Original Research Article

Understanding Second-hand Smoke (SHS) Exposure among University Students in Selangor and Perak, Malaysia: Role of Parents and Peers

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ABSTRACT

Second-hand smoke (SHS) exposure remains a significant public health concern worldwide, posing various adverse effects on individual health during both short- and long-term exposures. University students in Malaysia are particularly at risk due to the potential influence of parents and peers on their SHS exposure. However, there is a lack of comprehensive research exploring the extent of this influence and its implications for effective intervention strategies. This cross-sectional study administered an online questionnaire to 387 students from two universities in Selangor and Perak. Prevalence rates of SHS exposure were determined, and factors associated with exposure were identified through descriptive and multivariable logistic regression analysis. Almost half (49.9%) of the participants had been exposed to SHS. Female students had a reduced risk of exposure by more than half compared to male students (p = 0.050). Meanwhile, those who had a smoking parent and smoking friends had approximately four times (p = 0.000) and two times (p = 0.002) the increased likelihood of being exposed to SHS, respectively, then those who did not. Participants with higher household income (p = 0.000) and higher mothers' educational attainment (p = 0.028) had a significantly lower risk of SHS exposure. In conclusion, gender, parental smoking, peer smoking, and socioeconomic status were identified as factors associated with SHS exposure. Parental and peer awareness and understanding of SHS risk must be enhanced to minimise its exposure among their children and friends. Hence, health policymakers should address strategies such as ongoing public awareness campaigns, the extension of a smoking ban on advertising, promotion, and marketing of tobacco products, and rules for smoking prohibition at home to drive Malaysia's effort towards a smoke-free generation.

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1.0 Introduction

Second-hand smoke (SHS) is defined as the involuntary inhalation of tobacco smoke by non-smokers near smokers. SHS is harmful to individual health in both short- and long-term exposure. Associated with increased mortality risk from cardiovascular, respiratory, and cancer diseases, SHS exposure contributes to 1.2 million deaths worldwide annually. A national survey in 2019 highlighted high SHS exposure prevalence at 48.1%, and 1 in 2 Malaysians was reported to be exposed to SHS at eateries without air conditioning (1). Parental and peer smoking, poor knowledge, and residing in multi-unit housing were among the factors related to higher SHS exposure (2, 3, 4). In 2003, Malaysia introduced a 100% smoke-free policy in universities, aiming to reduce the smoking prevalence and SHS exposure among university students. Considering the COVID-19 lockdown situation, where most students are confined at home, SHS exposure for those with smoking family members is expected to be higher in this period (3). Several previous studies have reported various factors that are associated with SHS exposure. A study by Veeranki et al. reported that parental smoking or having household members who are smokers was the primary factor for increased SHS exposure (4). The study also highlighted that the risk of exposure to SHS is doubled for adolescents who have both smoking parents and peers compared to those who do not have both smoking parents and peers. Moreover, an African study on the exposure of never-smoking teenagers to secondhand smoke also discovered that adolescents with smoking parents had a significantly increased risk of exposure. Among adolescents who reported their parents smoking, 53%, 56%, and 69% were exposed to SHS inside the home, outside the home, and overall, respectively (5). In addition, peer smoking has been reported to increase the risk of SHS exposure among nonsmoking adolescents (5). Furthermore, the type of residency is thought to influence SHS exposure. Multi-unit housing (MUH) residents, such as flats or apartments, are vulnerable to SHS exposure because SHS can be spread across units (3, 6).

In view of the COVID-19 pandemic, with most university activities suspended during the study's conduct, a comprehensive evaluation of these environmental factors becomes of utmost importance. Despite the significance of understanding the influence of parental and peer smoking on SHS exposure, comprehensive data on this subject remains limited, particularly among university students in Malaysia. Thus, the primary aim of this study is to examine the association of socio-demographic and environmental factors, with a specific emphasis on parental and peer smoking, on second-hand smoke (SHS) exposure among university students in Malaysia. Evaluation of key factors contributing to elevated SHS exposure in this specific population contributes valuable insights to the development of evidence-based strategies aimed at reducing SHS exposure and promoting a healthier environment for university students in Malaysia.

2.0 Materials and methods

2.1 Design and participants

A cross-sectional study was conducted between April and May 2021 among 387 students from Universiti Teknologi Mara (UITM) Puncak Alam campus and Universiti Kuala Lumpur (UniKL). Upon the site researcher's agreement to participate, students from the two universities were recruited via convenience sampling. An invitation email with an attached link to the consent and survey forms was sent to the students through the respective site researchers. In addition, invitation messages were also distributed through social media sites such as WhatsApp, Facebook, and Twitter. Those who consented were assessed for eligibility. Eligible participants were students with active

university registration status who are either non-smokers or ex-smokers (at least six months' abstinence period), while those who were current smokers (cigarettes and e-cigarettes) and had an incomplete response were excluded from the study. Based on the following formula, the sample size with an estimated prevalence of SHS exposure at 0.357% (7) can be calculated as follows:

Sample size (n) = [Z^2P (1-P)] / d^2
Sample size (n) = [$(1.96)^2$(0.357) (1-0.357)] / $(0.05)^2$ = 352

Z value is set at 1.96 (CI 95%) and the precision (d) is 0.05. The recommended sample size is 352, which represents the minimum number of population parameters and the minimum number of necessary samples to meet the desired statistical constraints. This study has obtained ethical approval from the UiTM Research Ethics Committee (REC/03/2021-UG/MR/230).

2.2 Study tool

Data were collected using a validated online questionnaire adapted from previous studies by Kim et al., and Phetphum et al., (2, 8). Following the validation process, the questionnaires were transformed into an online survey form using the Google Form application, and a pilot study among 20 university students was conducted to evaluate the feasibility of the questionnaire and the selected online survey platform. Findings and feedback from the pilot study were utilised to improve the content and distribution of the questionnaire. The questionnaire consisted of three sections. Section one contained the participant's demographic, health, and family information. The second and third sections contained questions to assess the prevalence of SHS exposure among students at their respective locations. The respondents were asked about their exposure to SHS in the past 30 days and their frequency of SHS exposure in the last seven days.

2.3 Statistical analysis

IBM SPSS version 26 software was used in the data analysis. Chi-square was used to determine the association between participants' variables and SHS exposure. All the variables that were significant at $p < 0.05$ level in the chi-square tests were tested in multivariate regression analysis.

3.0 Results

3.1 Characteristics of Participants

Majority of the participants in this study consisted of female students (81.1%) and male students (18.9%), with a mean age of 22 years old. Most of the participants were Malay (97.9), currently pursuing degree study (95.9%), and enrolled in courses related to Science and Technology (83.2%). Over half of the participants (52.7%) lived in urban areas, and most resided in landed houses (88.4%).

Table 1 highlighted the participants' environmental characteristics, including their parents' education, monthly household income, status as parents, family members, and peer smoking. More than half of the participants' parents had tertiary education certification (defined as college, university, or higher). In terms of financial background, the majority of the participants were from the B40 family (47.2%) with a monthly household income of not more than RM 4849 (9). Less than one-third of participants in this study reported parental smoking (31.9%), while more than half reported having family members who are smokers (51.75%). Approximately 35.4% of the participants reported having friends who are smokers. Table 2 showed the SHS exposure characteristics of the participants. Nearly half (49.9%) of participants had been exposed to SHS within the previous 30 days. In the last

seven days, 19.2% claimed to have had no exposure, 46.6% claimed to have been exposed 1-2 days per week, 14.5% claimed to have been exposed 3-4 days per week, 4.7% claimed to have been exposed 5-6 days, and 15% claimed to have been exposed for seven days straight.

The primary area of exposure was at home (57%), followed by public areas (40.4%) such as bus stations, restaurants, and recreational parks, and on campus (2.6%). The majority (73.9%) of students had been exposed to anti-SHS information in the past 30 days.

Table 1: Demographic and environmental data

Variable	n = 387	%
Father's education		
Primary school and below	19	5.0
Secondary school	156	41.2
College/University and above	204	53.8
Mother's education		
Primary school and below	22	5.8
Secondary school	164	43.4
College/University and above	193	50.9
Monthly household income		
≤ RM 4849 (B40)	179	47.2
RM 4850- RM 10, 959 (M40)	140	36.9
≥ RM 10, 960 (T20)	60	15.9
Parental/guardian smoke		
Yes	123	31.8
No	264	68.2
Family member smokes		
Yes	196	51.7
No	183	48.3
Friend smokes		
Yes	137	35.4
No	250	64.6

Table 2: Second-hand Smoke (SHS) Exposure

Variable		%
Exposure to SHS	n=387	
Yes	193	49.9
No	194	50.1
Frequency of SHS exposure during last seven days	n=193	
0 day	37	19.2
1-2 day (s)	90	46.6
3-4 days	28	14.5
5-6 days	9	4.7
7 days	29	15.0
Exposure to SHS based on location	n=193	
At home	110	57.0
In public area	78	40.4
In campus	5	2.6

Exposure to anti-SHS information	n=387	
Yes	286	73.9
No	101	26.1

3.2 Factors Associated with SHS Exposure

Overall, the prevalence of SHS exposure was 49.9%. Table 3 shows the univariate analysis of SHS exposure by socio-demographic and environmental characteristics. SHS exposure was significantly more prevalent among students of the age group between 19 and 24 years old, male, taking business and management-related courses, residing in an urban area, and living in apartment-type housing. Further analysis revealed a significant association between gender and SHS exposure, with male students having a higher prevalence of SHS exposure (60.3%) than female students (47.5%) (p = 0.048). A higher percentage of exposure was reported among participants with parents who had certification of secondary education or below (p = 0.001 for the father, p = 0.000 for the mother). Besides, the prevalence of SHS exposure was also significantly higher among those who had smoking parents (73.6%), smoking family members (59.7%), and smoking friends (60.6%) (p = 0.000 for parental smoking, p = 0.000 for smoking family members, and p = 0.002 for smoking friends, respectively). In addition, respondents from the B40 family reported more exposure to SHS, which was about more than half (57.0%) of them were exposed to SHS compared to those from the T20 family (p = 0.001). The results of a multivariate logistic regression analysis of the factors related to SHS exposure are shown in Table 4. Based on our analysis, female students had a reduced risk of exposure to SHS by more than half compared to their male counterparts (p = 0.050). Meanwhile, those who had a smoking parent had approximately four times the chance of being exposed to SHS than those who did not (p = 0.000). A similar finding is observed in peer smoking. Students who had a smoking friend had almost two times the risk of being exposed to SHS than those who did not (p = 0.002). Additionally, several socioeconomic variables were shown to be significant predictors of SHS exposure among participants in this study. Participants from the T20 family had a significantly lower risk of SHS exposure than respondents from the B40 family (p = 0.000). Higher educational attainment among the mothers has also shown a lower risk of SHS exposure. However, exposure to anti-SHS information was inversely correlated to SHS exposure, where individuals who reported being exposed to anti-SHS information had a nearly two-fold greater risk of SHS exposure than those who did not (p = 0.004).

Table 3: SHS exposure by socio-demographic and environmental characteristics

Variable		Exposed		Non-Exposed		P value[a]
	n= 387	n	%	n	%	
Age						
19-21	146	73	50.0	73	50.0	0.972
22-24	222	111	50.0	111	50.0	
25 and above	17	8	47.1	9	52.9	

Gender						
Female	304	149	47.5	165	52.5	**0.048**
Male	73	44	60.3	29	39.7	
Ethnicity						
Malay	379	187	49.3	192	50.7	0.151
Others	8	6	75.0	2	25.0	
Faculty of study						
Science & Technology	322	158	49.1	164	50.9	0.355
Social Science & Humanity	25	11	44.0	14	56.0	
Business & Management	40	24	60.0	16	40.0	
Type of residency						
Landed house	290	146	50.3	144	49.7	0.398
Flat/Apartment	30	19	63.3	11	36.7	
Condominium/Serviced apartment	8	4	50.0	4	50.0	
Place of residency						
Urban	173	97	56.1	76	43.9	0.082
Rural	155	72	46.5	83	53.5	
Father's education						
Primary school and below	19	12	63.2	7	36.8	**0.001**
Secondary school	156	93	59.6	63	40.4	
College/University and above	204	82	40.2	122	59.8	
Mother's education						
Primary school and below	22	15	68.2	7	31.8	**0.000**
Secondary school	164	97	59.1	67	40.9	
College/University and above	193	75	38.9	118	61.1	
Monthly household income (parents)						
≤ RM 4849 (B40)	179	102	57.0	77	43.0	**0.001**
RM 4850- RM 10, 959 (M40)	140	68	48.6	72	51.4	
≥ RM 10, 960 (T20)	60	17	28.3	43	71.7	
Parental smoke						
Yes	121	89	73.6	32	26.4	**0.000**
No	258	98	38.0	160	62.0	
Family member smokes						
Yes	196	117	59.7	79	40.3	**0.000**
No	183	70	38.3	113	61.7	
Friend smokes						
Yes	137	83	60.6	54	39.4	**0.002**
No	250	110	44.0	140	56.0	

Table 4: Multivariate analysis of factors associated with SHS exposure.

Variable	Exposed		Non-Exposed		p-value [a]
	Adjusted OR (95% Cl) [a]				
Gender					
Female	0.60	(0.35-1.00)	1.68	(1.0-2.82)	**0.050**
Male	1.00		1.00		
Parental smoke					
Yes	3.93	(2.30-6.72)	0.25	(0.15-0.44)	**0.000**
No	1.00		1.00		
Father's education					
Primary school and below	1.00		1.00		0.260
Secondary school	1.54	(0.92-2.59)	0.65	(0.39-1.09)	0.101
College/University and above	1.43	(0.47-4.39)	0.67	(0.23-2.14)	0.531
Mother's education					
Primary school and below	1.00		1.00		0.093
Secondary school	0.56	(0.34-0.94)	1.78	(1.07-2.99)	
College/University and above	0.40	(0.13-1.17)	2.53	(0.86-7.48)	
Family member smokes					
Yes	1.31	(0.81-2.13)	0.76	(0.50-1.23)	0.264
No	1.00		1.00		
Household Income					
$\leq$ RM 4849 (B40)	1.00		1.00		0.136
RM 4850- RM 10, 959 (M40)	0.71	(0.46-1.11)	1.40	(0.90-2.19)	
$\geq$ RM 10, 960 (T20)	0.30	(0.16-0.56)	3.35	(1.78-6.32)	
Friend smoke					
Yes	1.97	(1.29-3.03)	0.51	(0.33-0.78)	**0.002**
No	1.00		1.00		

SHS = secondhand smoke, CI = confidence interval, OR = odds ratio, $p < 0.05$

4.0 Discussion

This study aimed to determine the sociodemographic and environmental factors that influence secondhand smoke exposure among university students in Malaysia. According to the current findings from our study, nearly half of the students were exposed to SHS. The proportion of students exposed to SHS in public was particularly higher than that of those exposed at home and on campus, respectively. Demographic factors such as gender and environmental factors such as level of parent's education, household income, parental smoking, and peer smoking showed significant associations with SHS exposure. The exposure to SHS was significantly more prevalent in male students, those with lower mothers' educational attainment, those with smoking family members and peers, and those whose household income was $\leq$ RM 4849 (B40). In terms of the level of exposure stratified by sex, male students in our study were more likely to be exposed to SHS than female students. This is consistent with findings from a previous local study on the prevalence

of SHS exposure among adolescents. (7). The higher SHS exposure among males is probably due to their social relationships with other male friends, many of whom are smokers, which increases their risks of being exposed to SHS (10). In addition, the higher SHS exposure among this group may be associated with their lower level of SHS avoidance compared to the female students. According to a study conducted in India, individuals with good, positive avoidance behaviour and self-efficacy of avoidance of SHS were less exposed to SHS (11). While this finding contradicts study by Aguku et al., a US study that indicated a higher risk of SHS exposure among adolescent females (12), several research, on the other hand, revealed that SHS exposure does not differ significantly by gender (5, 13).

Parental and peer smoking behaviour were among the primary predictors of SHS exposure among never-smokers. This finding is consistent with findings reported in previous studies (4, 14, 15, 16). In terms of parental smoking, our study found that individuals who had a smoking parent had a nearly fourfold increased risk of SHS exposure compared to those who did not (p = 0.000). According to previous studies, young people with smoking parents had a significantly higher risk of SHS exposure at home. This is because when one parent or both of their parents smoke, especially at home, the other household members are unlikely to stop them, even if they disagree, in order to prevent argument, particularly when the smoker is the head of a family, elderly, or male. Their activities are also unlikely to be questioned, as elderly men, especially in Asian cultures, have a higher social status in the household (17). Consequently, exposure to SHS due to parental smoking is unavoidable in a personal home setting. The expansion of prohibited smoking zones in Malaysia under the updated Tobacco Product Regulation 2004 control has also increased the tendency of parental smoking at home (18, 19). Frequent exposure to SHS, as described above, can have adverse effects on individuals exposed to it. According to King et al., SHS exposure has been associated with an elevated risk of heart disease and lung cancer in non-smokers. In addition, metabolites of tobacco-specific lung carcinogens associated with SHS have been detected in non-smokers with a smoking household member (6). Apart from the health risks, students were more prone to smoking initiation as a result of frequent exposure to SHS smoke at home (20). It was strongly predicted that each day of increased SHS exposure at home would result in a 16% higher likelihood of smoking initiation (6).

Besides, our study found that individuals with smoking friends had nearly double the likelihood of SHS exposure compared to those without smoking friends. These results align with previous research, indicating that peer smoking, similar to parental smoking, significantly increases the probability of SHS exposure in the majority of countries (4, 5). Based on data from Youth Tobacco Surveys conducted in 168 countries, adolescents who had both smoking parents and peers had a double risk of getting exposed to SHS compared to those who did not have both smoking parents and peers (4). Besides, adolescents who reported both family and peer smoking had considerably greater salivary cotinine levels than adolescents who had not been exposed to SHS (21). Studies have consistently reported that adolescents can be easily influenced by their friends' risky behaviour (4, 18). Aside from the increased SHS exposure, research has shown that peer smoking increases the susceptibility to smoking among non-smoking peers in the same way that smoking parents do. A study to investigate the impact of parents and peers smoking on the tobacco consumption behaviour of university students discovered that smoking behaviour among male students was influenced by their smoking peers, which explains why male students had a greater prevalence of smoking behaviour. They assumed that smoking was a

cool and manly practice that all males must engage in (18). These previous findings reinforce such evidence on the negative consequences of peer smoking behaviour. Hence, the results of the present study suggest that the evident detrimental consequences of SHS underscore the necessity for policymakers in Malaysia to adopt a preventive strategy, notably by advocating smoking prohibition rules within households and other personal spaces.

Despite the high prevalence of SHS exposure in multi-unit buildings, our study did not find a significant association between type of residency and SHS exposure among non-smoking students. SHS is a frequent indoor contaminant in multi-unit housing (MUH). It is also a precursor to third-hand smoke (THS), a harmful mixture of tobacco smoke residue that accumulates in indoor spaces where tobacco has been consumed. People are exposed to these compounds through contact with contaminated surfaces or inhaling off-gassing from these surfaces (22). Non-smokers who reside in multi-unit housing (MUH) do not have the same level of control over exposure to SHS as those who live in single-unit housing since they may share the same air space as those who smoke in adjacent units. Individuals living near one another in MUH are particularly exposed to poor air quality caused by SHS intrusions from units where smoking is permitted. SHS can enter multi-unit houses through a variety of channels, including vents and fractures in the walls or floor (23). A study in Denmark found that the type of house participants lived in influenced their level of SHS exposure. A large fraction of the Danish population living in multi-unit dwellings is exposed to SHS, which mainly comes from neighbouring smoke (24). Another study in the US found that among the non-cigarette-smoking residents who lived where no one had smoked cigarettes in the home for the past 3 months, a quarter of them reported a recent tobacco-smoke incursion (25). Almost all the participants in this study expressed their desire to reside in a tobacco-free building. Exposure to second hand smoke cannot be eliminated by cleaning the air or ventilating buildings. Eliminating indoor smoking is the only way to protect people from exposure to neighbouring smoke and SHS in general (24, 26).

There are some limitations to this study. Firstly, data on SHS exposure were self-reported and vulnerable to recall bias as no biomarkers were used to determine exposure; as a result, individuals' exposure may have been underestimated. Secondly, it is important to acknowledge that the generalisation of our study findings should consider the limitations of our sample, which included participants from only two specific states in Malaysia. To obtain a more comprehensive understanding of SHS exposure among university students nationwide, future research should encompass a more diverse and representative sample from various universities across Malaysia.

5.0 Conclusion

In conclusion, our study conducted in both Selangor and Perak revealed a high prevalence of secondhand smoke (SHS) exposure among Malaysian university students, with nearly half having been exposed to SHS in the previous 30 days. Gender, parental smoking, peer smoking, and socioeconomic status were identified as predictors for SHS exposure. With no known safe level of exposure, it is vital to ensure public health protection against SHS health risks. Thus, determining factors that influence SHS exposure will assist health professionals, researchers, and policymakers in developing and implementing effective initiatives to enhance parental and peer awareness and understanding of SHS risk in order to minimise its exposure among their children and friends.

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Conflict of Interest

The authors declared that they have no conflicts of interest to disclose.

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