted to select venues that were representative of the wider population of similar venues. Selection was done randomly from venues identified in business directories or websites but it is possible that those businesses are likely to be larger and more profitable with smaller, newer businesses not included in such listings. This may have introduced some bias to our sampling protocol.

The strength of this study included the fact that measurements were performed for more than 60 premises with good representation of different types of venues available specifically in Malaysia. The study also included a sample of open-air restaurants a very common type of venue and part of the cultural identity of the Malaysian population. Also, this study employed the use of covert monitoring, where monitoring was performed discreetly in order not to affect the behaviour of customers who served as a patron at the premises and to ensure that the monitoring performed reflects the normal behaviour which would be expected at the premise. Details of the benefits of covert observation for this type of research study are discussed elsewhere (Petticrew et al., 2007).

In summary, this study provides evidence of continuing high exposures of workers and patrons to SHS within a substantial proportion of hospitality venues in Kuala Lumpur. High SHS concentrations and evidence of smoking behaviour were observed in most hospitality venues exempt from Malaysian SFL and also in a number of venues where smoking is currently prohibited. To protect worker and patron health improved strategies to increase compliance are required. Extension of existing regulations to cover all hospitality venues and thus de-normalise smoking within all enclosed public spaces should also be considered.

Acknowledgements

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