

ORIGINAL ARTICLE

Prevalence and characteristics of e-cigarette users among Malaysian current and ex-smokers

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Abstract

Introduction: Electronic cigarettes (ECs) are new devices that have been accepted widely by both smokers and non-smokers. However, the evidence on EC used in Malaysia is scarce. The objective of this study was to determine the prevalence of EC use and the socio-demographic and smoking characteristics associated with current EC use among Malaysian current and ex-smokers.

Methods: This was a sub-analysis of data from a cross-sectional, national-population-based EC study conducted from May to June in 2016 in Malaysia. A detailed description of the sampling methods can be found in the National E-cigarette Survey (NECS) 2016 report. Briefly, data were obtained from 1396 individuals who had ever been smokers, i.e., 957 (68.6%) current smokers and 439 (31.4%) ex-smokers.

Results: Current EC use was found predominantly among current smokers (8.0%) as compared with ex-smokers (4.3%). Among current smokers, the main reasons given for smoking ECs were wanting to try it (44.7%), followed by intention to quit tobacco smoking (15.8%) and to reduce tobacco smoking (10.5%). Using multiple logistic regression analysis, we found that among current smokers, current EC users were more likely to be younger, i.e., 18–44 years (aOR= 4.83, 95% CI= 1.97–11.86, p=0.001), urban residents (aOR= 1.89, 95% CI= 1.15–3.11, p=0.012), single/ divorced/ widowed (aOR= 2.11, 95% CI= 1.24–3.61, p=0.006) and students (aOR= 2.25, 95% CI= 1.01–5.01, p=0.048). Among ex-smokers, only younger respondents (18–44 years old) was reported as being more likely to be current EC users (aOR= 3.81, 95% CI= 1.14–12.76, p=0.030).

Conclusion: This study showed that currently using and ever having used ECs were more prevalent among current smokers. The reasons given for initiating EC use among current smokers were mainly wanting to try it, followed by intention to quit and to reduce tobacco smoking. Current EC use appears to be common among current smokers who are younger, urban residents, single/divorced/widowed and students. Therefore, EC cessation intervention strategies and policies should target these high-prevalence groups.

Introduction

Smoking is one of the leading causes of preventable death worldwide and is considered to be a serious public health problem.¹ It is an important risk factor for disability and premature death.² Annually, tobacco use kills an estimated 6 million people worldwide, and 600,000 of these deaths were those of non-smokers who were exposed to second-hand smoke.³

The overall prevalence of current smokers has reduced slightly from 23.1% in 2011 to 22.8% in 2015. However, the prevalence of smokeless tobacco products, which includes electronic cigarettes (ECs), has increased markedly from 0.7% in 2011 to 10.9% in 2015.⁴ The Global Adult Tobacco Survey 2011 (GATS) showed that among those who have ever smoked on a daily basis, only 9.5% have quit successfully.⁵

ECs are new devices, introduced as smoking cessation aids, that have been widely accepted

by smokers and non-smokers. ECs are battery-powered devices that provide nicotine to the user by heating a nicotine solution and transforming it into vapour.^{6,7} Studies have raised health concerns related to EC use, as potentially harmful ingredients have been identified in some e-cigarette solutions.^{6,8,9} However, recent randomised controlled trials have showed that EC use may assist smokers in smoking cessation.¹⁰ Considering the difficulties involved in quitting smoking tobacco, ECs are of great interest to smokers, perhaps offering a way to quit.

One recent population survey in the U.S. found that about 11% of current smokers and 2% of former smokers had used ECs and also that well-educated smokers were more likely to be EC users.¹¹ As is the case in Malaysia, data is limited in terms of the extent and characteristics of EC use among smokers and ex-smokers. Hence, the objective of this study was to determine the prevalence of EC use and the socio-demographic and smoking characteristics associated with

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current EC use among current and ex-smokers in Malaysia.

Methods**Study design**

This was a sub-analysis of data from a cross-sectional, national-population- based EC study conducted from May to June 2016 in Malaysia. The methodology was designed to represent all Malaysian adults aged 18 years and above and was based on household populations at the national as well as the urban and rural levels. Approval for the study was obtained from the Medical Research and Ethics Committee of the Ministry of Health Malaysia (NMRR-16-171-28819 (IIR).

Sampling methods

Multistage stratified clustered random sampling was used in this survey, and stratification was done on the state and urban/rural levels. The Primary Sampling Unit (PSU) was the administrative district, and three districts were randomly selected from each state. The Secondary Sampling Units (SSUs) were the Enumeration Blocks (EBs) within the selected districts. The number of EBs selected per state was proportionate to the population size. Living Quarters (LQs) served as the Final Sampling Units. They were defined as separate and independent structures usually used as places for living. On average, an EB consisted of 80 to 120 LQs. Twelve LQs were randomly selected from each selected EB and all eligible respondents in the selected LQs were selected for the study. Eligible respondents included those who had lived in the selected residences for at least 6 months in the past year, were able to understand Bahasa Melayu or English and agreed to participate. Institutional populations, such as those staying in hotels, hostels, hospitals and so forth, were excluded from the study. A detailed description of the sampling methods is provided in the National E-cigarette Survey (NECS) 2016 report.¹²

There were a total of 10,471 adults identified for this survey, but only 3,604 and 3,302 adults were eligible (as per the selection criteria) from the urban and rural areas, respectively. Of these, 3,302 and 2,197, respectively, agreed to participate in the survey, providing response rates of 60% and 67% for the urban and rural areas, respectively. For the purposes of this study, data were obtained from the 1396 adults who had ever smoked, i.e., 957 (68.6%) current smokers and 439 (31.4%) ex-smokers.

Measures

Respondent characteristics gathered included age, sex, residence, education, occupation, ethnicity, religion, marital status, plus status of EC use and tobacco smoking.

The working definitions for EC use in our study were adopted from a National Center for Health Statistics (NCHS) Data Brief.¹³ A current EC smoker was defined as someone who had taken at least a puff of an EC and had been smoking for the last 30 days. Ever an EC smoker was defined as someone who had taken even one puff of an EC.

As for tobacco-smoking status, the working definitions used were adopted from the Centers for Disease Control and Prevention (CDC).¹⁴ Current smokers were defined as respondents who had smoked at least 100 cigarettes in their lifetime and who had smoked at least one cigarette in the past 30 days. Ex-smoker was defined as those who had not smoked for the past 6 months or more.

Analysis

Data was analysed using IBM SPSS statistical software Version 22.0. Differences between current and ex-smokers in socio-demographics, smoking characteristics and the prevalence of EC current use and having ever used were examined with chi-square tests for categorical variables and t-tests for continuous variables. The association of current EC use with sociodemographic characteristics and smoking profiles was assessed using multiple logistic regression. The analyses used current EC user status as the dependent variable. Variables with a p-value of less than 0.25 when tested were selected for inclusion in the multiple logistic regression analysis model.

For current smokers, covariates included for analysis were age group, residence, education, occupation, marital status and age at which they started smoking tobacco. As for the ex-smokers, the covariates included were age group, residence, education and occupation. All statistical analyses were carried out with 95% confidence intervals.

Results

Of the 1396 adults who ever smoked included in this study, 957 (68.6%) were current smokers and 439 (31.4%) were ex-smokers.

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Table 1 shows the socio-demographic characteristics as well as the smoking and EC use profiles of the participants by smoking status. Current EC use was found predominantly among current smokers (8.0%) compared with ex-smokers (4.3%). Ever using ECs was also significantly higher among current smokers (29.3%) as compared with ex-smokers (14.1%).

Table 2 shows the characteristics of current EC users by smoking status. Among current users of ECs, there were no significant differences between current and ex-smokers in the frequency of EC use, number of EC puffs per session and reasons for starting EC. Among current smokers, the reasons listed for smoking ECs were mainly wanting to try it (44.7%), followed by intentions to quit smoking tobacco (15.8%) and to reduce smoking tobacco (10.5%).

Table 3 shows the characteristics of current EC users by smoking status. Among current smokers, EC use was significantly higher

among younger smokers (18-44 years), urban residents, those who had attained a secondary education and above, students, being single/divorced/widowed and those who started to smoke tobacco at an age of less than 20 years old.

Table 4 shows the outcomes of the multivariate models investigating the demographic associations with current EC use among current smokers and ex-smokers. Among current smokers, we found that current EC users were more likely to be younger smokers, i.e., in the age range 18-44 years (aOR= 4.83, 95% CI= 1.97-11.86, p=0.001), urban residents (aOR= 1.89, 95% CI= 1.15-3.11, p=0.012), single/ divorced/ widowed (aOR= 2.11, 95% CI= 1.24-3.61, p=0.006) and students (aOR= 2.25, 95% CI= 1.01-5.01, p=0.048). Among ex-smokers, only younger respondents (18-44 years old) was reported as being more likely to be current EC users (aOR= 3.81, 95% CI= 1.14-12.76, p=0.030).

Table 1. Socio-demographic characteristics as well as the smoking and EC use profiles of the participants by smoking status (n=1396)

Variables	Current smokers (n=957) n (%)	Ex-smokers (n=439) n (%)	P
<i>EC use status</i>			
Current use	77 (8.0)	19 (4.3)	0.011
Ever used	280 (29.3)	62 (14.1)	<0.001
<i>Age group (n=1393)</i>			
18 - 44 years	589 (61.7)	207 (47.2)	<0.001
45 years and above	365 (38.3)	232 (52.8)	
<i>Sex (n=1393)</i>			
Male	920 (71.9)	359 (81.1)	<0.001
Female	35 (30.7)	79 (69.3)	
<i>Residence</i>			
Urban	439 (64.8)	238 (54.2)	0.004
Rural	518 (72.0)	201 (45.8)	
<i>Education (n=1394)</i>			
Primary and below	354 (66.3)	180 (41.2)	0.147
Secondary and above	602 (70.0)	258 (58.8)	
<i>Occupation</i>			
Employed	786 (72.9)	292 (66.5)	<0.001
Unemployed	134 (53.0)	119 (47.0)	
Student	37 (56.9)	28 (43.1)	
<i>Race (n=1395)</i>			
Malay	769 (71.7)	304 (69.2)	<0.001
Non-Malay	187 (58.1)	135 (41.9)	
<i>Religion (n=1395)</i>			
Muslim	838 (71.3)	337 (76.7)	<0.001
Non-Muslim	118 (53.6)	102 (46.4)	

Variables	Current smokers (n=957) n (%)	Ex-smokers (n=439) n (%)	p
<i>Marital status (n=1394)</i>			
Married/with partner	660 (67.3)	321 (32.7)	0.128
Single/divorced/widowed	295 (71.4)	118 (28.6)	
<i>Age started smoking cigarettes (n=1145)</i>			
< 20 years	807 (84.3)	146 (77.7)	0.025
≥ 21 years	150 (15.7)	42 (22.3)	

Table 2. Characteristics of EC current users by smoking status (n=96)

Variables	Current smokers (n=77) n (%)	Ex-smokers (n=19) n (%)	p
<i>Age started EC</i>			
mean (SD) in years	29.1 (11.1)	29.3 (13.6)	0.923
<i>Frequency of EC use</i>			
Daily	19 (24.7)	8 (42.1)	0.130
Less than daily	58 (75.3)	11 (57.9)	
<i>Frequency of EC use per day (n=92)</i>			
<20 times/ day	59 (79.7)	12 (66.7)	0.236
≥20 times/ day	15 (20.3)	6 (33.3)	
<i>No. of EC puffs per session (n=86)</i>			
Mean (SD)	13.9 (22.8)	25.1 (35.4)	0.218
<i>Reasons for smoking ECs (n=95)</i>			
To try	34 (44.7)	9 (47.4)	0.523
To quit tobacco smoking	12 (15.8)	6 (31.6)	
To reduce tobacco smoking	8 (10.5)	1 (5.3)	
To replace tobacco smoking	6 (7.9)	0 (0)	
To reduce cost of smoking	5 (6.6)	1 (5.3)	
Other	11 (14.5)	2 (10.5)	

Table 3. Characteristics of current EC users among current smokers and ex-smokers

Variables	Current smokers (n=957)			Ex-smokers (n=439)		
	Current EC users (n=77) n (%)	Not current EC users (n=880) n (%)	p value	Current EC users (n=19) n (%)	Not current EC users (n=420) n (%)	p value
<i>Marital status (n=1394)</i>						
18 - 44 years	71 (92.2)	518 (59.1)	<0.001	15 (78.9)	192 (45.7)	0.005
45 years and above	6 (7.8)	359 (40.9)		4 (21.1)	228 (54.3)	
<i>Sex</i>						
Male	75 (97.4)	845 (96.2)	1.000	17 (89.5)	342 (81.6)	0.547
Female	2 (2.6)	33 (3.8)		2 (10.5)	77 (18.4)	
<i>Residence</i>						
Urban	49 (63.6)	390 (44.3)	<0.001	7 (36.8)	231 (55.0)	0.120
Rural	28 (36.4)	490 (55.7)		12 (63.2)	189 (45.0)	
<i>Education</i>						
Primary and below	13 (16.9)	341 (38.8)	<0.001	2 (10.5)	178 (42.5)	0.006
Secondary and above	64 (83.1)	538 (61.2)		17 (89.5)	241 (57.5)	

Variables	Current smokers (n=957)			Ex-smokers (n=439)		
	Current EC users (n=77) n (%)	Not current EC users (n=880) n (%)	p value	Current EC users (n=19) n (%)	Not current EC users (n=420) n (%)	p value
<i>Occupation</i>						
Employed	61 (79.2)	725 (82.4)	<0.001	16 (84.2)	276 (65.7)	0.083
Unemployed	5 (6.5)	129 (14.7)		1 (5.3)	118 (28.1)	
Student	11 (14.3)	26 (3.0)		2 (10.5)	26 (6.2)	
<i>Race</i>						
Malay	62 (80.5)	707 (80.4)	0.985	14 (73.7)	290 (69.0)	0.668
Non-Malay	15 (19.5)	172 (19.6)		5 (26.3)	130 (31.0)	
<i>Religion</i>						
Muslim	70 (90.9)	768 (87.4)	0.366	14 (73.7)	323 (76.9)	0.782
Non-Muslim	7 (9.1)	111 (12.6)		5 (26.3)	97 (23.1)	
<i>Marital status</i>						
Married/with partner	31 (40.3)	629 (71.6)	<0.001	12 (63.2)	309 (73.6)	0.317
Single/divorced/widowed	46 (59.7)	249 (28.4)		7 (36.8)	111 (26.4)	
<i>Age started tobacco smoking</i>						
< 20 years	72 (93.5)	735 (83.5)	0.021	10 (90.9)	136 (76.8)	0.461
≥ 21 years	5 (6.5)	145 (16.5)		1 (9.1)	41 (23.2)	

Table 4. Adjusted associations between demographic variables and current EC use among current smokers and ex-smokers

Variables	Current smokers (n=957)			Ex-smokers (n=439)		
	Current EC users (n=77) n (%)	Adj. OR (95% CI)	p value	Current EC users (n=19) n (%)	Adj. OR (95% CI)	p value
<i>Age group</i>						
18 - 44 years	71 (92.2)	4.83 (1.97-11.86)	0.001	15 (78.9)	3.81 (1.14-12.76)	0.030
45 years and above	6 (7.8)	1.00		4 (21.1)	1.00	
<i>Residence</i>						
Urban	49 (63.6)	1.89 (1.15-3.11)	0.012	7 (36.8)	0.43 (0.16-1.13)	0.088
Rural	28 (36.4)	1.00		12 (63.2)	1.00	
<i>Occupation</i>						
Employed	61 (79.2)	1.00		16 (84.2)	1.00	
Unemployed	5 (6.5)	0.69 (0.26-1.86)	0.468	1 (5.3)	0.21 (0.03-1.65)	0.137
Student	11 (14.3)	2.25 (1.01-5.01)	0.048	2 (10.5)	0.84 (0.16-4.52)	0.838
<i>Marital status</i>						
Married/with partner	31 (40.3)	1.00		12 (63.2)	1.00	0.815
Single/divorced/widowed	46 (59.7)	2.11 (1.24-3.61)	0.006	7 (36.8)	0.88 (0.29-2.66)	

Discussion

This study is the first to report on the national prevalence of EC use among adult current and ex-smokers in Malaysia. Our findings revealed that the overall prevalence rates for the current use of and ever using ECs were higher among current smokers as compared with ex-smokers. This is consistent with the findings of Pearson et al., who found a higher utilization of ECs among current smokers (11.4%) compared to ex-smokers (2%).¹¹ The higher prevalence of EC use among current smokers could also be due to the marketing of ECs as smoking-cessation tools.^{15,16} In view of the popularity of EC use among current smokers, there is a need for more high-quality studies to examine the effectiveness of ECs as tools for quitting smoking.

Among current smokers, the reasons for smoking ECs were mainly wanting to try them, followed by the intention to quit and to reduce tobacco smoking. Similarly, many recent studies showed that the popular reasons for using ECs included health concerns, cutting down and quitting.¹⁷⁻¹⁹ Considering the difficulties in quitting tobacco smoking, ECs are of great interest to smokers who might view them as an option for smoking cessation.¹⁰ However, ECs are currently unregulated in Malaysia, and e-liquids are produced by many small manufacturers. There also remains limited evidence on the potential benefits and risks of EC use.⁹ The overall conclusion from a recent systematic review revealed that EC use was associated with significantly less quitting among smokers in the real world.²⁰ Further research is warranted to examine the long-term impact of EC use on tobacco initiation, cessation and users' health.

Among the current and ex-smokers, younger respondents were more likely to be current EC users than their counterparts. This is consistent with the findings by Dockrell et al.¹⁹ Higher awareness and use of ECs among younger adults may be due to the fact that e-cigarettes are usually marketed through social and electronic media.²¹ Since EC use could potentially lead to the initiation of tobacco smoking and increasing nicotine addiction, further surveillance is warranted among the younger adults, as they are particularly susceptible to the influences of social media.²²

Moreover, we found that among current smokers, current EC users were more likely to be students and urban residents, which is consistent with the findings by Goniewicz et al.²³ The higher

prevalence of EC use in urban populations might be explained by easier access to the Internet in the more urbanized areas of the country, as web sites are the main channels for advertising EC products. The use of ECs among students who are current smokers is worrying. A recent study has shown that the use of ECs was associated with heavier use of conventional cigarettes, and it might be creating another new pathway for adolescent students to become addicted to nicotine by reducing the chance of quitting conventional cigarettes.²⁴

Limitations and strengths of the study

The principle strength of this population-based EC survey is that it provides the policy makers with reliable and up-to-date information on EC use among the smokers and ex-smokers in the population. This data is important, as EC use has great potential to influence smoking and quitting behaviour in Malaysia.

There are several limitations to this study. Firstly, the survey responses were mainly self-reported by participants, which could lead to reporting bias. Thus, the accuracy of self-reported EC use is uncertain. Second, small sample sizes for some subpopulations resulted in less precise estimates, which could fail to be representative. Finally, the cross-sectional nature of this study does not allow inferences to be drawn about the causal nature of the associations found, for example, whether ex-smokers used ECs to help them to quit smoking or took up ECs after they had successfully quit smoking conventional cigarettes could not be determined. Further follow-up studies are needed to examine the prospective association between EC use and smoking cessation.

Conclusions

In conclusion, this study showed that the current use of and ever using ECs were higher among current smokers. The reasons given for initiating EC use among current smokers were mainly wanting to try it, followed by intention to quit and to reduce tobacco smoking. Current EC use was more likely among current smokers who are younger, urban residents, single/divorced/widowed and students. Therefore, EC cessation intervention strategies and policies should target these high-prevalence groups. Moreover, there is an urgent need for further research and preventive strategies and policies to protect younger adults and student from this harmful exposure.

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How does this paper make a difference to general practice?

- This study showed that current and ever using e-cigarettes occurred more frequently among current smokers. Hence, e-cigarette cessation intervention strategies and policies should target at this high-prevalence group.
- Among the current and ex-smokers, younger respondents and students were more likely to be current e-cigarette users. Thus, there is an urgent need for further research and preventive strategies and policies to protect younger adults and students from this harmful exposure.

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