

Review Article

Factors of e-cigarette use among Malaysian adolescents: A systematic review

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ABSTRACT

E-cigarette use remains a virulent issue in public health worldwide. Like various tobacco products, smoking e-cigarettes cause significant health risks to consumers, especially adolescents. To understand the enormity of this matter, it is best to be aware of the factors linked with using e-cigarettes to develop preventive strategies at an early adolescent stage. This current systematic review aims to explore and scrutinize the latest information on the factors linked to e-cigarette use among adolescents in Malaysia. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement were employed in this systematic review. The literature search used available online databases (Scopus, PubMed, Google Scholar) to select original articles published between 2013 and 2022. A total of 5 articles were chosen to be incorporated in this systematic review. Various factors linked to e-cigarette use were discovered, such as risky lifestyle behavior, including alcohol and drug abuse, unmarried parents living together, insufficient knowledge and awareness of the health and well-being effects of e-cigarettes, and lack of exposure to e-cigarette education in school. Therefore, targeted prevention steps dealing with policies, laws, and regulations must be developed to address contributing factors leading to e-cigarette use to solve the evolving issue effectively. Thus, it is necessary to monitor and evaluate current programs and interventions on e-cigarette use among adolescents in Malaysia to prevent its expansion towards the community.

Keywords: Adolescent, Factors of e-cigarette use, Vape, Sabah, Sarawak, Malaysia

INTRODUCTION

The popularity of e-cigarettes began to rise worldwide.^[1] This electronic device is identified as electric-powered technology that produces an aerosol by heating its e-liquid solution using a wire-wrapped coil inside the e-cigarettes.^[2] In the market, the e-cigarette device has various shapes and models to attract the buyer, such as pens, gadgets, and even similar to conventional cigarettes.^[3] The common ingredients of e-cigarettes consist of multiple additives, including flavors like fruits and beverages dissolved in glycerine solution or propylene glycol that serves as a vehicle to deliver the taste when inhaled.^[4] Two distinct types of e-cigarettes can be found in the market, usually known as nicotine and non-nicotine delivery systems operated electronically.^[5] Nonetheless, there is evidence that the harmful effects for e-cigarette and non-e-cigarette users are similar when exposed to the aerosol containing nicotine and other hazardous compounds.^[6] Adolescence is the critical stage of humans developing healthy behaviors, whereby smoking and other habits will be carried into adulthood.^[7] The increase of e-cigarette users

in recent years with the surge of various nicotine delivery devices like shisha, has changed the panorama of e-cigarettes to the declining adolescent tobacco user.^[8] According to data from 22 countries, utilization of electronic devices that carry nicotine and non-nicotine delivery systems by adolescents aged 13–15 is higher as compared to adults.^[9] Shockingly, most e-cigarette liquids labeled non-nicotine contain nicotine that causes addiction and can damage the adolescent's brain.^[10] Furthermore, various factors lead to the use of e-cigarettes among adolescents, for instance, the appealing forms and smell of the flavors offered.^[11] Meanwhile, some adolescents consider e-cigarettes safe and less harmful than conventional cigarettes, while others use e-cigarettes for smoking cessation.^[12] In addition, it is identified that the higher risk factors of e-cigarette users include males living in urban communities.^[13] It is also proven that e-cigarette use is more likely linked with other risky habits such as conventional cigarette smoking, drug use, and alcohol use.^[14] Moreover, using e-cigarettes is also associated with poor parental guidance and monitoring, parents using tobacco

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products, and family breakups history.^[15] In Malaysia, there is a lack of studies on e-cigarette use among adolescents, as the study often focused on adults.^[16] The local studies exploring the association between the factors of e-cigarette use are also insufficient, and unable to provide a better grasp on the differences in culture, norms, legislation, and parenting techniques.^[17] To support the Malaysian government in developing and implementing the prevention steps, every community member should come together to address the issue of e-cigarette use among adolescents. Thus, it is essential to provide a deeper understanding and clear insight towards preventing the increase of e-cigarette use as early as possible to protect adolescents from chronic illnesses in future. Ultimately, this systematic review offers an in-depth examination of the distinct factors, temporal trends, and changes in the usage of e-cigarettes among adolescents to provide valuable data for ongoing research and policy improvement to safeguard public health in Malaysia.

MATERIAL AND METHODS

This review was conducted using a systematic review regarding Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) tools commonly used in the systematic review study.^[18] PRISMA is widely used among researchers to produce critical findings on the collected studies.^[19] This systematic review aims to discover the factors of e-cigarette use among adolescents in Malaysia. Meanwhile, the mnemonic elements such as population, exposure, and condition focus on the adolescents in Malaysia, including Sabah and Sarawak, using e-cigarettes and factors of e-cigarette use, respectively. This systematic review used the selected articles to identify and synthesize existing evidence on the factors influencing e-cigarette use. Various elements were considered when choosing the pieces, including the key demographic characteristics, social and peer influences, marketing and advertising roles in e-cigarette initiation, existing regulatory or policy factors on the use of e-cigarettes, and the evolving factors about the determinant and prevalence of e-cigarette use, especially among adolescents. The study population focuses mainly on adolescents aged between 10–19 years with exposure to e-cigarettes or vaping. The articles were excluded if the primary objectives did not focus on the usage of e-cigarettes among Malaysian adolescents or if the data presented was insufficient to be included in this systematic review. The screening of titles and abstracts was done carefully when selecting the articles for the systematic review based on the inclusion and exclusion criteria. Therefore, any discrepancies were resolved through discussion with the authors. The data was extracted with standardized vital elements such as demographics study characteristics, including factors and

Table 1: Search keywords.

Databases	Keywords used
Scopus	(1) TITLE-ABS-KEY (((((((("Factors" OR "Determinant" OR "Use" AND ("E-cigarette" OR "Vape" OR "Electronic cigarette")) AND ("Adolescent")) AND ("Youth")) AND ("Malaysia"))
PubMed	(1) TITLE-ABS-KEY (((((((("Factors" OR "Determinant" OR "Use" AND ("E-cigarette" OR "Vape" OR "Electronic cigarette")) AND ("Adolescent")) AND ("Youth")) AND ("Malaysia"))
Google Scholar	(1) TITLE-ABS-KEY (((((((("Factors" OR "Determinant" OR "Use" AND ("E-cigarette" OR "Vape" OR "Electronic cigarette")) AND ("Adolescent")) AND ("Youth")) AND ("Malaysia"))

determinants of using e-cigarettes among adolescents in Malaysia.

Searching strategy

The article search was done in August 2023. The search engines used to obtain the articles were PubMed, Scopus databases, and Google Scholar. Table 1 shows the keywords used to look for related articles required for the systematic review. To compare and remove the duplicate articles, the EndNoteX7 library was employed according to a study conducted to remove duplication of articles using the EndNote application.^[20]

Eligibility criteria

The inclusion criteria were: (1) the article must be written in the English language; (2) the article type must be original articles that aimed to explore the factors linked to e-cigarette use among adolescents throughout Malaysia, as well as articles in the Peninsular and Borneo region. Meanwhile, other than non-original articles, for instance, meta-analyses, systematic reviews, commentaries, conference proceedings, perspectives, reports, and opinions were eliminated from the study. The publication period was set from 2013 to 2023 to obtain the recent discovery.

Study selection

A total of 36 potential articles were screened and reviewed to select suitable articles according to the criteria set. After careful consideration from independent reviewers based on the inclusion and exclusion criteria, 5 articles were kept for content screening. Of 36 studies, 31 were excluded, and 5 articles were selected for the systematic review.

Data extraction

The data extraction is shown in Table 2, which includes authors/journal, primary aim, study design, age group, total

Table 2: Summary of included research.

Author/journal	Primary aim	Study design	Age group	Total Participants	Associated factors
Jane Ling <i>et al.</i> 2022 ^[17]	To examine the sociodemographic and lifestyle behavior among e-cigarette users.	Cross sectional	13 to 18 years	22,228	<ul style="list-style-type: none"> • Male, Malay • 16 to 18 years old (Highest user) • Urban locality • Conventional cigarette user • Drug and alcohol users • Unmarried parents living together • Parents using a tobacco product
Mohd Radzi <i>et al.</i> 2021 ^[21]	To explore the nicotine dependency among e-cigarette users.	Cross sectional	13 to 17 years	227	<ul style="list-style-type: none"> • Male, Malay • 17 years old (Highest user) • Rural locality • Parents Education (Secondary School)
Nur Atikah <i>et al.</i> 2019 ^[22]	To identify the factors of using e-cigarettes.	Cross sectional	13 to 17 years	422	<ul style="list-style-type: none"> • Male • 14 years old (Highest user) • Household income between (Malaysian Ringgit (RM) 1001 – RM 4000) • Recreational cigarette smoker
Robert Lourdes <i>et al.</i> 2019 ^[23]	To discover the initiation factors of using e-cigarettes.	Cross sectional	10 to 19 years	13,162	<ul style="list-style-type: none"> • Male • 16 to 19 years old (Highest user) • Malay, Sabahan and Sarawakian • Conventional cigarette user
Yusof <i>et al.</i> 2019 ^[24]	To recognize the determinants of e-cigarette use.	Cross sectional	18 to 19 years	388	<ul style="list-style-type: none"> • Male, Malay (Kelantan) • Conventional cigarette user • Peer pressure • Curiosity • Pleasurable flavors

participants, and associated factors on e-cigarette use among adolescents in Malaysia.

RESULTS

A total of 156 articles were obtained from SCOPUS, PubMed, and Google Scholar using keywords in Table 1. After rigorous screening of 36 articles, 5 were included for review as shown in Figure 1, PRISMA flow diagram. Meanwhile, Table 2 presented the findings from 5 articles in the review. In addition, Figure 2 reveals the percentage of e-cigarette use among adolescents that participated in the study. Article 1^[17] reported that 9.1% out of 22,228 participants were identified as e-cigarette users. Meanwhile, article 2^[21] revealed that out of 227 participants, 52.9% were reported to be e-cigarette users. The highest percentage of e-cigarette users were from article 3^[22], with 73% out of 422 participants. The highest percentage observed in this study may be due to the small number of participants. Furthermore, article 4^[23] recorded only 9% out of 13,162 participants, and only 14.4% out of 388 were identified as e-cigarette users for article 5.^[24] All articles presented studies done throughout Malaysia, including East and West Malaysia. The articles included in this systematic review were cross-sectional studies published between 2018 to 2022.

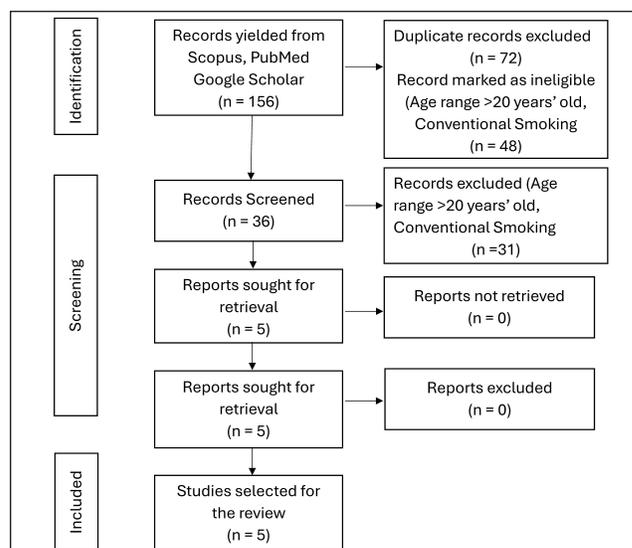


Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flow Chart.

Factors and determinants of E-Cigarette use

Socio-demographic

Among the 5 articles selected for this review, most reported that Malay males were identified as high users of e-cigarettes.

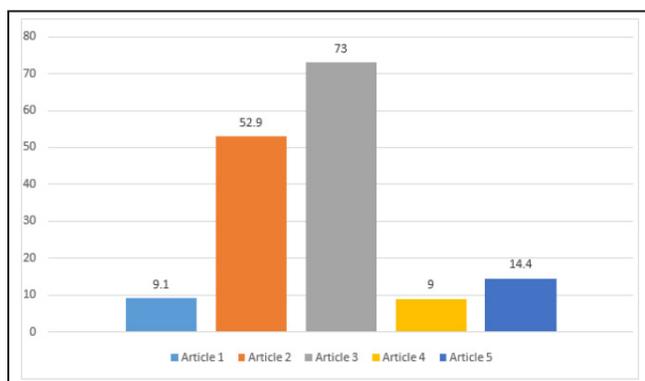


Figure 2: Percentage of e-cigarette use among adolescents.

Therefore, it is described as one of the risk factors for e-cigarette use among adolescents between 13 and 19. The findings may be due to the highest number of participants of Malay race and male gender. It was also found that most e-cigarette users were Malays, Sabahan, Sarawakian, and Bumiputeras schooling in urban localities. Meanwhile, another current study identified that many e-cigarette users were schooling in rural localities.^[21] One study mentioned that the household income between Ringgit (RM) 1,001 to RM 4,000 also serves as another critical risk factor for e-cigarette use among adolescents.^[22] Furthermore, a higher odd ratio of using e-cigarettes, about 2.25, was observed among Malaysian adolescents, including Malay, Sabahan, and Sarawakian Bumiputera.^[23] Nevertheless, it is identified that older adolescents aged 17–19 years old, with both parents having secondary school backgrounds, have a significant risk of e-cigarette use.^[21, 23] A recent study found that older adolescents between 16 and 18 have higher chances of using e-cigarettes.^[17]

Parents and peers

The peers and parental factors were considered important factors associated with adolescent use of e-cigarettes. One study mentioned that in West Malaysia, the adolescents who identified as e-cigarette users reported that they have unmarried parents living together and at the same time using tobacco products.^[17] Furthermore, it is found that in Malaysia, adolescents with peers who use e-cigarettes have 12 times higher odds of utilizing the same product.^[24] The same article also mentions that adolescents with parents using e-cigarettes also contribute to adolescents following their path of utilizing e-cigarettes.

Alcohol and drug use

In 2022, a study stated that adolescents who use e-cigarettes were identified as current alcohol users, with 7.7% and 2.7% out of 22,228 adolescents being current drug users.^[17] This result shows that the risk of taking e-cigarettes is also

significant to adolescents who are currently using substances like drugs and alcohol products.

Smoking status

Three articles in this study mentioned a greater risk of using e-cigarettes when adolescents used conventional cigarettes. Meanwhile, one article stated that adolescents who use e-cigarettes are also identified as smoking a conventional cigarette as a recreational means.^[22] Meanwhile, 13.9% of 22,228 respondents were reported as current smokers using e-cigarettes simultaneously.^[17] Furthermore, it is reported that many adolescents use e-cigarettes out of curiosity and as experimentation on the taste of e-cigarette products that contain a variety of flavors at lower prices.^[24]

DISCUSSION

E-cigarette use is prevalent among adolescents, which continues to challenge public health worldwide in preventing and protecting the community from e-cigarette hazards. Additionally, it is stated that e-cigarettes are harmful among adolescents as most e-cigarette products contain nicotine that is highly addictive and destroys brain development.^[25] In a recent study, e-cigarette is known to produce adverse consumer effects, including lung disease resulting from an imbalance of reactive species in the tissues and cells.^[26] Moreover, monitoring e-cigarette use in adolescents is crucial to fight against the global tobacco epidemic, as the World Health Organization (WHO) specified.^[9] Therefore, to create an effective intervention, it is paramount to understand the factors and determinants of e-cigarette use among adolescents to provide a strong foundation for designing a contemporary prevention strategy. Hence, this systematic review discussed several aspects of e-cigarette use among adolescents, including sociodemographics, parents and peers, alcohol and drug use, and smoking status. In this sociodemographic result, identical findings were found in the study conducted in the United States, whereby gender, male, and school location influence e-cigarette use among adolescents.^[27] The number is significant among male adolescents, who often consider e-cigarettes less harmful than conventional cigarettes.^[28] Nevertheless, internet advertisement exposes adolescents to controversial information, such as the health benefits of e-cigarette use.^[29] Other than that, the influence of e-cigarette use has been seen in research in the United States that peer relationship is significant in adolescents embracing social culture.^[30] Hence, adolescents may use e-cigarettes to be accepted among friends and circle.^[31] Parents who use e-cigarettes also indirectly influence their kids to follow their smoking behavior.^[17] Besides, adolescents schooling in urban areas are known to use e-cigarettes as the product is easy to obtain and readily accessible through various platforms

offered online with good internet connection.^[32] This systematic review also found that adolescents with unmarried parents living together and using tobacco products contribute to using e-cigarettes on their children.^[33] E-cigarettes offer many flavors with appealing forms, making adolescents want to try using e-cigarettes without having second thoughts about their short and long-term effects.^[24] In Hong Kong and the Republic of Korea, a study demonstrated that risky behaviors such as usage of tobacco, drugs, and alcohol have been recognized as the main components, contributing to the use of e-cigarettes among adolescents.^[34] Despite obtaining good information from studies included in this systematic review, some limitations to this review also exist. One limitation of this review is not being able to identify the causal relationship as all articles' study design is cross-sectional. Apart from that, some biases in this systematic review, such as language bias that only collects English-language publications.

CONCLUSION

This systematic review also found that adolescents with unmarried parents living together, and using tobacco products contribute to their children's habits of using e-cigarettes. There is no doubt that e-cigarette use is linked with primary factors in socio-demographics, risky lifestyle behavior including alcohol and drug abuse, unmarried parents living together, insufficient knowledge and unawareness of health hazards and ill-being effects of e-cigarettes, and lack of exposure to e-cigarette education in school. Hence, these identified factors must be addressed through various channels consisting of industry playmakers from the government, government-linked companies, and private sector organizations. Current prevention strategies, including knowledge and awareness programs, policies, laws, and regulations on the use of e-cigarettes among adolescents, must be monitored and evaluated from time to time to ensure its relevance.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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