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ORIGINAL ARTICLE

Factors Associated with Past 12-month Quit Attempt of Electronic Cigarette Use in Malaysian Adults

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ABSTRAK

Berbanding dengan kajian mengenai rokok konvensional, kajian berhenti rokok elektronik (EC) masih kurang dikaji di Malaysia. Kajian ini bertujuan untuk mengenal pasti prevalens dan faktor-faktor yang berkaitan dengan percubaan berhenti EC dalam tempoh 12 bulan yang lepas. Dalam kajian ini, tinjauan keratan rentas dalam talian dijalankan ke atas orang dewasa berumur antara 18 hingga 44 tahun yang pernah menggunakan EC menggunakan persampelan purposif. Soal selidik persepsi tentang faedah, kemudaratan dan kesan sampingan EC, Ujian Fagerström untuk Kebergantungan Nikotin, Soal Selidik Tingkah Laku Vaping Glover-Nilsson dan Skala Tarikan Nikotin Minnesota telah diedarkan. Nisbah odds kasar dan yang diselaraskan telah dikira menggunakan regresi logistik binari dengan percubaan berhenti dalam tempoh 12 bulan yang lepas sebagai pemboleh ubah bersandar. Kajian ini mendapati bahawa lebih daripada satu pertiga daripada peserta (37.0%) telah mencuba untuk berhenti EC dalam tempoh 12 bulan yang lepas. Motivasi yang lebih tinggi untuk berhenti merokok, usia yang lebih muda, usia yang lebih muda ketika permulaan penggunaan EC, dan usia yang lebih muda apabila memulakan

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penggunaan EC secara harian dikaitkan dengan kebarangkalian yang lebih tinggi untuk percubaan berhenti 12 bulan yang lepas. Penemuan kami memberi manfaat dalam usaha memprofilkan pengguna EC dan seterusnya membantu dalam usaha mereka untuk berhenti penggunaan EC. Penerapan literasi kesihatan terhadap golongan dewasa mungkin menjadi kunci untuk mengurangkan jurang dari segi pendidikan dalam usaha berhenti menggunakan EC.

Kata kunci: Berhenti merokok; percubaan berhenti tahun lalu; rokok elektronik

ABSTRACT

Relative to quitting cigarette smoking, quitting electronic cigarettes (EC) has been understudied in Malaysia. This study aimed to identify the prevalence and factors associated with an EC quit attempt in the past 12 months. In a cross-sectional online questionnaire survey, adults aged between 18 to 44 years old who had ever used EC were purposively recruited. A perception questionnaire about the benefits, harms and side effects of electronic cigarettes, as well as the Fagerström Test for Nicotine Dependence, Glover-Nilsson Vaping Behavioral Questionnaire, and the Minnesota Nicotine Withdrawal Scale were self-administered. Crude and adjusted odds ratios were computed using binary logistic regression with past 12-month quit attempt as the dependent. Our study found that more than one-third of our participants (37.0%) had tried quitting EC in the past 12 months. Higher motivation to stop vaping, younger age, younger age at EC use initiation and younger age when starting daily EC use were associated with higher odds of past 12-month quit attempt. Our findings offered insight in profiling EC users that may assist in helping them quit. Health literacy implemented on younger individuals may be key to reduce disparities in terms of education where it comes to stopping EC use.

Keywords: Cessation; electronic cigarette; past-year quit attempt

INTRODUCTION

The use of e-cigarettes (EC), also known as vape, has been increasing in prevalence among young adults (Ling et al. 2023). In the US, the prevalence of current and daily EC use has increased among young adults aged 21 to 24 years old, from 13.5 to 14.5% for current use, and 4.4 to 6.6% for daily use between 2017 to 2020 (Boakye et al. 2022). A survey in 2018 in China showed that the 15-24 years old age bracket recorded the highest prevalence of ever, last 12-month and current use of EC (Xiao et al. 2022). The number of EC ever users in Malaysia has increased as well. In 2020, data from the International Tobacco Control Malaysia Wave 1 Survey showed that 33.7% of Malaysians were ever users of EC (Driezen et al. 2022), which is triple

the prevalence of 11.9% reported by the National E-Cigarette Survey (NECS) in 2016 (Ab Rahman et al. 2019). The National Health and Morbidity Survey 2019 found that the prevalence of current EC users has doubled from 600,000 reported in the NECS to 1.2 million (Institute for Public Health, 2020). The prevalence was highest among young people aged between 20 to 24 years old, at 14.7% (Institute for Public Health 2020).

Despite its increasing prevalence, studies have shown that among current users of EC, some have reported a previous attempt at quitting EC, or have intention to quit EC in the future (Jankowski et al. 2020; Palmer et al. 2021; Rosen & Steinberg 2020). Palmer et al. (2021), in a study amongst adult EC users, found that 15.2% reported a past-year quit attempt and 60.7% reported planning to quit e-cigarettes in the future. Another study using 2015-2016 data in the US showed that 62.4% intended to quit EC for good, whilst 25% had a quit attempt in the prior year (Rosen & Steinberg 2020). A study in Central and Eastern Europe found that the prevalence of ever quitting EC was 13.9%, whilst 25.2% reported an intention to quit EC in the future (Jankowski et al. 2020).

A number of reasons have been associated with quitting EC use. A study among EC users who attempted and failed to quit, versus those who did not make any previous attempt, found that the former reported higher e-cigarette dependence, higher perceived barriers to quitting, and had positive and negative attitudes toward e-cigarette use (Garey et al. 2019). A systematic review found that EC users felt that quitting EC posed a risk for returning to smoking, have a higher dependency on EC, and used EC for stress reduction; the barriers and facilitators to quitting EC were health and hazard beliefs about EC use, the degree of EC enjoyment, and being influenced by social and environmental surroundings (Dyson et al. 2022). A cross-national study among EC users in Canada and the United States found that the most endorsed reason for quitting EC was that they had just tried EC use to see what it is like (50.5-59.7%), had lost interest or did not enjoy it (33.0-35.3%) and concerns about its health hazards (25.2-41.9%), among others (Hammond et al. 2024). Palmer et al. (2022), in their systematic review found that adults were more motivated to quit EC due to perceptions of higher cost, lower satisfaction from EC use, and various psychological factors.

In the Asian context, many studies have focused on EC initiation, ever, and current use (Hairi et al. 2022; Patanavanich et al. 2021), whilst studies on quitting EC has been scarce. The NECS conducted in 2016 in Malaysia showed that the number of current EC users (3.2%) was lower compared to ever (11.9%) and former (8.6%) users, suggesting that more EC users have quit or had only used EC at least once (Ab Rahman et al. 2019). The same study found that e-cigarette users who had no exposure to e-cigarettes at the workplace, perceiving that EC use posed more harm to others compared to tobacco smoke, and that EC was not useful in maintaining cigarette abstinence were associated with higher

odds of quitting EC (Yusoff et al. 2022). An earlier study conducted in 2015 showed that among the 429 EC users surveyed, 65.3% reported an intention to quit EC, and the intention to quit was associated with earning a lower income and perceiving that smoking EC was more expensive compared to smoking cigarettes (Wong et al. 2016). Among adolescents, the Tobacco and E-Cigarette Survey among Malaysian Adolescent (TECMA) in 2016 found that adolescents who had higher odds of having quit EC were those who could not afford EC, aged 13 years old and older, and reported their EC did not contain nicotine (Saminathan et al. 2019).

Understanding factors associated with a past 12-month quit attempt will aid in successfully formulating a treatment plan for EC users, and potentially enhancing the quit success rates EC users who choose to quit EC. Therefore, this study aimed to identify the factors associated with making a quit attempt in the past 12 months.

MATERIALS AND METHODS

Study Design

This was a cross-sectional study that was conducted via online survey. Cross-sectional studies are suitable for establishing the prevalence and associated factors of health concerns (Wang & Cheng 2020).

Study Participants

Adults aged between 18 to 44 years old were targeted for recruitment into this study. Inclusion criteria were individuals who had ever used EC and who were Malaysian citizens.

The sample size was calculated using Cochran's (1963) formula. The prevalence of e-cigarette use in 2019 was 4.9% in Malaysians aged 15 years old and above (Driezen et al. 2022). This could be translated to about 1.2 million e-cigarette users based on the adult population aged 15 years old and above (25,055,830 individuals) in 2019 (World Bank 2024). Assuming a proportion of 65.3% individuals who had intention to quit EC use (Wong et al. 2016), a 95% confidence interval and precision of 5%, a total of 349 individuals would be sufficient.

Measures

Several questionnaires used in this study (i.e., the demographic and EC use profile questions, benefits and side effects of EC, the Fagerström Test for Nicotine Dependence, Glover-Nilsson Vaping Behavioral Questionnaire and Minnesota Nicotine Withdrawal Scale) were based on the questionnaire used in the National E-Cigarette Study (Ab Rahman et al. 2019), which was adapted from the Global Adult Tobacco Survey (GATS) Malaysia (Omar et al. 2011) and Tobacco and E-Cigarette Use among Adolescents (Saminathan et al. 2019) surveys. This adaptation was conducted with input from experts in conventional cigarettes and/or e-cigarettes, from both the Ministry of Health and academics. The questionnaire was prepared in Bahasa Malaysia. This questionnaire was pre-tested and validated among adults with similar baseline characteristics as the target population.

(i) Demographic characteristics

Demographic information collected were gender, age, race, state, marital status, level of education, occupation and monthly income of the individual.

(ii) EC use profile

The EC use profile questionnaire was built by the National E-Cigarette Survey (NECS) 2016 (Ab Rahman et al. 2019). This questionnaire was built based on the researchers' purpose to collect information about the EC users' profile which consisted of the frequency of EC use, nicotine addiction, motivation to quit EC and attempts to quit EC.

(iii) Benefits and side effects of EC

The perception questionnaire about EC use compared to cigarette smoking, namely "I believe using EC is healthier compared to tobacco cigarettes" was derived from a previous study (Ab Rahman et al. 2019) conducted in Malaysia and back-translated from English to Malay independently by subject and linguistic experts. The subject experts are health science experts (forward translation) and language experts (backward translation). Participants answered "Yes" or "No" to this question.

Participants also identified the type of side effects that they had experienced due to EC use, including sore throat, eye irritation and nausea. Those who had answered yes to any of the side effects were coded as 1 = "Yes", whilst those who did not answer yes to any of these options were coded as 0, indicating they had not experienced side effects due to EC use.

(iv) The Fagerström Test for Nicotine Dependence (FTND)

This test had been translated, adapted and validated in Malay (Ab Rahman et al. 2019). There were six questions that had a scale from 0 to 10. The modified scale was the same as the original version of the FTND and was divided into three categories which were 1 to 3 as a low level of nicotine addiction, 4 to 6 as a moderate level of nicotine addiction and 7 to 10 as high levels of nicotine addiction. The modified changes were in the word "cigarette" to "electronic cigarette" and "how many cigarettes" to "how many sessions of using electronic cigarettes".

(v) Glover-Nilsson Vaping Behavioural Questionnaire (GNVBQ)

This questionnaire was translated, adapted, and validated in Malay and was used to collect information about behavioural patterns of nicotine dependence for EC. This questionnaire was modified and adapted from the use of tobacco cigarettes to electronic cigarettes. There were 11 questions with a total score of 44 points. Each question had a scale from 0 to 4, ie. 0 = Never, 1 = Very rarely, 2 = Rarely, 3 = Often and 4 = Very often. This modified questionnaire evaluated the relational aspects of feelings, perceptions and practices of electronic cigarette users. The higher the total score, the higher the level of nicotine

dependence behaviour and vice versa. The total score was divided into 5 categories, namely 1 to 6 was a little level, 7 to 11 was a mild level, 12 to 22 was a moderate level, 23 to 33 was a high level and a total score above 33 showed the level of behavioural dependence on nicotine was very high (Mohamed et al. 2020).

(vi) The Minnesota Nicotine Withdrawal Scale (MNWS)

This was a questionnaire that measured the level of nicotine withdrawal symptoms. The level of nicotine withdrawal symptoms was dependent on the dose and frequency of nicotine use, i.e. the higher the dose and frequency of nicotine use, the higher the severity of the withdrawal symptoms experienced (Shiffman et al. 2004). The scale used to measure the level of nicotine withdrawal symptoms for the use of electronic cigarettes was from 0 to 4 for each question, which was 0 = "Never", 1 = "A Little", 2 = "Mild", 3 = "Moderate" and 4 = "Significant". This questionnaire had been translated and validated in Malay and adapted for the use of electronic cigarettes (Blebil et al. 2014).

(vii) Motivation to quit EC

This scale was adapted from the Motivation to Stop Scale (MTSS) which as originally used to measure the motivation to quit conventional cigarettes (Kotz et al. 2013). It comprised a single item ("Which of the following describes you?") featuring seven options, which ranged from 1 = " I don't want to stop using e-cigarettes/ vape" to 7 = "I REALLY want to stop using e-cigarettes/vape and intend to in the next month." Higher scores indicated a greater inclination to quit e-cigarette use. Respondents selecting options 1 through 5 were categorised as having low motivation to quit ECs, whereas those choosing 6 and 7 were classified as having high motivation to quit. The EC use Motivation to Stop Scale was translated into Malay by experts in language and subject matter through back-translation, and face validity was established during the harmonisation meeting of the various translations involving the EC experts. Internal consistency reliability was not established as this was an one-item questionnaire.

(viii) COVID-19 effects on EC use

To measure whether the COVID-19 pandemic affected EC use, two questions adapted from Soule et al. (2020) were used. The questions were "I am concerned about vaping increasing the chances of complications from COVID-19" and "I have thought about quitting or reducing my vaping because of COVID-19". Participants answered "Yes" or "No". This questionnaire was translated into Malay and face validity was established by EC experts. Internal consistency reliability was not established as no composite score was derived from these two items.

(ix) Quit EC attempt

A questionnaire on attempts to quit using electronic cigarettes was built by

the National E-Cigarette Survey (NECS) 2016. This questionnaire was built based on the researcher's purpose to collect information about the attempts made by electronic cigarette users in an effort to quit using electronic cigarettes. Participants answered "Yes" or "No" to the question, "Have you attempted to quit EC use in the past 12 months?" (Ab Rahman et al. 2020).

Procedures

An online questionnaire survey was carried out between June and August 2021. First, we approached Malaysian EC users from the Malaysian Organisation of Vape Entity (MOVE), which was a nationally representative entity that comprised 52,074 registered EC users at the time of the study. We wrote to the President of MOVE to obtain permission to access their members through their official Facebook page. Upon obtaining permission from the president of MOVE, an advertisement was placed on the official Facebook page of MOVE (https://www.facebook.com/groups/right2vape/, accessed on 17 December 2023). Participants were screened based on the inclusion criteria after they filled in their name, age, gender, e-mail address and telephone contact number. Those who fulfilled the inclusion criteria were contacted to participate in the study via e-mail or their telephone contact number. Participants who agreed verbally were required to fill in the consent form before answering the online survey form hosted by Google Forms by ticking a box indicating their informed consent to join the study. The participants were then directed to the landing page on which they answered the survey questionnaires, and pressed the "submit" button after they had completed the survey. Participants were not provided any incentives for joining the study. Ethical approval was obtained from the Research Ethics Committee of Universiti Kebangsaan Malaysia (RECUKM) (approval number: UKM PPI/111/8/JEP-2021-048).

Data Analysis

IBM SPSS for Windows (version 27.0) was used to analyse the data. Descriptive statistics was used to compute means, standard deviations, frequencies and percentages. Crude and adjusted odds ratios were computed using binary logistic regression, with a past 12-month attempt to quit EC (yes vs. no) and a quit attempt of at least one week (less than one week vs. one week and above) as the dependent or criterion variables.

RESULTS

Table 1 showed the participants' demographic characteristics, EC use profile, and responses to the benefits, risks, and side effects of EC use questionnaire. Out of the 431 EC users who completed the screening questionnaire, 80 were deemed ineligible due to falling outside the inclusion age range of 18 to 44 years old. As a result, a final sample size of 351 participants (Mean age = 33.1, SD = 13.5 years) was obtained. A large majority of the participants were males (97.7%), and nearly two-

TABLE 1: Participant demographics

Variable	Total n (%)
Age (Mean, SD)	33.06 (6.3)
Gender	
Male	343 (97.7)
Female	8 (2.3)
Race	
Malay	318 (90.6)
Non-Malay (including Chinese, Indian, and Others)	33 (9.4)
Marital Status	
Single	99 (28.2)
Married/Cohabiting	243 (69.2)
Divorced	9 (2.6)
Education	108 (30.8)
Secondary	145 (41.3)
Diploma	98 (27.9)
Degree and above	
Employment Status	
Private	168 (47.9)
Self	92 (26.2)
Government	62 (17.7)
Unemployed	15 (4.3)
Student	14 (4.0)
Income	
<MYR 2,000	104 (29.6)
MYR 2,000 to MYR 3,999	152 (43.3)
MYR 4,000 to MYR 5,999	58 (16.5)
MYR 6,000 to MYR 9,999	19 (5.4)
>MYR 10,000	18 (5.1)

thirds (69.2%) were married. In terms of highest education attained, 41.3% had diploma education, followed by 30.8% with secondary education. Nearly half of the participants worked in private settings (479%), and less than 5% were either unemployed (4.3%) or students (4.0%). More than half of the participants (53.8%) had an income of RM2,999 (USD671.40) and below per month (Table 1).

Based on the Motivation to Quit Vaping questionnaire, a total of 325 (92.6%) EC users had low motivation to quit EC use. Glover-Nilsson Vaping Behavioral Questionnaire (GNVBQ) showed that nearly half (44.4%) of the participants had moderate behavioural dependence on EC, followed by 29.9% mild behavioral dependence. Nicotine dependence measured by the modified FTND showed that more than half (67.9%) reported moderate nicotine dependence, followed by 23.8% high nicotine dependence (see Table 2). A total of 37.0% of the participants answered they had tried quitting EC in the past 12 months. In terms of the smoking profile, 98.3% were ever smokers, 89.7% had smoked more than 100 cigarettes, 88.3% were daily EC users, and 81.5% reported that their favorite EC liquid contained nicotine. A large majority reported

that EC was healthier than cigarettes (94.0%). More than half of the EC users (59.0%) reported having experienced side effects due to EC use (Table 2).

The simple logistic regression analyses on factors associated with a past-12-month attempt to quit EC use showed that being a current dual user, having higher motivation to stop EC use, being worried about worse complications of COVID-19 due to EC use, had thought of stopping EC use due to COVID-19, being single, and unemployed were associated with higher crude odds ratios of a quit attempt. On the other hand, perceiving that EC is healthier than tobacco cigarettes, reporting yes for experiencing side effects due to EC use, was a tobacco cigarette smoker, younger age of EC use initiation, daily EC user, had more EC sessions on weekdays, younger age when starting daily EC use, using EC liquid

TABLE 2: E-cigarette (EC) use and smoking profile among EC users

EC use and smoking profile	Total n(%)
Current Dual User (EC user and smoker) (answered Yes)	69 (19.7)
Ever smoker (answered Yes)	345 (98.3)
Smoked 100 cigarettes in lifetime (answered Yes)	315 (89.7)
Daily EC user (answered Yes)	310 (88.3)
EC use sessions on weekdays (Mean, SD)	14.16 (20.30)
EC use sessions on weekends or holidays (Mean, SD)	19.01 (29.31)
Age of EC use initiation (Mean, SD)	26.78 (5.86)
Age starting daily EC use (Mean, SD)	27.65 (5.83)
Does your favourite vape liquid contain nicotine? (answered Yes)	286 (81.5)
Motivation to Quit Vaping	
Low (score <6)	325 (92.6)
High (score of 6 and above)	26 (7.4)
Motivation to quit vaping (Total Score) (Mean, SD)	3.13 (1.40)
EC quit attempt in the past 12 months (answered Yes)	130 (37.0)
EC quit attempt of more than one week (answered yes)	98 (29.0)
Minnesota Nicotine Withdrawal (Median, IQR)	2.00 (5.00)
Glover-Nilsson Vaping Behavior (Mean, SD)	16.88 (8.15)
FTND Vape (Nicotine Dependence)	
Low	29 (8.3)
Moderate	237 (67.9)
High	29 (23.8)
Perception on vaping: I believe using EC is healthier compared to tobacco cigarettes (answered Yes)	330 (94.0)
Experienced side effects of vaping (answered Yes)	207 (59.0)
Vaping behaviour during COVID-19 (answered Yes)	
I am concerned about vaping increasing the chances of complications from COVID-19	133 (37.9)
I have thought about quitting or reducing my vaping because of COVID-19	129 (36.8)

containing nicotine, younger age, and married were associated with lower crude odds ratios of a quit attempt. In the fully adjusted model, motivation to stop EC use (aOR = 1.63, 95% *CI*[1.32, 2.01], $p<0.001$), thought about quitting or reducing vaping because of COVID-19 (aOR = 2.47, 95% *CI*[1.36, 4.50], $p = 0.003$) were associated with higher odds of a past 12-month quit attempt. On the other hand, more frequent EC use sessions on weekdays (aOR=0.983, 95% *CI*[0.967, 0.999, $p = 0.036$) and older age of initiating daily EC use (aOR = 0.92, 95% *CI*[0.87, 0.97], $p = 0.003$) were associated with lower odds. Age of EC use initiation and age were entered into separate models from age of initiating daily EC use due to multicollinearity, and were found to be significantly associated with a prior 12-month attempt to quit EC (aOR = 0.94, 95% *CI*[0.89, 0.99], $p = 0.029$, and aOR = 0.92, 95% *CI*[0.86, 0.97], $p = 0.004$ respectively) (Table 3).

DISCUSSION

This study aimed to examine factors associated with reporting a quit attempt in the prior 12 months. Whether or not the study participants engaged in a quit attempt in the past 12 months was associated with motivation to stop EC use, thought about quitting or reducing EC because of COVID-19, higher EC use sessions on weekdays, age, age of initiating EC use and age of initiating daily EC use.

More than one-third (37.0%) of the study participants had tried quitting EC use in the past 12 months. The 12-month quit attempt proportion in our study was higher than the ever-quit attempt reported in Central and Eastern European participants, which was only 13.9% (Jankowski et al. 2020), and past 12-month quit attempt, which was 15.2% participants in a US survey (Palmer et al. 2021), and 25% in a 2015-2016 survey among US adults (Rosen & Steinberg, 2020). One of the reasons affecting the prevalence of EC use may be the COVID-19 pandemic. In our study, those who had tried quitting in the past 12 months had higher odds of reporting being aware that EC use would increase complications due to COVID-19, and that the COVID-19 pandemic had made them think of stopping or decreasing their EC use. Another study in the U.S. reported that 21.2% had attempted to quit EC use to reduce COVID-19 risk of harm (Klemperer et al. 2020). Therefore, the COVID-19 pandemic may have implications on quitting EC use in Malaysia, and may even affect its prevalence. This warrants further investigation.

A higher motivation to quit EC use was associated with a prior 12-month quit attempt. This is consistent with an intervention study where increasing motivation to quit EC use was associated with higher quit rates (Graham et al. 2022). However, in this study, only 7.4% of the EC users had high motivation to quit EC use. This low motivation may be due to their positive perceptions of EC in comparison to smoking tobacco cigarettes, such as EC is healthier than tobacco cigarettes. Many individuals may not see the reason to quit EC use due to perception of its benefits. However, an intervention study by

TABLE 3: Factors associated with past-12-month quit attempt at vaping

	Crude OR				p-value	Adjusted OR[a]				p-value
	B	OR	Lower	Upper		B	OR	Lower	Upper	
EC use and smoking profile										
Current Dual User (EC user and smoker) (Yes)	.706	2.026	1.190	3.452	.009	.528	1.696	.829	3.470	.148
Ever smoker (Yes)	-.540	.583	.116	2.930	.512					
Smoked 100 cigarettes in lifetime (answered Yes)	-.891	.410	.192	.876	.021	-.560	.571	.213	1.529	.265
Daily EC user (Yes)	-1.115	.328	.168	.641	.001	-.386	.680	.283	1.636	.389
EC use sessions on weekdays (Mean, SD)	-.021	.979	.964	.995	.008	-.017	.983	.967	.999	.036
EC use sessions on weekends or holidays (Mean, SD)	-.006	.994	.985	1.002	.160					
Age of EC use initiation (Mean, SD)[§]	-.083	.921	.885	.958	<.001	-.085	.919	.869	.971	.003
Age starting daily EC use (Mean, SD)[§]	-.079	.924	.889	.961	<.001					
Does your favourite vape liquid contain nicotine? (Yes)	-.621	.538	.312	.926	.025	-.112	.894	.441	1.813	.756
Motivation to stop vaping	1.265	3.544	1.531	8.205	.003	.489	1.631	1.324	2.009	<.001
Minnesota nicotine Withdrawal	.031	1.031	.998	1.065	.065					
Glover-Nilsson Vaping Dependence										
Mild	-.111	.895	.550	1.456	.654					
Moderate	-.045	.956	.612	1.494	.844					
Strong	.069	1.071	.629	1.822	.800					
Very strong	.818	2.265	.597	8.598	.230					
Fagerstrom Test of Nicotine Dependence										
Low	-.011	.989	.641	1.526	.961					
Moderate	-.055	.947	.613	1.462	.806					
High	.325	1.384	.532	3.599	.506					
Perception on Vaping: I believe using EC is healthier compared to tobacco cigarettes (Yes)	-1.306	.271	.106	.690	.006	-.209	.812	.216	3.056	.758

Experienced side effects of vaping (Yes)	-.624	.536	.305	.942	.030	.062	1.064	.620	1.826	.823
Vaping behavior during COVID-19										
I am concerned about vaping increasing the chances of complications from COVID-19 (Yes)	.759	2.136	1.367	3.338	.001	.475	1.609	.883	2.932	.121
I have thought about quitting or reducing my vaping because of COVID-19 (Yes)	1.273	3.572	2.258	5.650	<.001	.904	2.470	1.359	4.491	.003
Age[§]	-.090	.914	.881	.948	<.001					
Marital status										
Single	.903	2.468	1.533	3.974	<.001	.791	2.205	.348	13.992	.402
Married/ Cohabiting	-.844	.430	.270	.685	<.001	.470	1.600	.273	9.374	.603
Divorced	-.167	.846	.208	3.443	.816		1.000			
Education										
Secondary	-.058	.944	.590	1.512	.811					
Diploma	.015	1.015	.654	1.576	.947					
Degree and above	.043	1.044	.645	1.689	.862					
Employment status										
Unemployed	.963	2.620	1.209	5.679	.015	-.047	.954	.292	3.119	.938
Government	-.081	.922	.520	1.634	.780	.035	1.035	.448	2.394	.936
Private	-.109	.897	.581	1.384	.623	.020	1.020	.534	1.952	.951
Self	-.197	.821	.498	1.354	.440		1.000			
Monthly Household Income										
<MYR 2,000	.602	1.826	1.144	2.915	.012	-.698	.498	.132	1.872	.302
MYR 2,000 to MYR 3,999	-.165	.848	.547	1.316	.462	-.706	.494	.141	1.724	.269
MYR 4,000 to MYR 5,999	-.514	.598	.321	1.114	.105	-.433	.648	.165	2.551	.535
MYR 6,000 to MYR 9,999	-.830	.436	.142	1.343	.148	-.560	.571	.104	3.142	.520
>MYR 10,000	.325	1.384	.532	3.599	.506		1.000			

[a]Hosmer and Lemeshow test, p=0.747; Chi2 (20)=94.87, p<0.001, Nagelkerke's R2=0.332. [†]Participant answered "Yes" or "No". "No" was used as the reference group. [§]"Age" and "Age starting daily EC use" demonstrated multicollinearity with "Age of initiating EC use", and therefore were not investigated in the multiple logistic regression. OR = Odds Ratio. aOR = Adjusted Odds Ratio.

Brewer et al. (2019) showed that sending text messages on the harm of EC increased motivation to stop EC use among US adults. Therefore, educational and health messages may be shared among EC users in Malaysia by the Ministry of Health Malaysia so that EC users could make an informed decision on whether to quit EC use or not.

The present study also found that younger age, younger age at EC use initiation, and younger age when starting daily EC use were associated with higher odds of a prior 12-month quit attempt. It is encouraging that younger EC users are attempting to quit EC use. A qualitative study among young people in the US found that young people want to quit EC due to wanting to be healthier, saving money, and wanting to be free from being addicted (Amato et al. 2021). Additionally, younger EC users typically begin using EC due to curiosity and positive perceptions of EC, may have higher odds for quitting EC than older adults when they lose interest, stop perceiving EC as being "cool", and become aware of health risks of EC use (Kong et al. 2015). A study showed that older adults are more likely to use e-cigarettes for smoking cessation, while younger adults are more likely to be naïve to tobacco cigarette use (Bandi et al. 2021). This may explain the lower odds of those who are older in this study to report a quit attempt in the prior year, as they may see EC as an important means of them quitting and being abstinent of tobacco cigarette use, in comparison with the younger EC users. For many adults who were older, this segment of the population tended to use EC to quit smoking tobacco cigarettes and this would have affected their attitudes toward EC use (Bandi et al. 2021).

This study has a few limitations. First of all, it was conducted during the COVID-19 pandemic, and therefore may have limited generalisability in the post-pandemic era. Secondly, this was a cross-sectional study and therefore we could not infer cause-and-effect from the results. We had also used the convenience sampling method and had recruited our participants through an online platform. Therefore, we were not able to limit bias or estimate the response rate. This decision was made due to the COVID-19 pandemic which limited mobility of researchers and potential participants. Post-COVID, future studies should consider face-to-face modes of data collection through quantitative and qualitative methods to obtain information on EC users' quit attempts, their motivations to do so and barriers to quitting EC.

CONCLUSION

The present findings offer insight in profiling EC users that may assist in helping them quit. Health literacy may be key to helping reduce disparities in terms of education where it comes to stopping EC use.

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