SARJANA
Vol. 40, No. 1, June 2025, pp. 80-104

TRIANGULATING DATA TO INVESTIGATE THE E-CIGARETTE AND VAPE PHENOMENON IN THE KLANG VALLEY: A MIXED METHODS APPROACH

Christina Chin[1], Amer Siddiq Amer Nordin[2]*, Shanthi Thambiah[1] and Vilashini Somiah[1]

ABSTRACT

This paper explores how mixed methods in social science research can unlock deeper insights into the fast-evolving phenomenon of e-cigarette and vape (ECV) use among adults in the Klang Valley, Malaysia. Employing a two-phase Explanatory Sequential Strategy of Inquiry, the study combines diverse datasets which includes the National E-Cigarettes Survey 2016 conducted by the Ministry of Health, an original survey completed by the users of ECV, and in-depth interviews with the users and other stakeholders, resulting in the blending of statistical patterns with rich, lived experiences. By triangulating primary and secondary data, this paper not only provides a blueprint for navigating complex, understudied topics but also offers practical guidance for policy makers to understand emerging public health trends both locally and globally.

Keywords*:* Health Belief Model; mixed methods; public health; vape; e-cigarettes.

INTRODUCTION

This paper outlines the methodology adopted in the research designed to understand the perceptions of ECV in the general public, as well as ECV users and stakeholders representing industry, government, non-governmental organisations (NGOs) and academia (see Table 1). Gender is an important influencing factor when it comes to public perceptions but this is not necessarily so among ECV users. The Health Belief Model (HBM) is used as a measurement tool to collect the main dataset, comprising a survey and in-depth interviews of ECV users. Stakeholder perceptions are assessed based on the findings of secondary raw data provided by the Ministry of Health, and the principal researcher's (CC) own survey and in-depth interviews with ECV users, in light of Malaysia's aim of becoming a smoke-free nation by 2040. The explanatory sequential mixed method was necessitated because the two sets of survey results had to be explained further with two sets of interview data. Failure to incorporate the qualitative aspect would mean that the manuscript addresses only the descriptive and predictive aspects of numerical data. Why males and females behave in a certain way, and their behavioural

similarities and differences in relation to health must be explained before meaningful and impactful policies can be suggested. The objectives of this cross-sectional research, which covers the social-psychological aspect of ECV use, are to show why the use of either a quantitative or qualitative methodology alone is insufficient to explore new areas of research; and to outline the triangulation of quantitative and qualitative results in exploring the relationship between demographic variables and perceptions outlined in the HBM. This paper describes the need for mixed methods research and explains how four sets of data are collected, analysed and triangulated, to understand real experiences and perceptions of ECV.

LITERATURE REVIEW

The social normalisation of smoking behaviours by allowing ECV use should be monitored (Jankowski et al., 2019). Health-related beliefs and behaviours have been identified as means for demonstrating femininities and masculinities (Courteny, 2000). Saltonstall (1993) adds that "the doing of health is a form of doing gender" as "health actions are social acts." The social practices of showing masculinity or femininity bring different health advantages and risks (Courtenay, 1998). Thus, this research explores why, contrary to the observation that men construct gender by ignoring healthcare needs and embracing risk (Courtenay, 2000), more males are using or transitioning to ECVs which the industry has marketed as "safer than cigarettes". This is particularly novel as research comparing health-seeking behaviour between the genders "notably lacks any qualitative methods of enquiry" (Galdas et al., 2005). While studies have been done on smoking and gender, there remains a gap in literature relating the health belief perceptions of males and females and their ECV use.

Gender

The rise of ECV use is seen as a threat to Malaysia lowering its smoking prevalence, as the devices could be a gateway for adults and young people who have never smoked before, to pick up tobacco products (Mohamed, 2016). The National Health and Morbidity Survey 2022 found that the prevalence of tobacco product use among Malaysian adolescents is 18.5%, with the majority (14.9%) using ECVs (MOH, 2022). While relatively little quantitative research has looked at gender role orientation and smoking, or has compared these relationships in men and women (Hunt et al., 2004), higher expressions of masculinity have often been equated with greater risk of poorer health behaviours (Helgeson, 1995). Woman are smoking more at a time when male consumption has stabilised (Wilkinson & Howard, 1997). It is now widely espoused that smoking, like other health behaviours (Courtenay, 2000), is best understood as a gendered phenomenon (Hunt et al., 2004). Increased female tobacco use is seriously threatening women's health, maternal and child health, and economic well-being, yet despite a clear need for it, there is still a lack of gender focus in tobacco control research (Amos et al., 2011).

Of particular importance to note is that social research, including "qualitative approaches that illuminate the impact of gender on smoking initiation, types of tobacco used, depth and frequency of inhalation, response to diagnosis and health-seeking behaviour, would help explicate health impacts and provide a sound basis for policies and programmes" (WHO, 2003). Changing health behaviour of men and women, especially in regard to smoking, may partly explain the narrowing of the gender gap in mortality. The former benefits of health for women diminish due to the adoption of risky behaviours, but become increasingly relevant to reducing mortality among men, as they adopt lifestyle changes according to body sensitivities and undergo health check-ups (Flandorfer et al., 2010).

The Health Belief Model (HBM)

The focus of the Health Belief Model (HBM) is to assess an individual's health behaviour through the examination of perceptions and attitude towards a disease. The perceptions discussed briefly are abstracted from Rosenstock (1974) and Glanz et al. (2002).

a) Perceived susceptibility: This examines the individual's opinions about how likely the behaviour they partake in is going to lead to a negative health outcome.

b) Perceived severity: This perception addresses how serious the diseases that a person is susceptible to can be.

c) Modifying factors: These are outside influences including culture, education, past experiences, skill, and motivation that affect how threatened a person feels by the outcomes of continuing the same behaviours that put her/him at risk.

d) Perceived threat: This perception considers how likely it is that a disease could develop.

e) Environmental factors: Demographic background such as race, ethnicity, socioeconomic status and peers can have an influence.

f) Cues to action: These refer to anything that triggers a decision to change behaviour, e.g., media or concerned loved ones.

g) Likelihood of action: After becoming aware of the potential for developing a disease if behaviour does not change, a person will weigh out the benefits and the barriers to determine if change is worth it.

h) Perceived benefits: A person will only stop if there is a benefit such as greater quality of life and better health.

i) Perceived barriers: Barriers could be anything from losing friends to not having enough money, or even self-efficacy problems, such as not believing in oneself. For change to take place, the benefits must be stronger than the barriers. Perceived barriers are a significant predictor of behaviour (Carpenter, 2010; Janz & Becker, 1984; and Jones et al., 2015).

This study only looks at four HBM constructs, namely: susceptibility, severity, benefits, and barriers, because these are the most reliable predictors of behaviour (Janz & Becker, 1984). Quantitative reviews of these four constructs also suggests that these variables are significant predictors of health-related behaviours (Abraham & Sheeran, 2005). The HBM is the most appropriate psychological assessment tool to be applied in this research "as it is the most widely used conceptual framework in health behaviour since the 1950s" and "applies to behaviours with the potential to reduce risks of developing a disease as well as the effects of an existing disease" (Skinner et al., 2015). HBM has been successfully used to predict long-term adherence behaviours, and its central tenets—i.e., perceived susceptibility, severity, benefits and barriers—are supported by systematic reviews, yet the model has not been used to design an intervention in the field of addiction (Webb et al., 2010). The gap in the use of the model to

develop interventions in nicotine addiction, specifically in relation to the use of ECV, are reasons why the HBM is used in this study.

Mixed Methods and Triangulation

The mixed methods strategy was used to collect data, provide statistical evidence, and explain patterns by understanding the health perceptions of ECV users. It is more than simply collecting and analysing both kinds of data. The results of the quantitative and qualitative data were used side by side to reinforce each other (Creswell & Plano Clark, 2007). Both philosophical assumptions and approaches are mixed and used in tandem so that the strength of the research is greater than if either a quantitative or qualitative method was used (Creswell & Plano Clark, 2007). This has the potential to neutralise, or even eliminate, the biases posed by the use of a single method (Creswell, 2009). As the research was a mixed methods study, the qualitative phenomenological philosophy and strategy was also adopted to "identify the essence of human experiences as described by the participants" (Creswell, 2009) to understand their lived experiences.

The strength of this method lies in the combination of both quantitative and qualitative data to obtain statistical, quantitative results from a sample, before following up with a group of individuals to help explain those results in more depth (Creswell, 2009). The sequential strategy of inquiry was used to better understand data collected during the study (Kushman, 1992). Using triangulation to obtain different but complementary data on the same topic, this paper combined the strengths of quantitative data, namely the large sample size, predictive trends, and generalisation of findings, to the detailed and in-depth analysis provided by the qualitative data.

Triangulation in this research, extends beyond the process of validating findings through multiple data sources – it is treated as a potential form of social change and used to deeply understand the complexities of ECV uptake (Denzin, 2012). The entire process from designing the research and developing the quantitative and qualitative measurement instruments, to analysing and presenting the final results, was triangulated and grounded in a more fluid, critical interpretive approach to mixed methods for a more in depth, nuanced understanding of the social phenomena of ECV use. (Denzin, 2012). Denzin's "Triangulation 2.0" was referred to as a basis to enrich the use of triangulation to gain a richer, and more detailed understanding of data and perspectives obtained from the mixed methods findings.

METHOD

Conceptual and Theoretical Framework

For the purpose of the research, the following operational definitions of key concepts were adopted (Table 1).

Table 1: Concepts, theories and operationalisation

Concept/Theory	Operationalisation
HBM	A psychological model (Hochbaum & Rosenstock, 1952) used as a tool to assess ECV perceptions and to predict health-related behaviour.
ECV	Electronic cigarettes are defined as a subset of electronic nicotine delivery systems (ENDS) by the WHO's Study Group on Tobacco Product Regulation (WHO, 2019). The National E-Cigarettes Survey 2016 defines e-cigarettes as nicotine-containing devices while vape is considered non-nicotine containing devices (MOH, 2016).
Smoking	To the best of the principal researcher's knowledge, Malaysia is the first—and possibly the only—country in the world to draw a distinction between ECVs based on their nicotine content, as it was at the time, illegal to sell devices containing nicotine (MOH, 2016; Parlimen Malaysia, 2019). The law, however, was changed on April 1, 2023, to allow for the sale of ECV containing nicotine (Zaliha, 2023). Thus, as work on this research had started before that date, a similar distinction is drawn between ECV—smoking is used to refer to conventional tobacco cigarettes while vaping refers to the use of ECV.
Addiction	Tobacco addiction involves the interplay of learned or conditioned factors, genetic, social and environmental factors, as well as pharmacology, which is the enhancement of mood, either directly or through relief of withdrawal symptoms, and augmentation of mental or physical functions (Benowitz, 2010).
Gender roles	Gender roles offer scripts for how women and men can and should behave. Consequently, defying gender role expectations can elicit personal, identity, and systemic threat (Morgenroth & Ryan, 2020).
Femininity	Tobacco use in Victorian society among women became associated with deviance from constructions of ideal feminine norms, and smoking was one tool which women could use to resist dominant notions of ideal feminine behaviour (Elliot, 2011).
Masculinity	In the early part of the 19th century, the imagery surrounding tobacco and its usage was masculine. Anti-tobacco literature assumed the smoker would be male (Elliot, 2001). The masculinity implied by smoking was a key part of the cultural symbolism challenged by women smokers during the 1920s in industrial countries. The tobacco industry attempted to reposition female smoking as "respectable…sociable, fashionable, stylish and feminine" (Greaves, 1996).

This research was guided by a conceptual and theoretical framework grounded in HBM, and used to explain the behaviour of ECV users from a gender perspective, as seen in Figure 1.

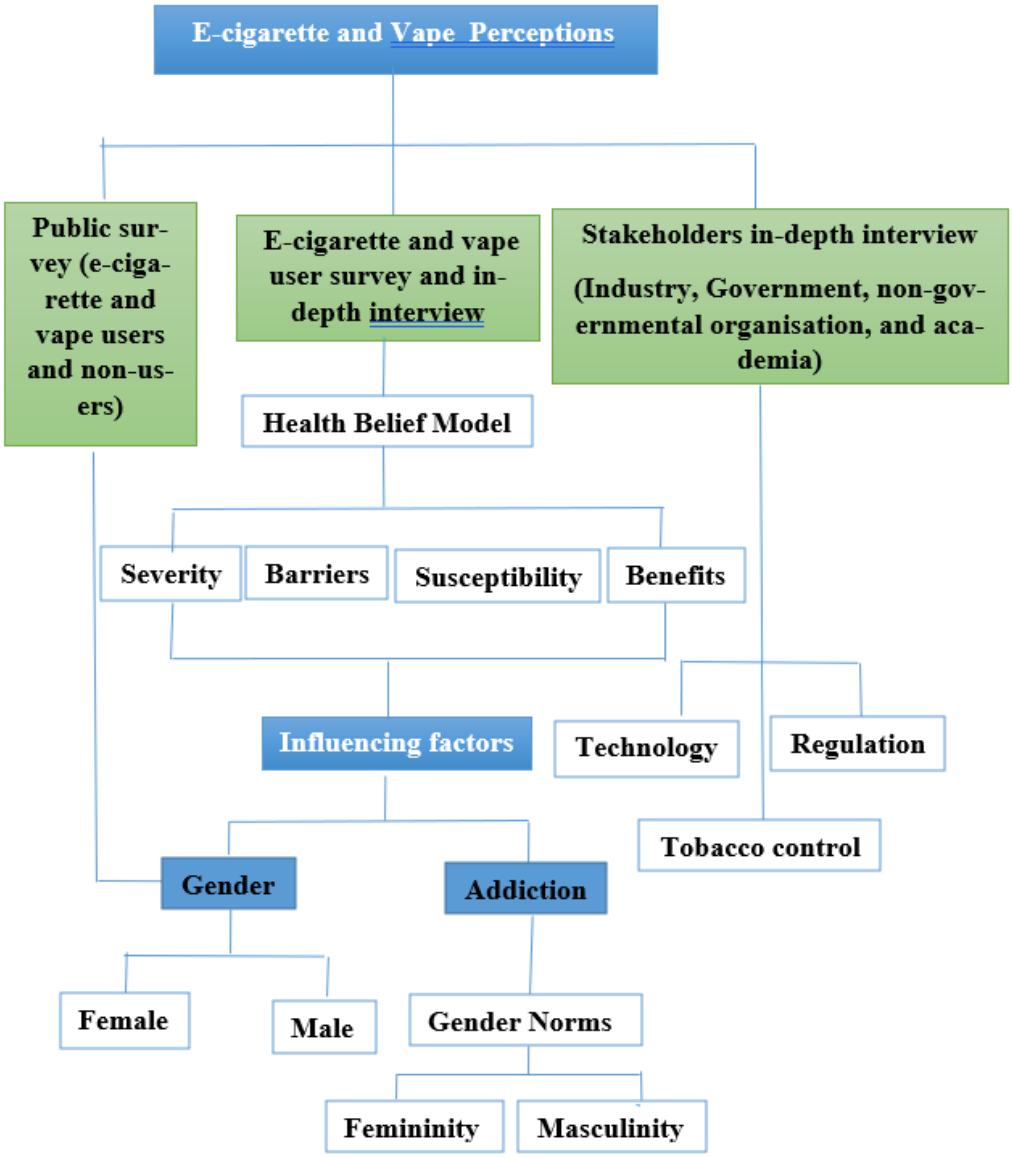

Figure 1: Conceptual and theoretical framework

HBM was used as a tool to understand the health-related perceptions of ECV users, with the influence of gender on user perceptions, as well as public perception. Stakeholders were interviewed to understand their perceptions of ECV use in Malaysia in relation to three main themes related to Malaysia's goal of becoming a smoke-free nation by 2040, i.e., tobacco control, technology, and regulation.

As this research was aimed at assessing the usage and transition to ECV, it was necessary that the theoretical framework is widely recognised as a sound gauge of behaviour. The HBM, which requires as few as six questions to assess its key constructs, assumes that people will engage in behaviour or take recommended action when they believe that doing so can reduce a health-related threat that is both likely and would result in severe consequences. More importantly, the model has been shown to be able to identify correlates of health behaviour that may help in designing appropriate interventions (Rimer & Brewer, 2008).

Used as a method to evaluate and explain individual differences in preventive health behaviour, the HBM is a good predictor of smoking behaviour, and can be used to develop

smoking prevention programmes (Li & Kay, 2009). Using HBM to determine factors influencing cigarette smoking behaviour of teenagers in Isfahan, Iran, Reisi et al., (2014) show that it can explain predictive factors systematically, and allow for better understanding of the behavioural complexities of smoking. The researchers recommend the use of the model for future studies looking to examine the predictors of cigarette smoking and to develop smoking prevention programmes. Mohammadi et al. (2017) also used the HBM to predict smoking behaviour among high school boys in Iran, and suggest that future studies examine girls for comparison. More recently, Pribadi and Devy (2020) examined the intention to stop smoking among young adult women smokers in Surabaya, and reveal a significant correlation with the perceived factors of HBM. As discussed, gender and smoking—and other related concepts—were integral to the theoretical framework in this research. These concepts relate to each other, and guide how the HBM was used to answer the research questions in the Malaysian context.

Mixed Methods Research Design and Purpose Statement

The postpositive philosophical worldview, traditionally seen in quantitative research, was adopted to "identify and assess the causes" (Creswell, 2009) that influence male and female users' perception of ECV. Thus, observational numeric measures were developed and the behaviour of ECV users were studied to answer the research questions. Using this scientific method, the principal researcher studied ECV uptake by identifying and assessing the causes that influence the perception of ECV users. Ideas were reduced into smaller sets that could be tested. In this research, the demographic variables of gender were tested to see if there was a difference in how males and females perceive ECV use on their health. This two-phased quantitative-qualitative methods research started with correlation and regression findings, which lays the foundation for further exploratory enquiries (see Figure 2).

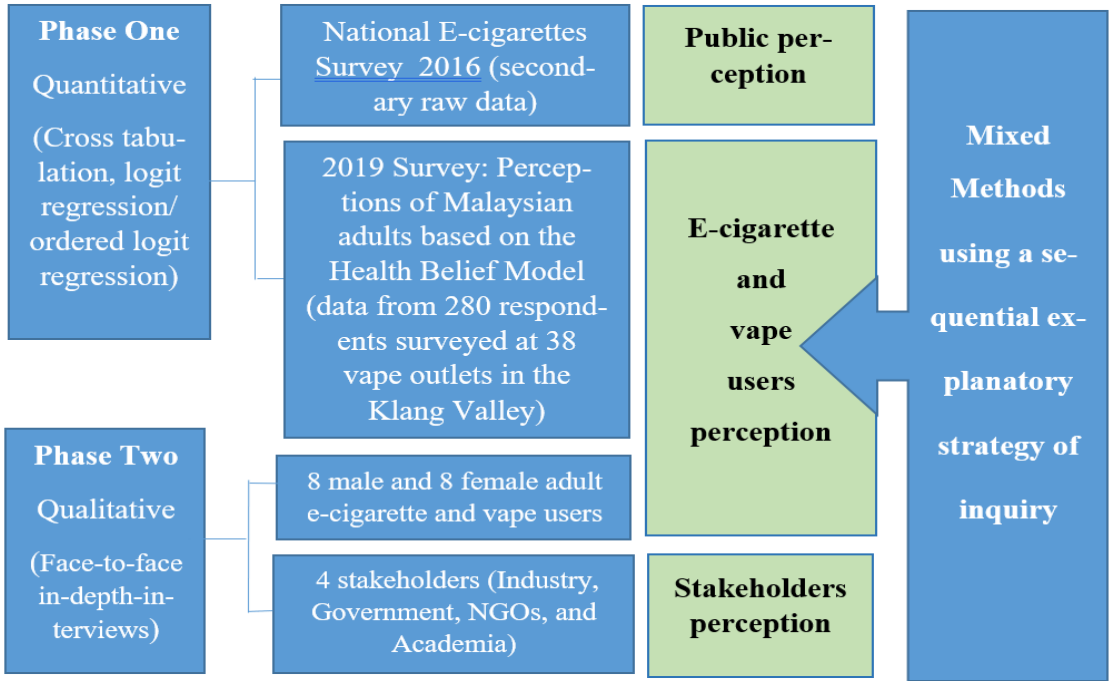

Figure 2: Explanatory sequential mixed methods research design

Phase One: Quantitative

National E-cigarettes Survey 2016 secondary data

Secondary raw data from the National E-Cigarette Survey 2016, which had already undergone methodological research rigour, was obtained from the MOH Institute of Public Health and analysed. The survey design, validation and data collection were done by the Institute. The principal researcher's contribution is in the analysis of the secondary raw data. The survey was conducted to measure the prevalence of ECV users in Malaysia—10,471 adults were sampled. Cross tabulations of the raw data by gender, education, ethnicity, and age, using Microsoft Excel, and logit regression analysis using Stata software were done to answer RQ1.

The survey included all Malaysian adults aged 18 years and above. The sample size, as explained in the National E-Cigarettes Survey 2016 report (MOH, 2016), was calculated using a formula for one-sample proportion. The final sample size after a 57% response rate was 5,722 ≅ 6,000 (MOH, 2016). The survey questionnaire form was developed with input from experts in tobacco control and smoking cessation from the MOH and academics (MOH, 2016).

The questionnaire was pre-tested at the International Islamic University of Malaysia in Kuantan, Pahang. Weaknesses were identified and improvements were made to the questionnaire. The published report states that data quality was assured at all levels and data collection was monitored using the National E-Cigarettes Survey 2016 IT system that was developed in-house. This includes the double data entry technique. Complex sampling analysis was performed using weight calculated from base or design weight and adjusted for response weight (MOH, 2016).

The study population was divided into six zones for data collection, namely, North, Central, South, East, Sabah and Sarawak. The data was collected concurrently in all zones in May and June 2016 before being posted to the central coordination office in Kuantan, where the double data entry process was carried out (MOH, 2016). Upon being given permission, data from the National E-Cigarettes Survey 2016 was exported to Stata for further analysis for the current study. Data was examined and cleaned for quality control. Analysis was performed according to the terms and working definitions provided by the principal researcher. Complex sample analysis procedures were used. Data was weighted in the analysis with attention to the complexity of the study design and response rate.

A chi-square test on whether the categories in each demographic variable responded differently, was done for the National E-Cigarettes Survey 2016. A logistic (or logit) regression estimating the demographic influences on perceptions of ECV was conducted, with emphasis placed on gender differences, if any. The estimation framework models the probability of a respondent answering in the affirmative to each of the 20 perception statements in the survey, dependent on his or her demographic characteristics. The collected data was analysed using frequencies (n) and percentages (%). For the quantitative data analysis, the statistical software Excel and Stata were used. A chi-square analysis was used to draw inferences from the data when demographic variables are associated with outcomes. Excel was used to cross tabulate ECV perceptions by demographic variables of gender, age, education, and ethnicity to answer RQ1.

A chi-square test was carried out to find out if there is a difference in how each category in a categorical demographic variable responds. Stata was used to do a logit regression analysis of gender effects on public perceptions of the National E-Cigarettes Survey 2016 to answer RQ1. A logit regression is carried out to determine how gender affects ECV perceptions, holding other demographic variables constant. The advantage of a logit regression over that of a simple chi-square test is that it provides control for other factors which may influence the effects of gender. It also provides an estimation of the probability of each gender answering yes to each of the survey questions, as well as the magnitude of their differences. The National E-Cigarettes Survey 2016 raw data is suitable for a logit analysis as the respondents are limited to a binary response. Along with the output from the logit regression, a two-tailed test was

performed on gender, the variable of interest, comparing responses from male and female respondents.

ECV Survey 2019

The National E-Cigarettes Survey 2016 raw data provide a macro understanding of general perceptions of ECV use among users and non-users. The research, however, necessitated a separate survey to explore very specific HBM perceptions in a micro population of male and female ECV users. This phase comprised a non-probability purposive sampling of adult ECV users who had visited outlets belonging to the biggest ECV company in the Klang Valley. A total of 380 survey questionnaires were distributed at all of the company's 38 outlets to ensure a wide demographic was represented. Of the 380 survey questionnaires distributed, 280, or 74%, were successfully filled out by ECV users.

The survey questionnaire, which contained 18 items, was adapted from the HBM 39-item Likert scale developed by Champion (1984) for her study of breast self-examination. As Champion's (1984) scales were developed for a different topic of study, reliability and validity tests were conducted on the measurement instruments used according to the process she used in her analyses.

To show the trustworthiness of the research, the face and content validation of the items in the quantitative measurement instrument were done by six tobacco cessation experts and addiction specialists from Universiti Malaya and the University of Auckland. The final version of this instrument contained 18 items that were either retained or corrected with minor modifications to ensure relevancy and clarity based on the Content Validity Index and Cohen's kappa, which are quantifiable methods to evaluate the input of the content experts (Zamanzadeh et al., 2014). The questionnaire garnered a Cronbach's alpha score of 0.782, indicating satisfactory to good reliability and internal consistency.

A multi-site data collection integrity monitoring plan was developed and tested during pilot data collection. The principal researcher adopted the single data entry with visual checking technique. The quality of data was assured, as data cleaning was carried out by the principal researcher. A human operator was engaged to manually validate the correct code for the questionnaire answers. Complex sampling analysis was performed using weight calculated from base or design weight and adjusted for response weight.

The questionnaire allowed five different responses on a Likert scale, namely, 'strongly agree', 'somewhat agree', 'neutral', 'somewhat disagree', and 'strongly disagree'. Specific focus was placed on the effects of gender on the four HBM perceptions. A chi-square test was conducted to find out if demographic variables and respondent's perceptions and attitudes towards ECV were independent of each other. This research focused on six demographic variables, namely gender, education, employment, race, religion, and marital status.

Stata was used to do an ordered logit regression analysis of gender effects on the HBM using data from the principal researcher's ECV Survey 2019. In the statistical analysis of this survey, an ordered logit model was carried out to estimate the magnitudes of associations. Due to the ordinal nature of responses, the binomial logit estimation framework used to analyse the National E-cigarettes Survey 2016 data is ill-suited to conduct this analysis. The ordered logit framework, which allows for the modelling of ordinal-scale responses, such as those in a Likert scale, is more suited to the E-cigarette and Vape Survey 2019.

An ordered logit regression model is estimated on the survey data collected in the principal researcher's survey. Unlike the National Survey 2016 dataset, where answers are binomial, respondents to the principal researcher's questionnaire answered on a five-point Likert scale: (1) 'strongly agree'; (2) 'somewhat agree'; (3) 'neutral'; (4) 'somewhat disagree'; and (5) 'strongly disagree'. A two-tailed test of significance for each of the coefficients of the

independent variables was conducted. Specific focus was placed on Gender, comparing responses from male and female respondents.

Phase Two: Qualitative

Face-to-face in-depth interviews with ECV users

Exploring the beliefs of ECV users in the in-depth interviews explains the reasons behind the HBM perceptions identified in the ECV Survey 2019. To understand the perspectives recorded in the survey, in-depth-interviews with an equal number of male and female ECV users were conducted. In-depth-interviews, which is popular in qualitative health science research, begins with a theoretical model (Creswell, 2009), and is hence suitable for this study, which adopted the HBM as a tool to explore perceptions.

Research participants were selected by snowball sampling—a common sampling method in qualitative research, particularly in medical science and in various social sciences (Noy C., 2008; Penrod et al., 2003). Snowball sampling is usually employed when no sampling frame can be constructed, as it is difficult to reach the study population (Kirchherr & Charles, 2018). ECV users are difficult to reach as they are a 'hidden' (Cepeda & Valdez, 2010) or 'concealed' (Morgan, 2008) population. When this study was conducted in 2019, the industry was still in its infancy and under scrutiny by the authorities, as nicotine e-liquids were being sold illegally (Code Blue, 2019). The snowball sampling began with the principal researcher asking 'well-situated people'—acquaintances of the principal researcher who were ECV users—the questions 'Who knows a lot about ECV?' 'Who should I talk to?' (Patton, 1990). The sample exceeded the acceptable minimum of 15 for qualitative research (Bertaux, 1981; Guest et al., 2006).

The semi-structured interview guide was adapted from the HBM scale developed by Champion (1984). The purpose of the interview guide was to capture the ideas and perceptions of men and women to see how the HBM perceptions apply, and the extent to which the beliefs differ or are similar between the genders. The 24 predetermined interview questions that cover the main domains of the model include perceived susceptibility, severity, benefits, and barriers. The interview guide questions were an elaboration of the survey questions developed to elicit unique experiences, emotions, and reasons behind their actions. Amendments were made to improve the semi-structured interview guide.

At the start of the interview, the research participants were briefed on the details of the research and asked to sign a consent form. All interviews were recorded using a tape recorder, smartphone, and tablet with the knowledge of the research participants. To ensure the reliability of the data obtained during the interviews, the interview recordings were transcribed verbatim by the principal researcher herself. This provided the "best database for analysis," especially for a novice researcher (Merriam, 2009). All transcribed interviews were reread by the principal researcher with the recordings for accuracy. The transcribed interviews were then arranged for data analysis. The techniques adopted in the research were those outlined in Creswell (2009), but the findings and discussions were structured according to HBM concepts (Schofield et al., 2008).

The research used gender analysis to explore the relevance of gender, gender roles, and gender norms in behaviour that promotes health. As the topic of this research is related to the health sciences, predetermined codes based on the theory being examined—in this case HBM—were used to identify the themes for the analysis of the interviews with ECV users. Subthemes were developed by analysing each interview line by line immediately after the interviews were transcribed (Peredaryenko & Krauss, 2013). Thus, the manual coding was both

deductive, in that the main themes were driven by HBM, and inductive, in that the subthemes were derived from the interview data. A coding sheet was prepared after all the interview transcripts were carefully read. The HBM's four main constructs (susceptibility, severity, benefits, and barriers) were identified as the main themes. Codes were then written on Post-It notes and pinned to a corkboard to give the principal researcher an overview of the data, as the codes are transformed into "higher conceptual categories" (Peredaryenko & Krauss, 2013) to allow sub themes to emerge. To ensure the reliability and validity of the coding sheet, an "intercoder agreement" (Cresswell, 2009) was developed, whereby another coder cross-checked the coding sheet. The interview participants were also given an opportunity to comment on the subthemes and findings (Cresswell, 2009).

Face-to-face in-depth-interviews with stakeholders

The in-depth-interviews with stakeholders from industry, government, NGOs and academia allowed the principal researcher to probe more deeply and to gain an insight from different groups of people. The industry stakeholders' experiences were compared and explored alongside the data collected from ECV users to better understand the behavioural pattern of the community.

Topic experts can reduce the number of participants needed in a study (Jette et al., 2000), thus only four stakeholders were invited to be interviewed. They were chosen for a specific reason as opposed to being randomly selected (Tashakkori & Teddlie, 2003). As topic experts and representatives of a larger group, these stakeholders can provide sufficient data to reach saturation where no more new findings are revealed (Döringer, 2021; Hennick & Kaiser, 2022). All stakeholders selected were purposively sampled, because the idea was to recruit reputable stakeholders who have been active in the industry or are interested in the area. These were "information rich" individuals (Tashakkori & Teddlie, 2010). Furthermore, as this research uses more than one method, it required fewer participants (Lee et al., 2002).

The stakeholder interviews were conducted with the Malaysia E-Vaporisers and Tobacco Alternative Association (MEVTA) representative and ECV patent holder; MOH Tobacco Control Unit head; Federation of Malaysian Consumers Associations tobacco control coordinator; and a tobacco cessation researcher, academic and medical doctor. The purpose of the interviews with stakeholders was to better understand the ECV industry as well as its impact on health policies to answer RQ4.

Based on the perceptions of the ECV users, according to the survey and in-depth-interview findings, a semi-structured in-depth-interview guide was constructed to explore the perceptions of the ECV stakeholders. The interview guide contained nine predetermined questions, which according to Lingard and Kennedy (2010), is typical of most studies that use this qualitative method. Amendments were made to improve the semi-structured interview guide after the face validation. The stakeholder interviews followed the same process as the interviews with ECV users.

The inductive coding process, where "patterns, categories, themes and sub themes emerged from bottom up" (Cresswell, 2009), was adopted. The initial sets of codes for the interviews with the ECV stakeholders were developed by analysing the interviews line-by-line. The principal researcher's codes were transformed into "higher conceptual categories" (Peredaryenko & Krauss, 2013) to allow themes and subthemes to emerge. To ensure the reliability and validity of the coding sheet, an intercoder agreement (Cresswell, 2009) was developed, whereby another coder cross-checked the coding sheet. The analysis was question-driven, seeking evidence of each of the elements of the model (Schofield et al., 2006).

Ethical considerations

Steps were taken to ensure that the research was done in accordance to professional and ethical standards. Informed consent and voluntary participation were obtained. All participants were asked about their interest in filling out the principal researcher's survey questionnaire and in being interviewed. They were all briefed on the research objectives and research design, before being asked to sign a consent form. It was made clear that they could pull out of the research at any point in time.

PROCEDURE

In this research, the findings from the National E-cigarettes Survey 2016, and principal researcher's own 2019 survey data (quantitative methodology) were used to inform the follow-up in-depth-interviews (qualitative methodology). The results from the quantitative methods helped identify participants for the in-depth interviews (Tashakkori & Teddlie, 1998). The qualitative data from the principal researcher's interviews are used to support and explain statistical results from the principal researcher's own survey. The sequential explanatory mixed methods strategy of inquiry was used to conduct this research. This research begun with a quantitative method, followed by a detailed exploration of individuals and stakeholder perceptions (Creswell, 2009).

RESULTS

The results from the data analysis between gender and HBM perception statements are discussed below. The complete results are presented in the Appendix.

Research Question 1: What is the correlation between demographic variables, particularly gender, and public perception of ECV?

Findings: From the chi-square analyses, we can conclude that the differences in perception stem from variations in gender, education, and age. Answers across the ethnic groups do not significantly differ. From the results of the chi-square test and logit regression, there is empirical proof of a clear difference in how male and female respondents perceive ECV. Both genders not only view ECV differently, but the magnitude of the differences between males and females are evident in the marginal effects values.

Research Question 2: How do demographic variables, particularly gender, influence HBM perceptions of adult ECV users in the Klang Valley?

Findings: From the chi-square analysis, we can conclude that the differences in perception stem from variations in education, employment level, ethnicity, religion, and marital status. Gender generally does not influence perception except in very specific behaviour, and even then, the influence is very nuanced.

Research Question 3: What are users' HBM perceptions and experiences with ECV, and how do these vary by gender?

Findings: ECV use is viewed by both men and women mainly as a health issue. The quantitative findings show that there is no difference in how males and females respond in 14 of the HBM perceptions. Gender was only statistically significant in 4 HBM perceptions.

Gender norms and stereotypes related to tobacco smoking are negated among men and women who are addicted to nicotine. Both genders were less averse to the idea of women vaping as compared to smoking cigarettes although there is still some stigma associated with females using ECV. The main benefit of ECV use seems to be that it is an alternative to smoking. However, quitting smoking is not the main reason for usage and transition to ECV among the majority of men and women. Both men and women indicated that they had a lot to gain by ECV because the devices: resulted in them either smoking tobacco cigarettes less or completely quitting tobacco cigarettes; were cheaper than tobacco cigarettes, convenient to use; and made them feel good mentally and emotionally. ECV are generally cheaper than cigarettes and does not eat into the respondents' work or activities with both genders citing improved mental and emotional feelings as a main reason for their ECV use.

Research Question 4: How should ECV be regulated if we want to achieve a smoke-free nation by 2040?

Findings: Three out of four stakeholders recommended a ban of ECV. It is not only the nicotine addiction that these stakeholders fear, but also the re-normalisation of the smoking habit among the population, and the normalisation of the habit among women and girls who traditionally do not smoke.

DISCUSSION

Gender proved to be an important variable in explaining the variation in perception of ECV among the Malaysian public, as revealed by the National E-Cigarettes Survey 2016, the government's first and largest national ECV survey. However, the principal researcher's own ECV Survey conducted in 2019 showed that gender generally does not influence perception except in very specific behaviour, and even then, the influence is very nuanced.

However, the sets of quantitative data (i.e. public perception and user perception), should not be compared, because the government survey comprised a much larger sample size, involved both ECV users as well as non-users, and looked at general health perceptions in relation to the use of ECV. The principal researcher's 2019 survey, however, comprised a sample of only ECV users to eliminate the possibility of bias by those who do not smoke or vape. This survey was also limited to a smaller, urban population, and looked specifically at HBM perceptions in relation to the use of ECV. Of the 18 HBM perceptions included in the principal researcher's survey questionnaire, the quantitative results show that gender only significantly effects perceptions in relation to anxiety about smoking-related disease when using ECV, financial security if the user is taken ill because of ECV, the use of ECV in preventing future problems, and concerns about ECV-related diseases. These quantitative findings, which are in line with Pribadi and Devy's (2020) study stating that the intention to stop smoking conventional cigarettes among young adult women has a significant correlation with HBM constructs, were explored via qualitative in-depth interviews.

Chi-square analyses, logit regressions and ordered logit regressions were used to analyse whether the gender variable significantly affected perceptions. Data from the National E-cigarettes Survey 2016 (MOH, 2016) showed that males and females perceive ECV differently in all 20 perception statements in the questionnaire. The principal researcher's own survey, however, only identified three important beliefs (i.e., benefit, susceptibility, and severity) that were influenced by gender in four perception statements. These perceptions were further explored in the interviews conducted after the survey. The main findings of this research were discussed in relation to the impact of gender and nicotine on the perceptions of ECV use, as summarised in Tables 2 and 3 (see Appendix).

STRENGTHS OF THE STUDY

Gender dimension

There are several studies looking at the profile of and topography of ECV users but based on literature review, this is the only—if not one of a handful—of mixed method studies using the HBM to explore the perception and behaviour of Malaysian ECV users according to gender. Studying the transition and use of ECV through a gender lens was novel, particularly as ECV was a new, emerging industry, at the time the research was initiated.

The gender aspect is particularly important because it is crucial in ensuring policies are effectively communicated, and measures formulated are relevant to both men and women. To influence health behaviour, it is imperative to first understand perception of individuals. This research attempted to go beyond the 'what' question. Harnessing the strength of the mixed methods approach and triangulation, this research also sought to address why certain perceptions are formed through the asking of questions beyond the interview guide. Interview responses that offer rationales give the principal researcher a glimpse into personal experiences, that not only explain the qualitative data, but also add richness to it.

The principal researcher consciously decided to only include ECV users in her 2019 survey, because unlike the National E-Cigarettes Survey 2016 survey, which has been criticised by vapers for its inclusion of the members of the public, i.e. people who may have not even tried using the devices themselves. Proponents of ECV have argued that there was a lack of locus standi among some participants to give their views about something that does not directly involve them. And, by only focusing on adult users, this research tried to eliminate, or at the very least minimise, responses from those who are merely experimenting with the devices.

Data triangulation

While this research is similar to Kushman's (1992) two-phase teacher workplace commitment study, where the quantitative and qualitative results are presented in the final discussion, the mixing of methods also occurred when constructing questions for the E-cigarette and Vape Survey 2019 and for the semi-structured in-depth-interview guide for ECV users and stakeholders. Both investigative and exploratory elements unique to quantitative and qualitative methods were utilised in formulating these mixed methods' instruments. The sequential explanatory strategy with its clear separate stages and straightforward design is its main strength. The design is easy to implement, describe and report (Creswell, 2009).

When presenting the results, the quantitative findings from the National E-cigarettes Survey 2016, and the principal researcher's own E-cigarette and Vape 2019 Survey, are discussed before proceeding with the qualitative findings (in-depth-interviews with users and stakeholders). This two-tiered discussion is meant to facilitate the exploration and triangulation process to discover the extent the HBM influences ECV usage among men and women. Finally, both quantitative and qualitative findings were discussed in tandem to answer the research questions.

WEAKNESSES OF THE STUDY

The Health Belief Model (HBM)

This research did not measure all perceptions of the HBM. The four constructs (i.e., benefits, susceptibility, severity and barriers) were considered, as seen in the survey design, since these

are the main pillars of the model in terms of their significance. Modifying factors, perceived threat, environmental factors, cues to action, and likelihood of action were not measured. While there are conceptual difficulties and multidimensionality in the operationalisations of the model (e.g., which variable is more important or the lack of ordering of the variables), and the small, albeit significant, effects of variables (i.e., susceptibility, severity, benefits and barriers), the principal researcher addressed these drawbacks by adopting 'good practices' in the research design, as outlined in the methodology. As the HBM's limited scope focuses on factors that affect the individual, interconnected cultural, environmental and social complexities were not fully accounted for. Social norms, the influence of peers and relationships may not be adequately measured. The model may not be able to provide insights into the broader nuances of social, cultural and religious diversity, which are particularly important in a country like Malaysia, in exploring ECV perceptions and health behaviours across genders. The model may have limitations in explaining intricacies evident in this new and dynamic ECV landscape, particularly in a multifaceted, multicultural country, where traditional gender norms and values are slow to change.

Sample population

More than half of the principal researcher's ECV Survey 2019 respondents did not finish their secondary school education. Thus, the sample may not be representative of the country's vaping population, as there could be a correlation and causation between education level and how ECV users choose to buy their vape products—e.g., online, as opposed to brick-and-mortar stores where the survey was conducted. This may have introduced a bias in the responses and the sample size of this survey is geographically limited to the Klang Valley (Kuala Lumpur and parts of Selangor). Thus, the sample of ECV users may have limited generalisability as the population of users surveyed were from a big city where the devices were widely used, and where users were likely to be more exposed to information about the product compared to those from smaller towns.

While the sample size was limited by time and funding, the limitation was addressed by doing in-depth interviews with 16 ECV users and four stakeholders. Also, to provide an accurate impression of the Malaysian demographics, the National E-Cigarettes Survey 2016 raw data was analysed. This was important as the data represents the largest national study on ECV to date. And, while this research is limited in its survey sample, the number of respondents in this research—which only looked at the Klang Valley—was somewhat proportionate to the sample size of the 2016 survey for the entire state of Selangor.

Biased responses may have also arisen from the self-reporting mechanisms in the data collection process. To minimise errors that could arise from self-reporting, the principal researcher verified the data entry and transcripts twice with the raw data and recordings before analysis was conducted. It should also be noted that the qualitative phases may not necessarily be imposed on a wider ECV-using population, as the nature and purpose of the method is to explore and understand rather than to generalise the behavourial findings.

Temporal gap in surveys and interviews

To put this research into perspective, it is important to note that the data collection—namely the principal researcher's own survey and in-depth interviews—were done during a very intense period where local and international research articles were flooding social media. The topic even received heavy coverage from mainstream media, whether in the form of local news or republished foreign reports. The principal researcher's survey and interviews were conducted between the months of July and October 2019, at a point where a proposed new Bill

to regulate tobacco-related products like ECV was expected. This might have caused some bias, as ECV users may have felt there was more at stake with their responses. This could mean that they may not have been as honest in answering questions about the negative aspects of ECV. The impact of this environment on stakeholders (government, NGOs, industry, and academia) must also be taken into account. Those for and against the use of ECV may have used this research as a platform to lobby either for a ban, more stringent regulation, or less strict laws.

The National E-Cigarettes Survey 2016, however, was conducted in 2016, during a period where the industry was booming, despite being relatively new in Malaysia. Thus, the sentiment of respondents may differ from those who participated in the principal researcher's own data collection. While the temporal gap between the data collected in 2016 and 2019 is discussed as a limitation because it could result in the findings of this thesis being outdated due to changing trends and behaviours, it is important to stress that the two sets of data were collected and analysed for different purposes. The two datasets are distinct and are not meant to be comparable. The 2016 survey was meant to give the principal researcher a general idea of public perception of ECV at the start of the industry's boom. The 2019 survey and in-depth interviews were conducted specifically to explore and to understand ECV users' health-related perceptions three years from when the devices were introduced in Malaysia.

The time gap between the 2016 and 2019 data collection can also be interpreted as a strength because it addressed the limitations of the national survey, namely that it was conducted among both ECV and non-ECV users, and that it was done at the peak of ECV popularity. Both these factors could have resulted in biased responses. The 2019 data findings can be seen as bringing the national survey up to date with the rapid evolution of the ECV devices. And, because the 2019 quantitative and qualitative data was the main component of the research, it ensured that the findings, when triangulated and taken in totality, were reflective of the latest trends.

CONCLUSION

This gender-specific study on HBM perceptions and ECV in Malaysia is novel as it adopts elements of Denzin's approach to triangulation in order to gain a deeper understanding and perspective into ECV use among men and women. This research gap needed to be addressed, because ECVs can either result in the demise of the tobacco industry or the resurrection of an addiction that had started to wane. Unlike variables such as age, race, and gender, an individual's beliefs can be modified to spur behavioural change if the right intervention is employed. Future research should look at: the use of Heated Tobacco Products (HTPs) in Malaysia and whether ECV users are transitioning to these devices; the influence of religion on ECV uptake as the National Fatwa Council has declared the devices haram; the impact of the recently gazetted Control of Smoking Products for Public Health Act (Act 852) on ECV prevalence; the impact of cultural norms on ECV use among women; the impact of COVID-19 on ECV users and the influence of social media on ECV prevalence.

ACKNOWLEDGEMENTS

The research was approved by Universiti Malaya's Ethics Committee and the MOH Medical Research Ethics Committee. The authors would like to thank Adrian Chan for his quantitative analysis insights; and the interview respondents for their time and invaluable input.

REFERENCES

Abraham, C., & Sheeran, P. (2005). The health belief model. In M. Corner & P. Norman (eds.), *Predicting Health Behaviour* (2nd ed.), 28–80. Open University Press.

Amos, A., Greaves, L., Nichter, M., & Bloch, M. (2011). Women and tobacco: A call for including gender in tobacco control research, policy and practice. *Tobacco Control,* 21, 236–243. http://doi.org/10.1136/tobaccocontrol-2011-050280

Benowitz, N. L. (2010). Nicotine addiction. *New England Journal of Medicine*, *362*(24), 2295–2303. https://doi.org/10.1056/NEJMra0809890

Bertaux, D. (1981). From the life history approach to the transformation of sociological practice. In D. Bertaux (ed.), *Biography and Society: The Life History Approach in the Social Sciences,* (pp. 29–45). SAGE.

Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication,* 25(8), 661–669. https://doi.org/10.1080/10410236.2010.521906

Cepeda A. & Valdez A. (2010). Ethnographic strategies in the tracking and retention of street recruited community-based samples of substance using hidden populations in longitudinal studies. *Substance Use and Misuse,* 45(5), 700–716. https://doi.org/10.3109/10826081003591282

Champion, V. L. (1984). Instrument development for health belief model constructs. *Advances in Nursing Science,* 6(3), 73–85. https://doi.org/10.1097/00012272-198404000-00011

Code Blue (2019, November 14). MP PKR kritik serbuan KKM terhadap peniaga vape. *Code Blue*. https://codeblue.galencentre.org/2019/11/14/mp-pkr-kritik-serbuan-kkm-terhadap-peniaga-vape/

Courtenay, W. H. (1998). *Better to die than cry? A longitudinal and constructionist study of masculinity and the health risk behavior of young American men* [Doctoral dissertation]. University of California at Berkeley.

Courtenay, W. H. (2000). Constructs of masculinity and their influence on men's well-being: A theory of gender and health. *Social Science and Medicine,* 50*,* 1385–1401. https://doi.org/10.1016/S0277-9536(99)00390-1

Creswell J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE.

Creswell, J. W. & Plano Clark, V. L. (2007*). Designing and Conducting Mixed Methods Research*. SAGE.

Denzin, N. K. (2012). Triangulation 2.0*. Journal of Mixed Methods Research, 6(2), 80-88. https://doi.org/10.1177/1558689812437186.

Döringer, S. (2021). 'The problem-centred expert interview': Combining qualitative interviewing approaches for investigating implicit expert knowledge. *International Journal of Social Research Methodology,* 24(3), 265–278. https://doi.org/10.1080/13645579.2020.1766777

Flandorfer, P., Wegner, C., & Buber, I. (2010). Gender roles and smoking behaviour. *Vienna Institute of Demography Working Papers*, *7*. Austrian Academy of Sciences (ÖAW).

Galdas, P. M., Cheater, F., & Marshall, P. (2005). Men and help-seeking behavior: Literature review. Integrative literature reviews and meta-analyses. *Journal of Advanced Nursing,* 49(6), 616–623. https://doi.org/10.1111/j.1362648.2004.03331.x

Glanz, K., Rimer, B., and Lewis, F. (2002). Health behavior and health education: Theory, research and practice. Wiley & Sons.

Guest, G., Bunce, A. & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods,* 18(1), 59–82. https://doi.org/10.1177/1525822X05279903

Helgeson, V.S. (1995). Masculinity, men's roles and coronary heart disease. In D. Sabo and D. Gordon (eds.), Men's Health and Illness: Gender, Power and the Body, 68–104. SAGE.

Hennink, M. & Kaiser, B.N. (2022). Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science and Medicine,* 292, 114523. https://doi.org/10.1016/j.socscimed.2021.114523

Hochbaum, G., Rosenstock, I. & Kegels, S. (1952). *Health Belief Model*. US Public Health Service.

Hunt, K., Hannah, M. K., & West, P. (2004). Contextualizing smoking: masculinity, femininity and class differences in smoking in men and women from three generations in the west of Scotland. Health Education Research, 19(3), 239–249. https://doi.org/10.1093/her/cyg061

Jankowski, M., Krzystanek, M., Zejda, J.E., Majek, P., Lubanski, J., Lawson, J.A., & Brozek, G. (2019). E-cigarettes are more addictive than traditional cigarettes: A study in highly educated young people. International Journal of Environmental Research and Public Health, 16(13), 2279. https://doi.org/10.3390/ijerph16132279

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. Health Education Quarterly, 11(1), 1–47. https://doi.org/10.1177/109019818401100101

Jones, C. L., Jensen, J. D., Scherr, C. L., Brown, N. R., Christy, K., & Weaver, J. (2015). The health belief model as an explanatory framework in communication research: Exploring parallel, serial, and moderated mediation. Health Communication, 30(6), 566–576. https://doi.org/10.1080/10410236.2013.873363

Kirchherr, J. & Charles K. (2018). Enhancing the sample diversity of snowball samples: Recommendations from a research project on anti-dam movements in Southeast Asia. *PLoS ONE*, 13(8), e0201710. https://doi.org/10.1371/journal.pone.0201710

Li, K. & Kay, N.S. (2009) Correlates of cigarette smoking among male Chinese college students in China—A preliminary study. *International Electronic Journal of Health Education,* 12*,* 59–71. http://www.iejhe.com/archives/2009/4178-14099-1-CE.pdf

Lingard, L. & Kennedy T. J. (2010). Qualitative research methods in medical education. In T. Swanwick (ed.), *Understanding Medical Education: Evidence, Theory and Practice* (pp. 323–335). Wiley-Blackwell.

Merriam, S. B. (2009). *Qualitative Research: A Guide to Design and Implementation.* John Wiley & Sons.

Ministry of Health Malaysia (MOH) (2016). *National E-cigarette Survey 2016: Prevalence, Pattern and Perception Regarding E-cigarette and Vape use Among Malaysian Adults.* MOH.

Ministry of Health Malaysia (MOH) (2022). *Technical Report National Health and Morbidity Survey (NHMS) 2022: Adolescent Health Survey*, *Malaysia* (Conducted by the Institute for Public Health). Kuala Lumpur.

Mohamed, M.H. (2016). Electronic cigarettes: Friend or foe? *International Medical Journal Malaysia*, 15(1), 1-2. http://irep.iium.edu.my/51289/

Mohammadi, S., Ghajari, H., Valizade, R., Ghaderi, N., Yousefi, F., Taymoori, P. & Nouri, B. (2017). Predictors of smoking among the secondary high school boy students based on the health belief model. *International Journal of Preventive Medicine,* 8*,* 24. https://doi.org/10.4103/ijpvm.IJPVM_264_16

Morgan, D. L. (2008). Sampling frame. In L. Given (eds.), *The SAGE Encyclopedia of Qualitative Research Methods*, 816–817. SAGE.

Morgenroth, T. & Ryan, M. K. (2020). The effects of gender trouble: An integrative theoretical framework of the perpetuation and disruption of the gender/sex binary. *Perspectives on Psychological Science*, *16*(6), 1113–1142. https://doi.org/10.1177/1745691620902442

Noy, C. (2008). Sampling knowledge: The hermeneutics of snowball sampling in qualitative research. *International Journal of Social Research Methodology*, *11*(4), 327–344. https://doi.org/10.1080/13645570701401305

Parlimen Malaysia (2019, October 14). *Penyata Rasmi Dewan Rakyat. Parlimen Keempat Belas, Penggal kedua, Mesyuarat Ketiga* (Hansard, no. 38). https://www.parlimen.gov.my/files/hindex/pdf/DR14102019.pdf#page=6&zoom=100&search=rokok

Patton, M. (1990). *Qualitative Evaluation and Research Methods*. SAGE.

Penrod, J., Preston, D. B., Cain, R. E. & Starks, M. T. (2003). A discussion of chain referral as a method of sampling hard-to-reach populations. *Journal of Transcultural Nursing*, 14(2), 100–107. https://doi.org/10.1177/1043659602250614

Peredaryenko, M. S. & Krauss, S. E. (2013). Calibrating the human instrument: Understanding the interviewing experience of novice qualitative researchers. *Qualitative Report*, *18*(43), 1–17. https://doi.org/10.46743/2160-3715/2013.1449

Pribadi, E. T. & Devy, S. R. (2020). Application of the health belief model on the intention to stop smoking behavior among young adult women. *Journal of Public Health Research,* 9(2). https://doi.org/10.4081/jphr.2020.1817

Reisi, M., Javadzade, S. H., Shahnazi, H., Sharifirad, G., Charkazi, A. & Moodi, M. (2014). Factors affecting cigarette smoking based on health-belief model structures in pre-university students in Isfahan, Iran. *Journal of Education and Health Promotion,* 3(23). https://doi.org/10.4103/2277-9531.127614

Rimer B. K. & Brewer N. T. (2008). Perspectives on health behaviour theories that focus on individuals. In K. Glanz, B. K. Rimer & F. M. Lewis (eds.), *Health Behavior and Health Education: Theory, Research and Practice*, 149–162. Jossey-Bass.

Rosenstock, I. M. (1974). The health belief model and preventive health behavior. *Health Education Monographs,* 2, 354–386. https://doi.org/10.1177/109019817400200405

Saltonstall, R. (1993, January). Health bodies, social bodies: Men's and women's concepts and practices of health in everyday life. *Social Science and Medicine,* 36(1), 7–14. https://www.sciencedirect.com/science/article/pii/027795369390300S

Skinner, C. G., Tiro, J. & Champion, V. L. (2015) The health belief model. In K. Glanz, B. K. Rimer & F. M. Lewis (eds), *Health Behavior and Health Education: Theory, Research and Practice*, 45–62. Jossey-Bass.

Schofield, I., Kerr S. & Tolson D. (2008, 14 April). An exploration of the smoking-related health beliefs of older people with chronic obstructive pulmonary disease. *Journal of Clinical Nursing,* 16, 1726–1735. https://doi.org/10.1111/j.1365-2702.2006.01876.x

Tashakkori, A. & Teddlie, C. (eds.). (2003). *Handbook of Mixed Methods in the Social and Behavioral Sciences.* SAGE.

Webb, T. L., Sniehotta, F.F., & Michie S. (2010). Using theories of behaviour change to inform interventions for addictive behaviours. *Addiction*, 105(11), 1879–1892. https://doi.org/10.1111/j.1360-0443.2010.03028.x

Wilkinson, H., & Howard, M. (1997) *Tomorrow's Women*, Demos.

World Health Organization (WHO) (2003, November). *Gender, Health and Tobacco.* https://www.tcsg.org/tobacco/minorities/Gender_Tobacco.pdf

World Health Organization (WHO) (2019). WHO study group on tobacco product regulation report on the scientific basis of tobacco product regulation. *WHO*. https://apps.who.int/iris/bitstream/handle/10665/329445/9789241210249eng.pdf?sequence=1&isAllowed=y

Zaliha, M. (2023). Kenyataan media: Pengawalan sediaan cecair atau gel mengandungi nikotin untuk tujuan merokok menggunakan rokok elektronik atau peranti pengewapan elektronik melalui rang undang-undang baru. *MOH*. https://www.moh.gov.my/index.php/database_stores/store_view_page/100/2313

Zamanzadeh, V., Rassouli, M., Abbaszadeh, A., Majd, H., Nikanfar, A. & Ghahramanian A. (2014). Details of content validity and objectifying it in instrument development. *Nursing Practice Today*, 1, 163–171. https://npt.tums.ac.ir/index.php/npt/article/view/24

Appendix

Gender and HBM perception statements that are not statistically significant

HBM perception statements affected by gender	**Quantitative n = 280**		**Qualitative n = 16**	
	Chi-square test (p-values)	**Ordered logit regression** (log-odds)	**Male (n = 8)**	**Female (n = 8)**
Benefits: Physical health, social, mental and emotional health and financial impact				
I have a lot to gain by using e-cigs/vaping	The majority of males (n = 121, 52%) and females (n = 20, 49%) agree more than they disagree. *P-value: 0.60*	The minority of males (n = 30, 12%) and females (n = 6, 15%) disagree more than they agree. *Log-odd: 0.221*	Most respondents (n = 13) transitioned from tobacco cigarettes to e-cigarettes because smoking made them smell bad and vaping was odourless and 'tasted nice'. *'You don't have cigarette butts around; you don't have that smell that sticks to you—your breath -doesn't affect you that way.' (M4)*	All respondents (n = 16) link ECV use to positive feelings of happiness, relaxation and stress relief. *'Happy… less stress… for 15 seconds when the nicotine kicks in you get kind of stoned… it calms you down a bit.' (F3)*
E-cigs/vaping can help me quit cigarettes	The majority of males (n = 156, 65%) and females (n = 24, 59%) agree more than they disagree. *P-value: 0.90*	The minority of males (n = 29, 12%) and females (n = 5, 12%) disagree more than they agree. *Log-odd: 0.314*	Half of the men (n = 4) and all except for one woman (n = 7), said e-cigarettes helped them either quit (n = 5) or reduce (n = 6) smoking. *'…vaping is the tool to stop people*	Heavy smokers and former smokers (n = 13) reported improved stamina and breathing, or prevented these pre-existing conditions from worsening because e-cigarettes had weaned them off cigarettes. *'… everyone said if you vape you will stop smoking, which happened.' (F7)*

			from smoking.' (M7)	
Susceptibility: Physical, mental and emotional health				
My chances of getting e-cigarette/vape-related health problems (e.g., respiratory issues) are high	The majority of males (n = 109, 46%) and females (n = 15, 37%) disagree more than they agree. *P-value: 0.79*	The minority of males (n = 50, 21%) and females (n = 9, 22%) agree more than they disagree. *Log-odd: -0.392*	All respondents (n = 16), including two male respondents with asthma and sinus, said they believe they are susceptible to ECV diseases. *'...whatever substance that we ingest in our bodies, if unchecked will definitely affect.' (M1)*	All respondents (n = 16) felt they were susceptible to respiratory illnesses and cancer. *'When you vape or you smoke or anything is a huge, huge risk of getting any illness'. (F2)*
Severity: Physical health, social, and financial impact				
I am afraid to even think about e-cig/vape—related diseases	The majority of males (n = 109, 46%) and females (n = 16, 39%) disagree more than they agree. *P-value: 0.12*	The minority of males (n = 35, 15%) and females (n = 12, 30%) agree more than they disagree. *Log-odd: -0.534*	While the respondents all perceive themselves to be susceptible to ECV-related diseases, the severity of the condition varies. *'I'm actually scared… but less worried compared to smoking… My chest feels lighter a bit.' (M5)*	The severity of e-cigarette-related conditions noted ranged from the external—namely dry skin and stained teeth, to a lack of stamina, dehydration and respiratory issues. *'I did think whether my boyfriend will become impotent…' (F7)*
Health problems I would experience from e-cig/vape-related diseases would last a long time	The majority of males (n = 105, 44%) and females (n = 22, 54%) were neutral. *P-value: 0.45*	The minority of males (n = 32, 13%) and females (n = 4, 10%) agree more than they disagree. *Log-odd: -0.200*	No major health concerns were reported among male and female users (n = 16). *'My parents disagree of me smoking or vaping…after seeing cases of kids with water in their lungs…' (M3)*	Casual smokers (n = 5) generally felt discomfort when using the ECV devices initially and did not think it really helped improve their health. *'I don't cough this much previously so I feel it's very, very harmful.' (F7)*
If I got e-cig/vape-related diseases, it would be more serious than	The majority of males (n = 131, 56%) and females (n = 21, 51%) disagree more than they agree.	The minority of males (n = 29, 12%) and females (n = 5, 12%) agree more than they disagree.	Respiratory impact was consistently cited among both genders. *'...vaping is better than cigarettes but*	Lung complications was the most severe condition both genders felt they were susceptible to. *'I think it will be more serious than people who*

smoking-related diseases	*P-value: 0.11*	*Log-odd*: - 0.304	*not so much…' (M7)*	*take cigarettes disease because I don't know what it's made from.' (F4)*
If I had e-cig/vape-related diseases, my whole life would change	The majority of males (n = 106, 45%) and females (n = 16, 40%) disagree more than they agree. *P-value: 0.66*	The minority of males (n = 48, 20%) and females (n = 11, 27%) agree more than they disagree. *Log-odd*: -0.356	None of the men (n = 8) were concerned. *'As long as you work or have investments I don't think it will impact your financial security if you get a disease.' (M1)*	Five women felt that their use of ECV would jeopardise their career. *'It would change my life.' (F2)*
Barriers: Masculine and feminine constructs				
It is embarrassing for me to use e-cig/vape	The majority of males (n = 164, 69%) and females (n = 27, 66%) disagree more than they agree. *P-value: 0.67*	The minority of males (n = 14, 6%) and females (n = 4, 9%) agree more than they disagree. *Log-odd: -0.241*	The men (n = 8) did not see the use of ECVs as diluting their masculinity although two of them admitted to being teased by smoker friends. *'I'm an old school guy…Men who vape are less manly than smokers…' (M3)*	The women (n = 6) did not feel less feminine when using ECVs and were not bothered about society's perception. *'I don't experience any embarrassment because maybe because I have nothing to prove…' (F1)*
E-cig/vape are harmful	The majority of males (n = 138, 58%) and females (n = 25, 62%) disagree more than they agree *P-value: 0.51*	The minority of males (n = 27, 11%) and females (n = 2, 5%) agree more than they disagree *Log-odd: -0.0739*	Mentally and emotionally, both men and women share somewhat similar fears. *'I see vape is safer than cigarette, than smoking is because I did both.' (M7)*	Teeth staining, skin problems, breathlessness, lack of stamina, cough and dehydration are some of the negative health effects respondents believe are caused by ECV use. *'…Most people would say that vaping is not as bad as smoking.' (F5)*
E-cig/vape are a waste of time and money	The majority of males (n = 126, 53%) and females (n = 18, 44%) disagree more than they agree. *P-value: 0.88*	The minority of males (n = 27, 12%) and females (n = 6, 15%) agree more than they disagree. *Log-odd: -0.335*	The men (n = 7) said it took less time to vape compared with smoking. *'You tend to smoke less… a few puffs and then you will stop. Cigarette you can't do that. When you light it up, it burns.' (M4).*	Everyone, except two women, said it was much cheaper than smoking. *'So instead of spending RM30 a day, if you're a heavy smoker, you're spending RM30 a week.' (F1)*

My family would make fun of me when I use e-cig/vape	The majority of males (n = 161, 59%) and females (n = 26, 64%) disagree more than they agree. *P-value: 0.88*	The minority of males (n = 25, 11%) and females (n = 5, 9%) agree more than they disagree. *Log-odd: 0.106*	The men (n = 8) did not see the use of ECVs as diluting their masculinity although two of them admitted to being teased by smoker friends. *'It doesn't really affect me.' (M4)*	Negative opinions are based on ECV being perceived by tobacco cigarette smokers as an inferior product, that have little to do with gender. *'My family doesn't know (laughs). Because I come from a religious background…it's a sin.' (F5)*
E-cig/vape interferes with my work and recreational activities	The majority of males (n = 161, 59%) and females (n = 27, 67%) disagree more than they agree. *P-value: 0.86*	The minority of males (n = 15, 7%) and females (n = 2, 4%) agree more than they disagree. *Log-odd: -0.171*	The men (n = 7) equated the use of ECV with higher productivity. *'The devices were quite easy to manage… barely takes out any of your time.' (M1)*	The women (n=7) agreed that it was not a waste of their time to vape. *'... increase of the ability to socialise.' (F6)*
E-cig/vaping would require starting a new habit, which is difficult	The majority of males (n = 118, 49%) and females (n = 22, 54%) disagree more than they agree. *P-value: 0.42*	The minority of males (n = 34, 15%) and females (n = 7, 17%) agree more than they disagree. *Log-odd: 0.347*	Almost half (n = 3) acknowledged that ECV did help with conversation. *'...vape is more efficient.' (M4)*	Female respondents (n = 3) cited ease of making friends and bonding in a social setting from using ECV. *'...you can use it indoors.' (F3)*
I am afraid I won't like the long-term experience of e-cigs/vaping	The majority of males (n = 123, 52%) and females (n = 21, 51%) disagree more than they agree. *P-value: 0.92*	The minority of males (n = 34, 15%) and females (n = 5, 9%) agree more than they disagree. *Log-odd: -0.0974*	All respondents believe that they would be able to stop using the devices. *'I could be blowing bubbles through a straw. It's just something for me to do.…' (M1)*	All respondents (n = 16) said the physical movements which mimic smoking and the nicotine led to the positive feelings. *'You're still sucking something in and blowing out smoke.' (F7)*

Table 3: Gender and HBM perception statements that are statistically significant

HBM perception statements affected by gender	**Quantitative n = 280**		**Qualitative n = 16**	
	Chi-square test (p-values)	**Ordered logit regression** (log-odds)	**Male (n = 8)**	**Female (n = 8)**
Benefits: Physical health, social, mental and emotional health and financial impact				
Using e-cigarettes/ vaping prevents future	N/A	A higher proportion of females disagreed (n = 7, 17%) as	All except one non-smoker (n = 7) admitted that e-cigarettes were	Although uncertain about the type and degree of harm, all (n=8) believed that e-cigarettes would

problems for me		opposed to males (n = 29, 12%). *Log-odd:* 0.601 (p<0.1)	not 100% safe but said they were feeling better about their health. *'I get a massive migraine, headache* or sometimes heartburn from my smoking. But since I switched fully to vaping, a few months ago, those things are almost normal.' (M8)	cause them health problems in the future. *'No matter what level of nicotine is—high or low—it's still dangerous.' (F2)*
I would not be anxious about smoking-related diseases if I used e-cig/vape	A higher proportion of females disagreed (n = 11, 26%) as opposed to males (n = 46, 19%) *P-value:* 0.09 (90%CI)	N/A	All (n = 8) felt their risk of getting smoking-related diseases were lower with ECV. *'Smoking was heavier for my lungs. When you're vaping, you don't feel the heat.' (M5)*	All except two (n = 6) were anxious about smoking-related diseases as they equated it with diseases caused by ECV. *'...my boyfriend doesn't like to see me vape sometimes because if I get pregnant, it's gonna be difficult…' (F7)*
Susceptibility: Physical, mental and emotional health				
I worry a lot about getting e-cig/vape - related diseases	N/A	A higher proportion of males disagreed (n = 104, 44%) as opposed to females (n = 45, 32%) *Log-odd:* (p<0.1)	All (n = 8) denied having concerns but as the interviews progressed, it was apparent that they all shared a certain degree of worry but were either dismissive of those fears, left it to 'luck' and 'fate', or did not want to think about them. *'I'm afraid to think about what could happen… it's ok… it won't happen to me' (M4)*	All (n = 8) felt uneasy, anxious and worried, brushing off their concerns with nervous giggles and uncertainty when asked if they were worried about getting sick. *'...too much of anything is no good also.' (F5)*
Severity: Physical health, social, and financial impact				

My financial security would be endangered if I got e-cig/vape-related diseases	A higher proportion of males disagreed (n = 98, 41%) as opposed to females (n = 14, 34%) *P-value:* 0.09 (90%CI)	A higher proportion of males disagreed (n = 98, 41%) as opposed to females (n = 14, 34%) *Log-odd:* -0.678 ($p<0.05$)	The men (n = 8) did not think they would become so ill as to not be able to work because of their ECV use. And, even if they did become sick, they believed their savings, investments and insurance would be enough. *'... hopefully insurance will be able to cover if not than it will be a financial burden.' (M2)*	The majority (n = 5) agreed that their career and ability to earn a living would be compromised. F2 was concerned about the financial impact if she suffered from a condition so severe that she could not work, while F7 said not using ECV made her difficult to deal with at work which could hamper her career progression and her performance. *'It would affect my financial security because I have to go on medication.' (F2)*

[1] Gender Studies Programme, Faculty of Arts and Social Sciences, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

[2] Department of Psychological Medicine, Faculty of Medicine, Universiti Malaya, 50603 Kuala Lumpur, Malaysia. +603 79492068. amersiddiq@um.edu.my

[*] Corresponding author