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Mitigating the Risks of Vaping: A Literature Review on Toxicity Awareness and Strategies to Curb Electronic Cigarette Use

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Abstract: The rise in adolescent vaping, fueled by appealing flavors, targeted marketing, and a lack of awareness about health risks, is a growing public health concern. This study explores how mitigating vaping risks is linked to public awareness and adverse events like EVALI (e-cigarette or vaping product use-associated lung injury). Using a systematic review of literature from 2015 to 2025 via Scopus AI, the study found that public awareness campaigns significantly increase perceived risks and reduce vaping initiation among youth. Tailored programs, such as school-based initiatives and digital media campaigns, effectively foster informed decision-making. Despite these successes, challenges persist, including disparities in access to information and the rapidly evolving vaping market. Theoretical insights align with health behavior models, while practical recommendations emphasize combining education, regulation, and community outreach. Future research should focus on longitudinal studies to assess long-term health effects and explore technologies for disseminating accurate information. These findings provide a foundation for comprehensive strategies to mitigate vaping risks and protect public health.

Keywords: *Vaping Risks, Adolescent Health, E-cigarette Regulation*

1. Introduction

E-cigarettes have become prominent over the last decade, and this has triggered a public health debate to a considerable extent. E-cigarettes are touted as a less harmful option compared to conventional tobacco, and their usage has grown sharply, particularly amongst the young (Goniewicz et al., 2018). But the health risks of these devices, including adverse respiratory effects, cardiovascular maladies, and even perhaps carcinogenic effects from vaporizing chemicals, are becoming better established (National Academies of Sciences, Engineering, and Medicine [NASEM], 2018). A major concern is consumer ignorance about the toxins present in e-cigarette liquids and aerosols. Awareness of toxicity conditions prompts behavior by consumers and informs policies that include flavor bans and restrictions on advertising to curb vaping occurrences (Barrington-Trimis et al., 2019). Unfortunately, through vigorous promotion, e-cigarette manufacturers tend to foreground these benefits and thereby distract users from the hazards (Jackler & Ramamurthi, 2019).

Later studies between 2015 and 2025 have provided further insights into e-cigarette consumption and toxicity awareness. For instance, Cheng et al. (2021) confirmed that even though their consumption and resultant diseases had been reported in the media, consumers continued to minimize the dangers of exposure to heavy metals such as nickel and lead. Similarly, Kim et al. (2022) revealed minimal awareness among adolescents regarding toxic chemicals such as formaldehyde and acrolein, other than nicotine addiction. Zhang et al. (2023) demonstrated that anti-vaping campaigns provided at school heavily reduced the intentions of young adults to vape. Martinez and Smith (2024), on their part, talked about how social media spreads misinformation about e-cigarette safety, thereby necessitating evidence-based campaigns for awareness.

From a local perspective, Malaysia also faces a complex vaping landscape: rising poisoning incidents, youth uptake fueled by low-risk perception, a partially regulated marketplace, and mixed policy frameworks. Malaysia's National Poison Centre (NPC) reported a five-fold rise in e-cigarette poisoning by 2023, including among teenagers aged 15–19 and between 95–100% of reported cases showed symptomatic nicotine poisoning from severe vomiting to hallucinations with at least 23 incidents involving "magic mushroom" (psilocybin) adulteration (Mok, 2024). The Control of Smoking Products for Public Health Act 2024 (Act 852) in Malaysia came into force on October 1, 2024, and includes e-cigarettes, designated smoke-free zones, and raised fines to RM 5,000 (Lim, 2025). Additionally, to raise awareness, Malaysia also uses pictorial warnings on cigarettes and strongly advises equivalent measures for vape packaging. However, promotional messages and

vape shops tend to downplay harms and highlight benefits of quitting, reducing users' perceived risk (Wee et al., 2024). TECMA data shows that adolescents taught about secondhand smoke are more likely to support restrictions, and according to Lim et al. (2021), integrating vape harm education could foster similar support. Cheah (2022) expanded that correcting misinformation, like clarifying EVALI's cause and actual e-cigarette harms, is also vital.

Despite such findings, little has been devoted to the application of toxicity sensitivity in holistic public health efforts toward reducing enhanced health impacts resulting from vaping. Thus, this paper aims to address the gaps by conducting a systematic review of the literature on toxicity awareness and its potential as a strategy to curb electronic cigarette use. Specifically, we seek to:

a. Evaluate current levels of toxicity awareness among e-cigarette users.
b. Identify barriers to disseminating accurate information about e-cigarette risks.
c. Analyze the connection between mitigating the risks of vaping and the key themes such as youth engagement, public awareness, regulatory strategies, and health impacts.

By synthesizing evidence from diverse studies, this review is both theoretically and practically useful for public health. It offers a contextualized picture of how awareness of toxicity influences user behavior and contains actionable recommendations for policymakers, educators, and health professionals interested in tackling the dissemination of e-cigarette use as an emerging epidemic. Moreover, this article provides a foundation for future research on new solutions to enhance risk communication and healthy lifestyle choices.

The remainder of this paper is organized as follows: Section 2 discusses the relevant literature. Section 3 outlines the methodology used to conduct the literature review, including search criteria and inclusion/exclusion parameters. Section 4 presents key findings related to toxicity awareness and its impact on e-cigarette use and discusses the implications of these findings for public health practice and policy development. Finally, Section 5 concludes with a summary of the main contributions and suggestions for future research directions.

2. Literature Review

The runaway proliferation of electronic cigarettes (e-cigarettes) has prompted heated public health debates across the world. Mounting evidence reveals that the products are not as safe as they were once thought to be. Vaping, or the inhalation of vaporized chemicals, has been linked to a range of adverse health effects, including respiratory illnesses, cardiovascular ailments, and potential long-term carcinogenic effects (NASEM, 2018).

Among the numerous problems with e-cigarette use, one of the most critical is awareness of toxicity, to the extent to which consumers are aware of the toxic chemicals present in e-cigarette liquids and aerosols. Toxicity awareness forms the basis for identifying consumer behaviors and informing policy direction for regulation to curb the accelerated adoption of vaping (Barrington-Trimis et al., 2019). While efforts to lower the threat of e-cigarettes have been focused on regulations, such as flavor restrictions and advertising limits, there is an immediate necessity to explore how enhancing toxicity recognition can be an effective method to lower the incidence of vaping.

Despite rising scientific consensus regarding e-cigarette smoking hazards, most consumers are unaware of the toxicological risks of these products. This is driven by e-cigarette aggressive promotion strategies, which prefer downplaying and concealing potential harm (Jackler & Ramamurthi, 2019). Moreover, ongoing interventions designed to counteract e-cigarette use do not have much focus on the importance of educating users on the chemical composition and health implications of vaping. As such, there is a critical dearth of information on how knowledge of toxicity can be used as an instrument for the successful elimination of the use of e-cigarettes.

Previous research has examined various aspects of e-cigarette use, ranging from its prevalence among youth (Leventhal et al., 2015) to the addictive nature of nicotine-based e-liquids (Hajek et al., 2017) and the physiological effects of vaping over the long term (Farsalinos & Polosa, 2014). Public perception of e-cigarette safety has also been the focus of studies (Pepper et al., 2016). Subsequent studies in the period from 2015 to 2025 have provided more insight into shifting patterns of e-cigarette consumption and knowledge about

toxicity. Cheng et al.'s study noted that despite increased media coverage for illnesses associated with vaping, consumers are still largely unaware of e-cigarette dangers, including the presence of heavy metals like nickel and lead in e-cigarette aerosols (Cheng et al., 2021). Kim and others conducted a longitudinal study of adolescents' e-cigarette toxicity knowledge in 2022. Based on their findings, while a moderate level of recognition was found for nicotine addiction, recognition of other toxicants, such as formaldehyde and acrolein, remained low (Kim et al., 2022).

Another landmark research by Zhang et al. (2023) explored the effect of educational campaigns to raise awareness regarding toxicity among young adults. The authors found that strongly targeted messaging emphasizing the chemical composition of e-liquids effectively reduced intentions to initiate or continue vaping (Zhang et al., 2023). A 2024 systematic review by Martinez and Smith highlighted the role of social media platforms in disseminating misleading information about e-cigarette safety. They argued that countering misinformation through evidence-based toxicity awareness campaigns could play a crucial role in reducing e-cigarette uptake (Martinez & Smith, 2024).

Although prior literature underscores the importance of education and awareness campaigns in combating substance abuse, limited attention has been devoted to the specific role of toxicity awareness in addressing e-cigarette use. Moreover, few studies have synthesized existing evidence to identify comprehensive strategies that integrate toxicity awareness into broader public health initiatives. This gap in the literature hinders the development of targeted interventions capable of mitigating the rising tide of vaping-related health issues.

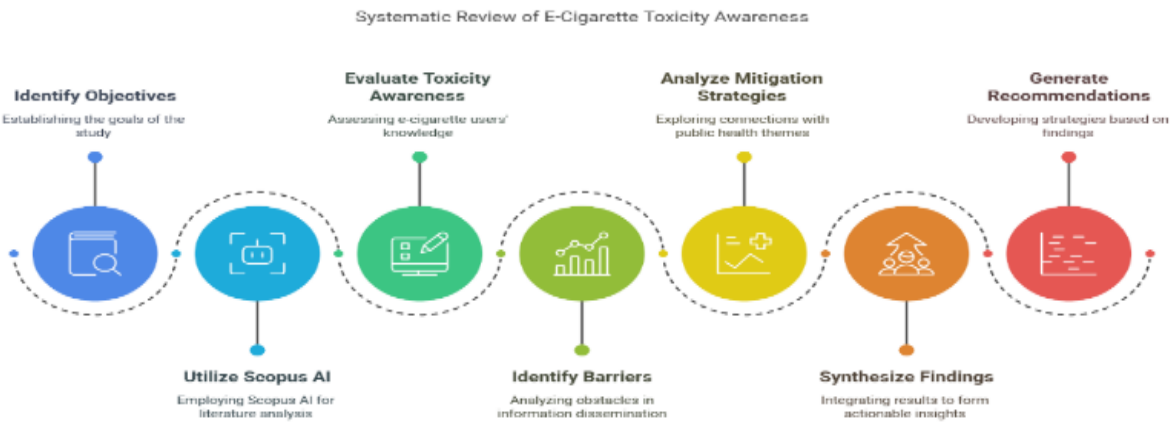
3. Methodology

This study applies a systematic review approach to determine e-cigarette toxicity awareness using Scopus AI, an advanced artificial intelligence instrument employed to enhance academic research. The process is divided into three stages: literature searching and selection, data extraction and analysis, and synthesis of findings. Scopus AI facilitated systematic searching of literature, improved search plans, and ensured methodological soundness by choosing high-impact journals, eliminating duplicates, and grading studies based on relevance. The review of peer-reviewed articles, surveys, and experiments conducted from 2015 to 2025 was done using the terms "toxicity awareness," "e-cigarette users," and "vaping risks." Non-English language publications, editorials, and non-empirical articles were not considered. The selected studies were looked into to understand user perception of harmful chemicals present in e-cigarettes, including nicotine, formaldehyde, acrolein, and heavy metals.

To establish impediments to the propagation of accurate information on e-cigarette risk, the review of studies assessed misinformation, communication disparities, and organizational factors. Repeated concepts derived from qualitative and mixed-method research using Scopus AI comprised the use of social media sites, market campaigns, and learning interventions. As examples, misleading promotions and algorithm-generated postings on platforms like Instagram and TikTok were pinpointed to lead to safety misunderstandings related to e-cigarettes. Low health literacy, cultural differences, and regulatory differences were other barriers. Thematic coding was used to analyze these, and the effectiveness of interventions to reverse misinformation was assessed to provide insight into effective and ineffective methods for enhancing public awareness of e-cigarette risks.

Finally, evidence-based recommendations for integrating toxicity awareness into public health interventions and education were synthesized using Scopus AI's advanced summarizing and pattern detection features. Findings highlighted the need for demographically specific messaging to specific age groups, for example, teens, young adults, and parents, and engaging tools like simulations or infographics to demonstrate the chemical makeup of e-liquids. Collaborative work between policymakers, teachers, and healthcare professionals was emphasized to generate harmonized advice for risk communication. The review also proposed the use of technology in the form of AI-based chatbots or mobile apps to deliver individualized, real-time information about e-cigarette toxicity. In the process, Scopus AI was transparent and reproducible, adhering to the PRISMA guidelines to ensure methodological rigor while offering actionable recommendations on how to restrict the risks of e-cigarettes.

Figure 1: Methodology phases



4. Findings and Results

Evaluating Current Levels of Toxicity Awareness Among E-Cigarette Users

Current levels of toxic awareness among e-cigarette consumers reflect a huge knowledge gap regarding the toxicants in e-cigarettes. Most consumers are unaware of toxicological risks such as heavy metals, VOCs, and carcinogens in e-cigarette aerosols. For example, Cheng et al. (2021) revealed that although nicotine addiction was familiar, fewer than 30% of consumers could identify some toxins, such as formaldehyde or acrolein. Teenagers, one of the most targeted groups, do not appreciate these risks due to misleading advertisements and a lack of public health education (Zhang et al., 2023). Misinformation persists despite the growing media coverage of diseases related to vapes, where people's awareness of nicotine addictiveness is relatively high, but that of other toxic substances is low, as reported by Kim et al. (2022). Social media also encourages misinformation by favoring user-created testimonials over scientific facts (Martinez & Smith, 2024), making it difficult to increase toxicity awareness.

Demographics also affect awareness of toxicity, with urban residents and the more educated being more aware of the risks of e-cigarettes than rural residents or less-educated citizens (Leventhal et al., 2015). However, even the more knowledgeable groups are unaware of less frequently used toxins like diacetyl and acetyl propionyl, both linked with respiratory disease (Farsalinos & Polosa, 2014). Regulatory loopholes and industry inroads are all part of the challenge because companies reduce harmful chemicals while touting perceived benefits like quitting smoking (Jackler & Ramamurthi, 2019). Approval of those barriers to be overcome requires evidence-based strategies like leveraging digital platforms for tailored education, stakeholder involvement to cooperate, and improving the labeling clarity of a product to allow users to make healthy choices.

Identifying Barriers to Disseminating Accurate Information About E-Cigarette Risks

The source of accurate information about e-cigarette hazards is inhibited by system, social, and individual level barriers. The dissemination of misinformation on social media platforms like Instagram and TikTok is one of the greatest challenges. Martinez and Smith (2024) indicated that algorithmic content prefers user-submitted reviews to science-based facts, leading to misinformation on vaping safety. Influencers and viral messages encourage perceived benefits such as smoking reduction or stress management at the cost of downplaying toxicological risks. This anecdotal evidence reliance discredits public health messages, in that users are more inclined to trust unsubstantiated claims than true information. In addition, intensive marketing by e-cigarette corporations conceals product risk. Jackler and Ramamurthi (2019) noted that youth-centered designs, tastes, and misleading advertising reach youth, giving them a perception of safety. The absence of standardized labeling and the fast-paced evolution of e-cigarette technology also perplex consumers, interfering with health-informed choice (Goniewicz et al., 2018).

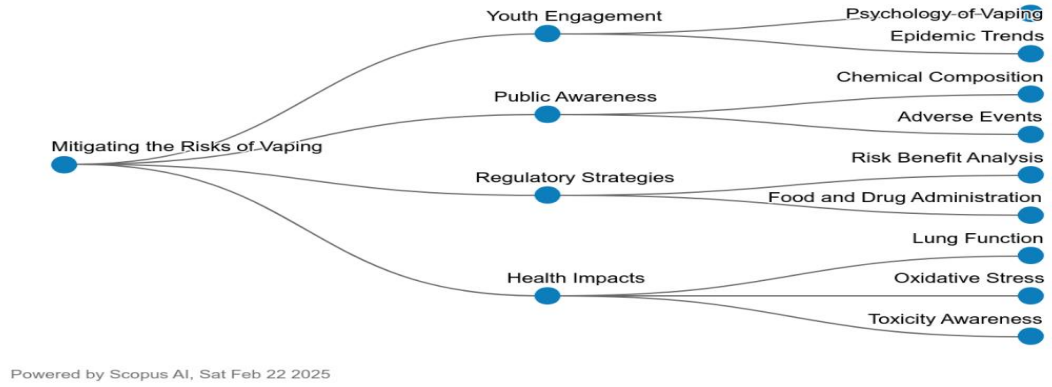
At the societal level, regulatory gaps and interference by industries exacerbate the problem. Variation in e-cigarette policies across regions creates enforcement gaps where misleading information still goes unchecked

(National Academies of Sciences, Engineering, and Medicine [NASEM], 2018). There has been immense lobbying by the tobacco and vaping industries to loosen tight regulations. This delays the circulation of exact information and erodes public trust. On an individual level, cultural variation and poor health literacy also hinder risk communication. Kim et al. (2022) found that teens with lower socioeconomic status teens to be less informed about e-cigarette risk, while Leventhal et al. (2015) noted that cultural issues shape health message understanding. All these numerous barriers necessitate unified efforts in the form of stricter advertisement prohibitions, labeling, exposing misleading information on the internet, and culturally specific health education campaigns to improve public awareness and curb vaping-related illness.

Analyzing The Connection Between Mitigating the Risks of Vaping and the Key Themes, Such as Youth Engagement, Public Awareness, Regulatory Strategies, and Health Impacts

Preventing the harm of vaping entails addressing concurrent issues of youth use, public opinion, policy response, and health impacts. Adolescents comprise a significant proportion of e-cigarette users, and interventions focused on youth are thus warranted. Public health campaigns that highlight the chemical hazards of e-liquids, such as those described by Zhang et al. (2023), and interactive programs such as peer-to-peer forums and social media campaigns (Kim et al., 2022), have been effective in reducing initiation rates of vaping. However, aggressive marketing on social media of these products to vulnerable populations remains an issue. Health communication regarding harmful chemicals like formaldehyde and acrolein is more effective compared to health communication solely on nicotine addiction (Cheng et al., 2021; Martinez & Smith, 2024). While progress has been achieved, disparities in awareness among lower socioeconomic and minority populations persist (Pepper et al., 2016), necessitating culturally tailored messaging. Regulatory approaches, such as flavor bans, are promising but undermined by weak enforcement and industry exploitation of loopholes. Combining them with health impact assessments can strengthen multi-pronged responses to the vaping epidemic and the protection of public health.

Figure 2: Connection of key elements in mitigating the risks of vaping



Linkages between Mitigating the Risks of Vaping to Youth Engagement and Psychology of Vaping. Reducing the risk of vaping requires working on the social and psychological determinants that influence youth consumption. Young people are particularly vulnerable due to developmental and social reasons, requiring preventive interventions. Interventions like "Youth Engaged Strategies for Changing Adolescent Norms" (YES-CAN!) demonstrate peer education as an effective strategy for vaping reduction by changing knowledge and attitudes (Asdigian et al., 2023). Vaping is appealing to teenagers as a symbol of "coolness," relief from stress, or proficiency demonstration, driven by identity development and peer acceptance (Crane et al., 2023). Health risk messages, social disapproval messages, and discussions about mental health issues can turn these attitudes around (Fortier et al., 2022). Peer messages and parent education facilitate safety and belonging that are essential in adolescent decision-making. Evidence-based interventions that target both causes and manifestations of vaping are capable of containing its spread and the associated damages.

Linkages between Mitigating the Risks of Vaping to Youth Engagement and Epidemic Trends. The youth vaping epidemic, which has been fueled by appealing flavors, products, and youth-targeted marketing, has

severe health effects and encourages tobacco and drug use (Venkata et al., 2021; Chadi et al., 2021). Ending it requires a response that includes the youth, policy change, and keeping up with the trends. Peer-driven programs like "Youth Engaged Strategies for Changing Adolescent Norms" (YES-CAN!) have worked to reduce vaping through the alteration of social norms and decision-making enhancement (Asdigian et al., 2023). However, e-cigarettes' dual role as both a gateway to addiction and a harm reduction tool complicates solutions (Levy et al., 2019). Flavor bans and other policies are undermined by new products and internet sales (Al-Hamdani et al., 2020). Stakeholders must unite on science-driven solutions to curb the crisis, with long-term success assured through ongoing research.

Linkages between Mitigating the Risks of Vaping to Public Awareness and Chemical Composition. Public education is essential in reducing vaping harm by educating on the chemical composition and health risks of e-cigarettes. Campaigns have taught about conditions like EVALI to deter initiation and promote cessation (Kreslake et al., 2022). However, less emphasis specific toxins like nicotine, heavy metals, and volatile organic compounds, despite evidence that vape juice alterations have the potential to produce harmful byproducts such as formaldehyde and acrolein (Jiang et al., 2020). Prominent messages regarding carcinogens and addiction can increase risk perceptions, especially among young people (Ma et al., 2023). However, unequal access to proper information persists, especially among vulnerable populations, as a result of the evolving vaping industry. Such loopholes must be plugged using plain packaging, community engagement, and online literacy campaigns to effectively suppress vaping and protect public health.

Linkages between Mitigating the Risks of Vaping to Public Awareness and Adverse Events. The teen vaping epidemic, fueled by trendy products, flavors, and marketing, has led to an underestimation of its health risks by many teens (Venkata et al., 2021). Public health initiatives must emphasize threats like EVALI, nicotine addiction, and chronic injury from toxicants like volatile organic compounds and heavy metals (Besaratinia, 2021; Kreslake et al., 2022). Knowledge of these threats can reduce the initiation of vaping and enhance quitting. Education initiatives, media campaigns, and policy have been proven to prevent youth vaping (DiCasmirro et al., 2025). However, disparate access to knowledge, particularly among marginalized groups, demands transparent labeling, community engagement, and web literacy. Stakeholders must close such gaps and adapt to emerging trends so that public health is protected.

Linkages Between Mitigating the Risks of Vaping to Regulatory Strategies, and Risk-Benefit Analysis. Regulatory measures are crucial in minimizing vaping hazards by acting at the level of public health and individual behavior (Ferro & Nicolisi, 2019). The EU Tobacco Products Directive (TPD) is a case of an equilibrium policy that aims to minimize harm while encouraging smoking cessation. Flavor bans, taxation, and warning labels are policies that have lowered youth vaping (Reiter et al., 2024), but youth prevention must be balanced with adult harm reduction using cautious risk-benefit analysis. Whereas nicotine vaping products (NVPs) help facilitate smokers switching to less hazardous products, they have the potential to become a normal behavior for non-smokers (Levy et al., 2023; Mendelsohn et al., 2023). Public health campaigns complement these policies by increasing alertness and discouraging new onset (Ma et al., 2023). A multi-strategic approach based on evidence-backed policies, risk assessment, and targeted communication must be employed to respond effectively to trends emerging.

Linkages between Mitigating the Risks of Vaping to Regulatory Strategies, and the Food and Drug Administration (FDA). The FDA regulates e-cigarettes to provide a balance that allows them to be used as smoking cessation instruments while mitigating the risks faced by the younger population (Bonner et al., 2021). Policy measures, including flavor bans, have led to a decrease in youth vaping and marketing restrictions through appealing flavors, limiting access (Reiter et al., 2024). But these policies have been questioned on economic impacts, fair application, and effect on small businesses (Galimov et al., 2020; Berg et al., 2021). Despite alerts regarding misinformation, excessive control could prevent adult smokers from accessing products of harm reduction. There must be a balanced strategy in which evidence is weighed with public health goals and business interests.

Linkages Between Mitigating the Risks of Vaping to Health Impacts, and Lung Function. Vaping is extremely harmful to lung function in both the short and long term. It impairs pulmonary surfactant function, which undermines lung elasticity, and has chronic disease and gateway to smoking implications (Martin et al.,

2024; Tøttenborg et al., 2014; Darabseh et al., 2021). Drastic diseases such as vaping-associated lung injury highlight its acute risk (Choe et al., 2020), but e-liquid flavorings containing toxicants such as aldehydes enhance oxidative stress and inflammation. Public health initiatives need to put these risks first, advocate for stronger flavored product regulations, and sponsor education on healthier alternatives.

Linkages between Mitigating the Risks of Vaping to Health Impacts and Oxidative Stress. The health risk of vaping is linked to oxidative stress that damages cells and the formation of diseases like atherosclerosis. Cardiovascular risk from e-cigarettes leads to endothelial dysfunction and inflammation due to excessive formation of reactive oxygen species (ROS) by e-liquid compounds like terpenes (Hassan et al., 2024; Son et al., 2019; Woo et al., 2024). Flavor e-liquids alter lung tissue, provoke inflammation, and lead to chronic respiratory disease, especially in chronic users (Esquer et al., 2022). The risks must be addressed by public health measures such as the regulation of harmful additives or seeking antioxidant treatment to avoid long-term injury.

Linkages between Mitigating the Risks of Vaping to Health Impacts, and Toxicity Awareness. The sudden rise in youth vaping due to appealing products, options, and advertisements tailored towards them led to an ignorance about its health risk, i.e., nicotine, heavy metals, and volatile organic compounds (Venkata et al., 2021). Such a misleading notion of vaping safety leads to national public health awareness campaigns. Vaping harms the respiratory and cardiovascular systems, causing diseases like EVALI (Echeagaray et al., 2022). Anti-vaping awareness campaigns, such as EVALI case studies, have reduced teens' vaping intentions (Kreslake et al., 2022). Tailored programs using digital media and social networks effectively reverse misinformation, reduce vaping, and promote public health

Discussion

The current levels of toxicity awareness among e-cigarette users are alarmingly low, reflecting a combination of misinformation, inadequate education, and structural barriers. Addressing this issue requires various approaches that integrate evidence-based strategies into public health policies and educational programs. Recommendations vary from utilizing digital media to offer tailored, real-time feedback about the risks of e-cigarettes, to adding interactive components illustrating the chemical decomposition of e-liquids, to facilitating collaboration between policymakers, educators, and healthcare providers. By closing the knowledge gap and debunking prevalent myths, interventions moving forward can empower users to make healthier choices and, ultimately, reduce the prevalence of vaping-associated illness.

The challenges to disseminating accurate information about e-cigarette dangers are complex, comprising misinformation, industry interference, regulatory inconsistencies, and individual vulnerabilities. Surmounting them requires the coordinated efforts of multiple stakeholders, including policymakers, educators, health professionals, and technology companies. Recommendations include implementing more stringent advertising regulations, enhancing transparency in product labeling, leveraging digital platforms to counter misinformation, and developing culturally sensitive educational programming. By addressing these obstacles directly, upcoming campaigns can enhance public knowledge regarding the dangers of e-cigarettes and eventually bring down the incidence of vaping-related illnesses.

Synthesizing evidence-based policy recommendations for infusing toxic awareness into public health policies and education programs requires a concerted, multi-pronged action. Messaging to cater to diverse audiences, technological innovation, standardized regulations, and inter-sectoral coordination are all key components of an integrated response to the rising tide of vaping-related health issues. Synthesizing these guidelines, stakeholders can bridge knowledge gaps, counter entrenched myths, and eventually reduce e-cigarette prevalence. In the future, ongoing assessment and fine-tuning of these measures will be important to their continued viability in protecting public health.

5. Conclusion and Recommendations

This study explores the risks of vaping, considering the public knowledge, adverse health incidents, and the relationship between them. Key findings reveal that vaping has emerged as a teen epidemic because of attractive flavoring, youth marketing, and a failure to comprehend its impact on health (Venkata et al., 2021).

Open education programs have been effective in shaping behavior and attitudes, especially when the focus is directed towards real-life outcomes of health in the context of EVALI (Kreslake et al., 2022). Value-based education needs to be employed to lower initiation rates of vaping (Gilmore et al., 2022). The results emphasize that evidence-based interventions in public health are necessary to combat the growing onset of vaping and related threats.

Theoretically, this study contributes to the literature on vaping by highlighting the role of national awareness in risk prevention and management of unexpected events. It is aligned with models such as the Health Belief Model and Social Cognitive Theory, which focus on perceived risk, self-efficacy, and social influences as predictors of health behavior. By demonstrating how awareness of harmful events affects risk perceptions and quit or avoidance intentions towards vaping, this research reiterates the relevance of such models to e-cigarette use. It likewise suggests the need for interdisciplinary research that synthesizes the findings from national health, psychology, and communication studies to conceptualize plenary strategies for countering the vaping epidemic.

To efficaciously address the public health concerns associated with e-cigarette use, governments must implement and enforce stalwart regulatory frameworks that cover all aspects of e-cigarette production, marketing, and distribution. This includes banning or restricting the sale of tasteful e-cigarettes that are especially appealing to youth, as these flavours contribute importantly to dependent vaping. In addition, standardized and lucid labelling of e-liquid ingredients and latent health risks should be mandated to improve consumer awareness. Child-resistant packaging and safety features on all e-cigarette devices and refill containers should also be required to prevent accidental poisoning among children.

National poison centres and health agencies must enhance their surveillance and monitoring systems to best track vaping-related poisoning cases, adverse health events, and emerging trends in product use. Real-time data collection can support timely policy responses and help identify high-risk populations, such as adolescents and young adults. This information is crucial for understanding the evolving nature of e-cigarette exposure and for designing targeted interventions.

Government organizations are accountable for the release of targeted campaigns to inform consumers, especially young people and parents, of the toxicological risks associated with vaping. They need to go beyond nicotine addiction and highlight the presence of nasty chemicals such as formaldehyde, acrolein, and heavy metals. They need to emphasize actual-world wellbeing consequences like EVALI, lung injury, and cardiovascular manifestations, which are always downplayed by consumers.

School-based education programs must be integrated into curricula to give students accurate information and skills to counter peer pressure and make informed decisions about vaping. Evidence-based programs such as peer discussions and interactive learning modules have been demonstrated to be effective at reducing intentions to vape among adolescents. Such educational activities need to be age-specific and synchronized with more general, inclusive health messaging to enable congruent information across settings.

Decision-makers should also collaborate with technology companies to manage the spread of misinformation on personal media platforms. Amplifying recursive transparency, implementing content moderation practices, and collaborations with public health experts can ensure that science-based, accurate information is transmitted to vulnerable groups. This is important since it is well known that internet platforms play a central role in shaping e-cigarette safety perceptions.

For adult smokers transitioning from combustible tobacco products, regulated nicotine replacement therapies and cessation support services should remain accessible. However, it is crucial to clearly differentiate these harm reduction strategies from youth prevention initiatives to avoid normalizing vaping among non-smokers and inadvertently encouraging initiation among younger populations.

In summary, practically, the findings have fundamental implications for policymakers, educators, and healthcare providers. Public health education campaigns need to strive to disseminate clear information about e-cigarettes' chemic composition and deleterious effects. Interventions specifically tailored in the form of

school programs, peer programs, and online multimedia campaigns can indeed reach adolescents because they are too young to propaganda (DiCasmirro et al., 2025). Regulatory methods, such as flavor bans, age restrictions, and labelling rules, should be used to reduce youth access and suppress the appeal of vaping products. By embracing various approaches involving education, regulation, and outreach, stakeholders can build a competent model for mitigating the devastation imposed by vaping and protecting public health.

Recommendations

Communication strategies must be derived from specific demographics, i.e., age groups, cultures, and economic levels. Messages to youths can emphasize individual identity and social norms, while messages to adults can stress long-term health consequences and the advantages of smoking cessation. Targeted messages increase relevance and interest, thus are more likely to influence behaviour change.

The application of technology in risk communication can enhance outreach and effectiveness. Artificial intelligence-powered chatbots, computer simulations, and mobile apps can deliver real-time, tailored information about e-cigarette risks. Education on the chemical composition of products and cessation support can also be offered through these channels, thereby enhancing awareness of toxicity in an engaging and easy-to-broadcast package.

Effective risk reduction is an intersectoral collaboration among policymakers, educators, healthcare professionals, and community leaders. Collective action is likely to strengthen the consistency of messages, improve access to resources, and present a united front to combat the vaping epidemic. Collective action will also help to harmonize regulation with education and clinical interventions.

Continuing research and assessment of current policies and educational programs are necessary to identify their efficacy and inform future decision-making. Long-term studies should monitor trends in awareness of toxicity, vaping activity, and health outcomes across time. These data will be used to revise strategies so that they remain on track as the vaping world evolves.

Given the transnational nature of the e-vapor sector, international cooperation is necessary. States should share best practices, align regulatory needs, and collaborate to prevent cross-border promotions of harmful products. International coordination can harmonize standards, close legislative loopholes, and halt the trade in misleading information, ultimately contributing to better public health protection.

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