

ORIGINAL ARTICLE

Displace of Smoking Into the Home and Second-hand Smoke Exposure at Home Among Malaysian Adults -findings From Two National Population-based Studies in Malaysia

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ABSTRACT

Introduction: Expansion of smoke-free areas in public domains is suspected to displace smoking into the home. However, the scarcity of such information in Malaysia warrants an investigation to determine SHS exposure at home among adults in Malaysia. **Methods:** This study studied 4,250 and 21,445 adults who participated in the 2011 Global Adult Tobacco Survey-Malaysia (GATS-M) and, the National Health and Morbidity Survey (NHMS) 2015, respectively. Multivariable logistic regression modelling was used to compare the odds of SHS exposure at home among adults in 2011 (GATS-M) to odds of SHS exposure at home among adults in 2015 (NHMS 2015). **Results:** Approximately one third of respondents were exposed to SHS at home in 2011 (38.4%) and 2015 (37.9%). MLR analysis revealed the odds of SHS exposure at home was not significantly different from 2011 [AOR 1.14, 95 % CI (0.99-1.31). 2015 exposure to SHS as reference]. This study also indicates no significant displacement of smoking into the home by socio-demographic and smoking status between 2011 and 2015. **Conclusion:** The findings suggest that smoking has not been displaced into the home in the past four years although the number of smoke-free public areas have increased. More public smoke free areas should be established.

Keywords: Second-hand-smoke, Home exposure, Displacement of smoking, Global Adult Tobacco Survey-Malaysia (GATS-M), National Health and Morbidity survey (NHMS).

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INTRODUCTION

Epidemiological studies have shown that second-hand smoke (SHS) exposure increase the risks of morbidity and mortality. Risk of respiratory diseases, cardiovascular and lung cancer increases with intensity of SHS exposure (1-2). One percent (1%) of the global burden of diseases and, annually 603,000 deaths worldwide are due to SHS exposure(3). Malaysia as a signatory to the Framework Convention on Tobacco Control (FCTC) has introduced and implemented a smoke-free policy in public areas since 1993, through the Control of Tobacco Products Regulation. Initially, the regulation prohibited smoking in health care facilities, public lifts, public halls, public vehicles, public transport terminals, childcare nurseries and schools. It was expanded include to more public areas through amendments to the regulation in 1997, 2004, 2008, 2009, 2011, 2012, 2014, 2015, 2017(4). Currently, there are a total of 38 selected building and areas that have been declared as smoke free areas (4).

The smoke free regulation is enforced by the frequent deployment of enforcement officers to those smoke free areas.

Studies conducted locally and abroad have shown that smoke free initiatives in public areas significantly reduces SHS (4,5). A previous study in Malaysia reported that the ratio of SHS exposure in smoke free versus non-smoke free areas was 1:4(4). However, residential homes have not been included as smoke-free areas, as they are private property. Therefore, the Ministry of Health, Malaysia have included smoke-free home campaign in the community intervention programmes such as "Komuniti Sihat, Perkasa Negara" (KOSPEN) (Healthy community, developed the nation), in which the health volunteers and District health department carried out the health promotion programmes on the benefit of smoke free-home, health hazard of second-hand-smoke and encourage smokers to quip smoking. Those who made their home as smoke-free areas will be awarded the token of appreciation (6). However, the KOSPEN programme was implemented in the selective areas only, and the prohibition of smoking in public areas might displace smoking into the home, in view of the limited public areas where smoking is allowed.

However, findings on the impact of expansion of smoke free areas on displacement of smoking into the home (measured by SHS exposure at home) have been mixed. Some studies found positive evidence of displacement of smoking into the home due to restrictions on smoking in public areas (7-10). However, several other studies found that the policy reduced SHS exposure at home due to adoption of voluntary restrictions on smoking in the home indicating there is no displacement (5,11,12). Studies and systematic reviews have also found that no changes in SHS exposure at home post legislation (13-15). In addition, the impact of smoke-free initiatives varied by sociodemographic background, whereby smoke-free initiatives policy reduced SHS exposure at home among those with higher education attainment and income level, however, little effect was seen among those from lower social economic groups (16).

Information on the impact of smoke-free initiatives on displacement of smoking in Malaysia is scarce, as no studies on SHS exposure was carried out before 2010. However, from 2011, effect of SHS of home was investigated in the Global Adult Tobacco Survey (GATS-M) 2011(17) and the National Health and Morbidity Survey (NHMS) 2015 (18). Both surveys used similar items, definition of SHS exposure and target populations, which provided an opportunity to address information gaps in SHS in Malaysia. This study aims to determine the SHS exposure at home between 2011 and 2015 among Malaysian adults as a proxy of measurement for displacement of smoking into the home, and to assess displacement by socio-demographic and smoking status. An increase in prevalence of SHS exposure at home after implementation of smoke-free initiatives in public places would indicate displacement of smoking from public places to the home.

MATERIALS AND METHODS

Data source and sample

This paper analysed data from the Global Adult Tobacco Survey-Malaysia (GATS-M 2011) and the National Health and Morbidity Survey (NHMS) 2015. Both surveys were national-wide population-based studies that employed cross-sectional designs. To select a nationally representative sample of non-institutional residents in Malaysia aged 15 years and above, respondents were selected via multistage cluster stratified systemic sampling scheme with probability proportional-to-size approach. Data were obtained via a pre-validated questionnaire adapted from GATS, and through face-to-face interviews by trained research assistants. All selected participants given the written informed consent prior to the interview. Ethical approval for both surveys were approved by Medical Research Ethics Committee (MREC), Ministry of Health, Malaysia. Detailed explanations of the two surveys can be obtained from Lim et al (4) and the GATS-M reports (17).

SHS exposure at home

The dependent variable (exposure to SHS at home) was measured by an item: "How often does someone smoke in your house: with the response options of "Every day", "Every week", "Every month", "Less than 1 month" and "Never". Those who responded, "Every day", "Every week" or "Every month" were classified as exposed to SHS at home", and those who responded, "Less than 1 month" and "Never", as "Not exposed". Respondents who answered 'Unknown' or 'refused to answer', were excluded from the analysis.

The primary independent variable was exposure to SHS at home in 2011 and 2015. Socio economic variables included were gender, residential area, ethnicity, education attainment, age group, quintile of income (Quintile 1 (lowest) to Quintile 5 (highest)), marital status, type of occupation, and current smoking status.

Statistical analysis

Data from both GATS-M and NHMS 2015 were cleaned and sample weights were generated based on data from the 2010 National population census sample to reflect the general population. Descriptive analysis was used to describe the characteristic of the respondents. Separate multivariate logistic regressions were performed to assess predictors of change in SHS exposure in the home. All independent variables were entered in the models. Two-way interaction between the years of survey and all other independent variables were examined to determine effect modification. *P* value more than 0.05 indicated that there is no significant two way interaction. All regression results are presented with their corresponding 95% confidence intervals.

RESULTS

Sample characteristics

Table 1 showed that the study sample of GATS-M, 2011 and 2015 NHMS comprised similar proportions of gender (male and female), age groups, income level, marital status, type of occupation and smoking status across survey years ($p > 0.05$). However, some variation was observed between the ethnicity and education attainment between GATS-M 2011 and NHMS 2015. (49.6%, 95 CI, 48.7-50.5 in 2011 and 58.9%, 95 CI 56.8-60.9 in 2015) and lower education attainment (No formal education 10.1, 95 CI (9.1-11.2) to 6.7, 95 CI 6.3-7.2 and primary school education 30.8% (95 CI 30.9-32.7) to 23.2% (95 CI 22.9-25.9).

The result showed no reduction in SHS at home across all socio-demographic backgrounds and smoking status between 2011 and 2015. Prevalence of SHS exposure at home declined by only 1.3% , from 38.4 in 2011 to 37.1% in 2015. Prevalence of SHS exposure at home across all social-demographic variables and smoking status were similar for the similar period. Non-smokers,

Table I: Social-demographic characteristic and smoking status among Malaysian adults

Variable	2011				2015			
	N	n	%	95 CI	N	n	%	95 CI
Gender								
Male	10515362	2086	51.2	49.2-53.3	11305164	10220	51.6	50.7-52.5
Female	10014858	2164	48.8	76.7-50.8	10610444	11225	48.4	47.5-49.3
Residential								
Urban	14807892	2085	72.1	70.6-73.6	16609048	12369	75.8	75.1-76.4
Rural	5722329	2185	27.9	26.4-29.4	5306360	9076	24.2	23.6-24.9
Ethnicity								
Malay	12083159	2531	58.9	56.8-60.9	10872208	13345	49.6	48.7-50.5
Chinese	3808989	641	18.6	16.9-20.3	5087215	3407	23.2	22.4-24.0
Indian	1923013	263	9.4	8.1-10.8	1480516	1519	6.8	6.8-7.2
Others	3715058	815	13.2	12.1-14.5	4475668	3174	20.4	19.7-21.2
Education level								
No formal education	2061180	651	10.1	9.1-11.2	1090041	1307	6.7	6.3-7.2
Primary school	6286532	1393	31.8	30.9-32.7	3831352	4614	23.7	22.9-29.5
Secondary school	9515856	1779	46.6	44.5-48.6	7177127	7504	44.4	43.4-45.4
Tertiary education	2576026	406	12.6	11.2-14.1	4076999	3604	25.2	24.3-26.1
Age group (years)								
15-24	5689674	742	27.7	25.7-29.8	5493294	4218	25.1	24.3-25.9
25-44	8525991	1768	41.5	39.6-43.5	9355186	7984	42.7	41.8-43.6
45-64	4860331	1326	23.7	22.1-25.3	5395163	6793	24.6	23.9-25.3
65+	1454226	414	7.1	6.2-8.1	1671964	2449	7.6	7.2-8.0
Marital Status								
Married	17003068	2712	58.5	56.5-60.6	13209903	13845	60.3	59.5-61.2
Single	7195864	1042	35.1	33.0-37.2	7278630	5645	33.2	32.4-34.1
Widow/widower/dvorcee	1302670	490	6.4	5.6-7.2	1404922	1941	6.4	6.0-6.8
Occupation								
Government employee	1807870	397	8.8	7.8-9.9	1925402	2195	11.3	10.7-11.9
Private	6576084	1112	32.1	30.1-34.1	8135063	6204	47.8	46.8-48.8
Self employed	3108054	843	15.2	13.8-16.6	3448862	3885	20.3	19.5-21.0
Homemaker	8123079	1707	39.6	37.6-41.6	2909014	3347	17.1	16.4-17.8
Retiree	886675	187	4.3	3.6-5.2	609305	786	3.6	3.3-3.9
Income level								
Quintile 1	2304748	844	11.4	10.3-12.5	2570888	2978	11.2	10.2-12.3
Quintile 2	3120933	829	15.4	14.1-16.8	3731827	4008	17.0	16.4-17.7
Quintile 3	4184595	822	24.6	19.0-22.3	4545777	4661	20.7	20.0-21.5
Quintile 4	4718554	842	23.3	21.5-25.1	4792572	4431	21.9	21.1-22.6
Quintile 5	5946366	846	29.3	27.4-31.4	6274541	5367	28.6	27.8-29.4
Smoking status								
Yes	4746504	989	23.1	21.4-24.9	4991457	4477	22.8	22.1-23.6
No	15783716	3361	76.9	75.1-78.6	16882539	16938	77.2	76.4-77.9

N- Estimated population n- sample

government employee, aged 45 years and above, urban dweller, those with tertiary education attainment and female had lower prevalence of SHS exposure at home was lower among in both surveys (Table II).

Multivariate logistic regression showed that similar likelihood of SHS exposure at home in 2011 and 2015. Table 3 shows, Males, Malays, lower education attainment (no formal schooling and primary school), younger age group (15-24 years) and smokers were

more likely to report SHS exposure at home in 2011 and 2015 (Table III)

DISCUSSION

Using data extracted from the Global Adult Tobacco Survey-Malaysia (GATS-M) and NHMS 2015, the study found no difference in prevalence and likelihood of adult exposure to SHS at home over these 4 years across sociodemographic, and smoking status during

Table II: Exposure to SHS at home among Malaysian adults in 2011 and 2015

Variable	2011				2015			
	N	N	%	95 CI	N	n	%	95 CI
Overall	7639286	1663	38.4	36.4-40.5	8095569	8154	37.1	36.2-37.9
Gender								
Male	4436166	920	43.3	40.4-46.3	4713964	4350	41.9	40.6-43.1
Female	3202119	743	33.3	30.7-36.0	3381604	3814	32.0	30.9-33.1
Residential								
Urban	5105593	706	35.7	33.2-38.4	5520270	4091	33.3	32.3-34.3
Rural	2532692	963	45.4	42.8-48.0	2575298	4073	48.8	47.4-50.3
Ethnicity								
Malay	5116068	1071	43.9	41.2-46.5	4607385	5601	42.3	41.4-43.6
Chinese	837666	142	22.5	18.5-27.2	1052019	723	20.8	19.1-22.5
Indian	433626	55	23.1	17.3-30.2	370178	361	25.1	22.3-28.0
Others	1250924	395	47.8	43.0-52.7	2065985	1477	46.4	44.3-48.6
Education level								
No formal education	845768	271	43.8	38.6-49.2	463940	524	42.7	39.1-46.5
Primary school	2426720	594	39.7	36.2-43.4	1573088	1856	41.2	39.3-43.2
Secondary school	3688898	691	40.0	37.0-43.1	2805827	3046	38.2	37.8-40.7
Tertiary education	652141	100	25.7	20.5-31.7	944981	848	23.2	21.5-25.0
Age group (years)								
15-24	2159187	309	39.3	25.0-31.8	2219245	1802	40.5	38.7-42.4
25-44	3399929	726	41.1	38.2-44.1	3701933	3211	39.7	38.4-41.1
45-64	1649466	496	35.2	31.7-38.8	1738490	2435	32.3	31.0-33.78
65+	429702	132	30.3	24.7-36.6	435899	716	26.2	23.8-28.6
Marital Status								
Married	4453505	1077	38.2	35.8-40.7	4831552	5298	36.7	35.7-37.8
Single	2760542	423	39.9	36.0-43.9	2859027	2320	39.3	37.8-40.9
Widow/widower/dvorcee	413885	160	32.8	27.0-39.2	404808	546	28.9	26.1-31.8
Occupation								
Government employee	508852	107	29.1	23.9-34.9	558678	595	29.1	26.6-31.7
Private	2761317	463	43.4	39.5-47.3	3176659	2521	39.2	37.7-40.7
Self employed	1422114	412	47.0	42.2-51.9	1520066	1787	44.2	42.1-46.2
Homemaker	2800809	537	35.7	32.6-38.9	1073381	1332	37.0	34.9-39.1
Retiree	142535	43	16.5	11.5-23.2	145217	219	24.0	20.5-28.0
Income level								
Quintile 1	1180770	422	15.7	13.7-17.9	811638	939	31.8	29.6-34.1
Quintile 2	1306460	359	43.0	38.5-47.7	1614125	1750	43.4	41.3-45.4
Quintile 3	1750216	333	42.8	38.3-47.4	1805039	1977	39.9	38.1-41.8
Quintile 4	1549653	280	34.0	30.0-38.3	1935933	1801	40.5	38.7-42.4
Quintile 5	1734193	240	30.0	26.1-34.3	1928831	1697	30.8	29.3-32.3
Smoking status								
Yes	3421640	757	72.4	68.3-76.1	3730405	3433	75.0	73.3-76.6
No	4217245	906	27.9	25.8-30.0	4365163	4731	25.9	25.1-26.7

Table III: Multivariate analysis to determine the association factors with SHS exposure at home among Malaysian adults

Variable	2011		2015	
	AOR	95 CI	AOR	95 CI
Survey year				
2011			1.14	0.99-1.31
2015			1	
Gender				
Male	0.49	0.36-0.69	0.52	0.43-0.62
Female	1		1	
Residential				
Urban	1		1	
Rural	0.92	0.70-1.21	1.27	1.13-1.44
Ethnicity				
Malay	2.24	1.48-3.39	2.53	2.12-3.00
Chinese	1			
Indian	0.74	0.38-1.45	0.98	0.73-1.31
Others	2.28	1.32-3.93	2.14	1.73-2.81
Education level				
No formal education	2.08	1.02-4.21	2.62	1.96-3.50
Primary school	1.88	1.05-3.40	1.86	1.78-2.34
Secondary school	1.37	0.82-2.27	1.60	1.35-1.91
Tertiary education	1		1	
Age group (years)				
15-24	4.32	1.99-9.39	1.96	1.41-2.71
25-44	2.50	1.31-4.76	1.62	1.21-2.18
45-64	1.61	0.92-2.82	1.26	0.96-1.67
65+	1		1	
Marital Status				
Married	1		1	
Single	0.48	0.31-0.74	1.14	0.99-1.31
Widow/widower/ divorcee	0.61	0.36-1.03	0.93	0.74-1.17
Occupation				
Government employee	1.81	0.68-4.81	1.67	1.37-2.03
Private	3.56	1.44-8.79	1.74	1.40-2.16
Self employed	3.04	1.21-7.61	1.92	1.52-2.42
Homemaker	4.27	1.76-10.36	0.88	0.62-1.24
Retiree	1		1	
Income level				
Quintile 1	1.14	0.69-1.87	1.05	0.84-1.32
Quintile 2	1.27	0.79-2.03	1.18	0.94-1.50
Quintile 3	1.18	0.77-1.83	1.22	0.98-1.52
Quintile 4	1.10	0.68-1.50	1.24	1.01-1.53
Quintile 5	1		1	
Smoking status				
Yes	21.76	13.6-34.83	11.33	9.47-13.58
No				

the period of expanding smoke free public areas in Malaysia. This indicates that there is no evidence of displacement of smoking from public places into homes due to the expansion of smoke free areas. This is contrary to findings from Taiwan (16,19), and United States (20), that reported a reduction in SHS exposure at home, due

to the smoke-free restriction at home after smoke free regulation in public areas were expanded. Similarly, Ho et al.(8) and Zheng et al.(10) in Hong Kong and Macao, reported that adults smoked more in the house after the introduction and implementation of smoke-free initiatives in public areas.

The “last refuge model” (21), suggests that smoking prohibition in public places would lead to more smoking in the home thus increasing SHS exposure in the home, while, the social diffusion hypothesis (22), puts forth that regulations on smoking in public areas increases the probability of households imposing voluntary home smoking restrictions. However, both theories were not applicable in this study. The results suggested that the findings may be due to several factors, firstly, the coverage of smoke free areas in public areas may be inadequate, i.e. only 37 areas have been declared smoke-free areas and only working areas with central mechanical ventilation was smoke free.

In addition, non-smoking areas do not cover all public areas frequently visited by the public such as open-air dining areas, which are still not gazetted as smoke free areas until 2018, and smokers are still free to smoke in such areas. Furthermore, over 20% of smokers still smoke in smoke free public areas (4), that indicates rampant violation of the smoke-free regulation, which requires more comprehensive enforcement activities such as the increase deployment of enforcement officers. Currently, the enforcement activities are carried out by environmental health officers or assistant environmental health officers, who have a host of other duties, such as disease prevention activities, inspection of food premises, food quality monitoring through sampling of food sold, monitoring of public and private water quality, and other responsibilities. Therefore they are unable to concentrate on enforcing smoking bans in gazetted public places (23).

Furthermore, the comparison between SHS exposure in home (as a proxy for measuring displacement) is only for a period of 4 years, which may be too short a period to observe a change in social norms and attitude in the Malaysian population toward SHS. This may be due to the slow adoption of changes towards smoking, and exposure to SHS, as have been observed from previous NHMS surveys, which have reported no change in smoking prevalence by locality or sociodemographic status among Malaysians over the last two decades (24) Continuous monitoring by SHS exposure at home is essential to identify any changes that occur to strengthen of anti-smoking policies based on the finding.

Women were more likely to be exposed to home SHS in our study. This may be attributed to the gender difference in smoking (16). The prevalence of smoking in Malaysia is generally higher among men (44.5% among men vs. 1.3% among women, in 2015) (18). This results in reduced risk of home SHS exposure among men as their

female household members are less likely to smoke. And vice versa for women, there is a higher risk of SHS exposure at home as their male household members are more likely to smoke. Thus gender differences in smoking has implications on SHS exposure among women.

Participants with lower education attainment were more likely to expose to SHS at home compared to those with tertiary education level. The odds of SHS exposure in homes was much higher among respondents with lower education levels than among those with tertiary education attainment. Differences in home SHS exposure with education levels did not reduced significantly in 2015. Policy effect on SHS in homes differed from results of studies on smoke-free legislation in Wales 24 where post-legislation reductions in SHS exposure were limited. This finding suggests that more interventions on smoke-free homes should focus on those with lower education, while not neglecting to focus on those with high school and tertiary education, as SHS levels has plateaued in the last 4 years (18).

Malays and others Bumiputra ethnic groups, as well as those who reside in rural areas and respondents below 45 years of age, showed high SHS exposure at home in both surveys. This findings might be explained by the high prevalence of smoking among these ethnic groups, those residing in rural areas, and respondents less than 45 years old. In addition, a negative attitude among non-smokers(25) may be a plausible explanation for the study's findings, However, in-depth qualitative studies are suggested to elucidate the cause of this observation.

Smokers are reported to have higher likelihood to be exposed at home in both studies. The findings are consistent with the results of Jallow et al in the Gambia(26). This may be because smokers are usually more liberal when dealing with smoking issues, and less likely to prohibit others from smoking in the home, as they do not have legitimate authority to advice or convince others not to smoke in the home because they themselves are smokers.

This study provided the information on displacement of smoking into the house since the last 4 years, following the implementation of expanding of Smoke-free initiatives in Malaysia. However, there were limitations. Firstly, the information in this study was based on interview and lacked objective measurement of SHS exposure, such as salivary or serum cotinine levels, which might invoke recall bias and social desirability bias. Second, several independent variables such as families with children, knowledge on health hazard and attitude toward SHS, which is a significant variable associated with SHS exposure at home was not investigate in the current study. Finally, This study could not rule out the effect of other anti-tobacco policies and community intervention programmes. These policies

may influence smoking prevalence and raise awareness on harms of SHS on their health, and data on the smoking behaviours of household members were unavailable, that might influence the outcome of the study. Limitations notwithstanding, this study was based on a large representative national sample from two national surveys, using similar standardised survey questions, target population, study design and sampling methods. The higher response rate enables the generalization of the finding to the Malaysian general population. The face-to-face approach and assurance of anonymity and confidentially increased the trustworthiness of the information obtained.

CONCLUSION

The results show that displacement of smoking at home was not observed. Therefore, the expansion of smoke-free initiatives in public areas should be continued to cover even more public areas, as previous study in Malaysia by Lim et al 2018 (4) showed lower exposure to SHS in gazetted areas. This study also did not observe any changes of SHS exposure at home by sociodemographic at home during the same period. Public health practitioner and policymakers should also be aware of the disparities in SHS exposure at home as reported in our study. Therefore, more creative and innovative interventional programmes targeted the respondents identified in this study not to smoke in the home are strongly recommended, to reduce the SHS exposure at home among Malaysians. In which Yu et al.(2017)(27), reported that distributed the health hazard of smoking and SHS through mobile phone significant increase the smoke-free home, in addition, spousal interaction and support with Intervention programmes should be consider as previous studies showed the it to be effective in helping smokers quit or reduce smoking (28-29). Overall, our study highlights the essential heed for Ministry of Health, to establish more smoke free public areas to protect non-smokers from SHS exposure, and demoralise smoking among Malaysians

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REFERENCES

1. International Agency for Research on Cancer (IARC), World Health Organization. Tobacco smoke and involuntary smoking: summary of data reported and evaluation. Geneva: WHO; 2004
2. US Department of Health and Human Services. The health consequences of involuntary exposure to tobacco smoke: a report of the surgeon general. Atlanta, GA: U.S. Department of health and human services, centers for disease control and prevention.

Coordinating center for health promotion, national center for chronic disease prevention and health promotion, office on smoking and health, 2006:1988–2002.

3. Oberg M, Jaakkola MS, Woodward A, Peruga A, Pruss-Ustun A. Worldwide burden of disease from exposure to second-hand smoke: a retrospective analysis of data from 192 countries. *Lancet* 2011;377:139–46. doi:10.1016/S0140-6736(10)61388-8
4. Lim KH, Teh CH, Nik Mohamed MH, Pan S, Ling MY, M Fadhli MY et al. Exposure to tobacco secondhand smoke and its associated factors among non-smoking adults in smoking-restricted and non-restricted areas: findings from a nationwide study in Malaysia *BMJ Open* 2018;8:e017203. doi: 10.1136/bmjopen-2017-017203
5. Lim KH, M Fadhli Y, Omar M, Rosnah R, M. Nazaruddin B, Sumarni MG et al. Technical Report. Evaluation of effectiveness of implementation of “Komuniti Sihat Perkasa Negara” (KOSPEN) Programme in Malaysia - Phase 1. 2014
6. Yang T, Abdullah AS, Li L, et al. Public place smoke-free regulations, secondhand smoke exposure and related beliefs, awareness, attitudes, and practices among Chinese urban residents. *Int J Environ Res Public Health*. 2013;10(6):2370–2383.
7. Adda J, Cornaglia F (2006) The Effect of Taxes and Bans on Passive Smoking (IZA Discussion Paper No. 2191).
8. Ho SY, Wang MP, Lo WS, Mak KK, Lai K, Thomas et al. Comprehensive smoke-free legislation and displacement of smoking into the homes and young children in Hong Kong. *Tob Control*, 2010,19, 129-133.
9. Park JH, Lee CK, Kim KH, et al. Decrease in the urine cotinine concentrations of Korean non-smokers between 2009 and 2011 following implementation of stricter smoking regulations. *Int J Hyg Environ Health* 2016;219:123–8
10. Zheng ZL, W.L.Lam, Wu CP, Kuok WS, Liang WJ, Wang HL. Second-hand smoke exposure of children at home and prevalence of parental smoking following implementation of the new tobacco control law in Macao. *Pub Health*, 2017;44: 57-63
11. Chan SSC, Cheung YTD, Leung DYP, Mak YW, Leung GM, Lam TH, Second-hand smoke exposure and maternal action to protect children from second-hand smoke: pre- and post-smoke free legislation in Hong Kong. *PLoS One*, 2014.9, p. e105781
12. Jarvis MJ, Sims M, Gilmore A, Mindell J Impact of smoke-free legislation on children’s exposure to secondhand smoke: cotinine data from the Health Survey for England. *Tob Control*.2012. 21: 18–23.
13. Lidyn-Moyano C, Martınez-Sánchez JM, Fu M, et al Secondhand smoke risk perception and smoke-free rules in homes: a cross-sectional study in Barcelona (Spain) *BMJ Open* 2017;7:e014207. doi: 10.1136/bmjopen-2016- 014207
14. Callinan JECA, Doherty K, Kellejer C. Legislative smoking bans for reducing second hand smoke exposure, smoking prevalence and tobacco consumption. *Cochrane Database Syst Rev*. 2010;(4):CD005992.
15. Dove MS, Dockery DW, Connolly GN. Smoke-Free Air Laws and Secondhand Smoke Exposure Among Nonsmoking Youth. *Pediatrics* 2010;126: 80–87.
16. Tsai Y, Chang L, Sung H, Hu TH, Chiou ST. The impact of smoke-free legislation on reducing exposure to secondhand smoke: differences across gender and socioeconomic groups *Tob Control*. 2015;24:62-69.
17. Institute for Public Health. Report of the Global Adult Tobacco Survey (GATS). Malaysia 2011. Malaysia: Ministry of Health; 2012.
18. Institute for Public Health. National health and morbidity survey 2015 – report on smoking status among Malaysian adults, 2015.
19. Wang Y, Tsai Y, Tsai T, Chan PY. Children’s exposure to secondhand smoke at home before and after smoke-free legislation in Taiwan. *Tob Control* 2017;26:690-696.
20. Kruger J, Jama A, Homa DM, Babb SD, King BA. Smoke-free home and vehicle rules by tobacco use status among US adults. *Prev Med* ., 2015. 78, 9-13.
21. Liang LA, Weber A, Herr C, Hendrowaristo L, Meyer N, Bolte G. Children’s exposure to second-hand smoke before and after the smoking ban in Bavaria—a multiple cross-sectional study, *Eur J Public Health*, 2016. 26(6): 969–974
22. Rogers, Everett (2003). *Diffusion of Innovations*. New York: Free Press.
23. Lim KH, Teh CH, Heng PP, Sayan P, Ling MY, Fadhli MY, et al., Source of Cigarette among youth smokers in Malaysia: Findings from the Tobacco & E-Cigarette Survey in Malaysia among Malaysian adolescents. (TECMA) *Tob Induc Dis*. 2018(Nov)16
24. Lim KH, Teh CH, Pan S, Ling MY, M Fadhli MY, Sumarni MG et al. Prevalence and factors associated with smoking among adults in Malaysia - Findings from the National Health and Morbidity Survey (NHMS) 2015. *Tob Induc Dis*. 2018;16:1. doi:10.18332/tid/82190.
25. Moore GF, Moore L, Littlecott HJ, Ahmad N, Lewis S, Sulley G. et al. Prevalence of smoking restrictions and child exposure to secondhand smoke in cars and homes: a repeated cross-sectional survey of children aged 10–11 years in Wales *BMJ Open* 2015;5:e006914. doi:10.1136/bmjopen-2014-006914
26. Lim KH, Sumarni MG, Amal NM, Hanjeet K, Wan Rozita WM, Norhamimah A. Tobacco use, knowledge and attitude among Malaysians age 18

- and above. *Trop Biomed.* 2009;26(1):92-99.
27. Jallow IK, Britton J, Langley T Prevalence and factors associated with exposure to secondhand smoke (SHS) among young people: a cross-sectional study from the Gambia *BMJ Open* 2018;8:e019524.
28. Yu SH, Duan ZS, Redmon PB, Eriksen MP, Koplan JP, Huang C, mHealth Intervention is Effective in Creating Smoke-Free Homes for Newborns: A Randomized Controlled Trial Study in China. *Sci Rep.* 2017; 7: 9276. DOI: 10.1038/s41598-017-08922-x 1
29. Hemsing N, Greaves L, O’Leary R, Chan K, Okoli C. Partner support for smoking cessation during pregnancy: A systematic review. *Nicotine Tob Res* 2012; 14: 767–776 .