From Vaping to Ventilation: E-Cigarettes in Emergency Medicine

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ABSTRACT

Aims: The aim of this review is to raise awareness among healthcare professionals, particularly those working in emergency departments, about the potential health consequences associated with the use of e-cigarettes.

Material and methods: A PubMed search conducted on May 25, 2025, identified 31 articles published between 2021 and 2025. English-language articles from 2020–2025 and a limited number of earlier studies were also reviewed for eligibility. A total of 21 articles met the inclusion criteria.All authors jointly reviewed and revised the manuscript for accuracy.

Results: Electronic cigarettes, classified as the most prevalent form of electronic nicotine and non-nicotine delivery systems. Recent studies point to potential long-term health risks. In 2023, 10.0% of high school and 4.6% of middle school students reported current use, with higher prevalence among females. Though less common in adults (4.5%). Health risks, including vaping-related lung injury (EVALI) have raised significant concern among healthcare professionals.

Conclusions: The long-term consequences of EVALI on respiratory function and imaging results are still unclear. Prospective research and standardized follow-up protocols is essential to better characterize these effects and optimize outcomes.

Key words: e-cigarettes; vaping; emergency medicine; evali

INTRODUCTION

E-cigarettes are the most common type of electronic nicotine delivery systems (ENDS) and electronic non-nicotine delivery systems (ENNDS). These devices work by heating a liquid to produce an aerosol that the user inhales. The so-called e-liquids may contain nicotine or be nicotine-free, but they do not include tobacco. They usually also contain various additives, flavorings, and chemicals that can be harmful to health. E-cigarettes belong to a broader category of ENDS and ENNDS products, which also includes items like e-cigars and e-pipes [1].

The rapid increase in the use of electronic cigarettes (e-cigarettes) worldwide has raised serious public health concerns, particularly with regard to their potential adverse health effects [2,3,4]. Initially marketed as a safer alternative to traditional tobacco products, e-cigarettes have gained popularity among both adults and youth [2,3,4]. However, emerging evidence suggests that vaping may be associated with acute and chronic health complications, including respiratory distress, cardiovascular effects, and toxic exposures [2,4].

For healthcare workers, especially those in emergency departments, recognizing vaping-related illnesses is a diagnostic challenge due to their often nonspecific and overlapping symptoms with other common medical conditions [4]. Cases of electronic cigarette or vaping-related lung injury (EVALI), nicotine poisoning, and cardiovascular events underscore the need for increased clinical suspicion in patients with a history of vaping [2,4].

AIM

The objective of this review is to raise awareness among healthcare professionals, particularly those working in emergency departments, about the potential health consequences associated with the use of e-cigarettes. Due to the often nonspecific clinical manifestations, the presented case studies aim to support differential diagnosis and improve recognition of vaping-related conditions.

MATERIAL AND METHODS

A database search was performed on May 25, 2025 the open-access PubMed database, using the terms: “(e-cigarettes) AND (emergency department)) AND (EVALI)”. The search covered the

years 2021–2025 and the initial search returned 31 relevant studies. Additional references were identified by checking bibliographies of included papers, allowing the addition of some pre-2021 sources. We considered English-language articles classified as original studies, case reports, reviews, systematic reviews, or observational research. In total, 21 papers were included. The manuscript underwent collective review and editing by all contributing authors to ensure consistency and accuracy.

RESULTS

Epidemiology of Electronic Cigarette Consumption

Recent data indicate a concerning prevalence of electronic nicotine delivery systems (ENDS) and electronic non-nicotine delivery systems (ENNDS) use among various age groups. In the United States, the prevalence of current e-cigarette use among high school students surged dramatically from 1.5% in 2011 to 27.5% in 2019, while among middle school students, it increased from 0.6% to 10.5% over the same period [2].

In 2023 in the World, 4.6% of middle school children and 10.0% of high school students reported current use of these products, with notable gender differences 5.6% of middle school girls and 3.5% of boys were users, while among high school students, usage was higher in girls (12.2%) than in boys (8.0%). Adult consumption was lower but still significant, at 4.5%, with slightly higher use among males (5.1%) compared to females (4.0%). These findings highlight the growing public health challenge posed by e-cigarette use, particularly among adolescents, where prevalence rates are alarmingly high [3]. Alarmingly, regulatory gaps persist globally: 88 countries lack a minimum legal age for purchasing e-cigarettes, and 74 have no regulations restricting these harmful products [1].

E-cigarette Vaping Associated Lung Injury (EVALI)

EVALI (E-cigarette or Vaping Product Use-Associated Lung Injury) is a serious lung disease associated with the use of e-cigarettes or vaping products that was first recognized in the United States in 2019 [2,4,5,6,7]. A history of e-cigarette or vaping product use within 90 days prior to the onset of symptoms is required to make the diagnosis [2,6,7]. EVALI cases are characterized by the acute onset of respiratory symptoms, such as shortness of breath, cough, and chest pain, as well as constitutional symptoms, such as fever, fatigue, and gastrointestinal symptoms [2,4,5,7].

EVALI is a diagnosis made by exclusion of other causes, and alternative etiologies must be considered in the diagnostic process, including negative virologic tests, such as influenza and SARS-CoV-2 [2,6,7]. Radiological findings often reveal pulmonary infiltrates resembling pneumonia or organizing pneumonia, as well as alveolar hemorrhage [2,4,5,7]. The main etiological factor associated with EVALI is vitamin E acetate, used as a thickener in illegal products containing tetrahydrocannabinol (THC) [6,7]. Treatment of EVALI primarily involves cessation of e-cigarette use and glucocorticoid therapy, which often provide rapid improvement [2,5,7]. Although the number of EVALI cases has decreased significantly since the peak of the epidemic, it remains a significant public health problem, especially in the context of the unregulated market for vaping products and their popularity among young people [1,4,6].

Rare and Unusual Cases in Emergency Medicine

A 35-year-old female patient who chronically smokes e-cigarettes and abuses psychoactive substances was brought to the Emergency Department due to cardiac arrest. The cardiac arrest incident was not preceded by respiratory symptoms. After ROSC, the patient developed dyspnea and hypoxia. Crackles were heard over the lung fields, and a ground-glass image was visible in the CT scan. COVID-19 infection and pulmonary embolism were excluded in the patient, and EVALI was suspected. Appropriate treatment with methylprednisolone was implemented, which improved the clinical condition. In follow-up imaging studies, the pulmonary changes receded. In summary, the described patient experienced non-specific symptoms of EVALI, which caused a delay in making a diagnosis and thus delayed the initiation of appropriate treatment. Future research should be deepened to consider earlier implementation of treatment in patients with suspected EVALI in emergency departments, before other causes are excluded. Severe hypoxemia can quickly lead to cardiac arrest, as in the patient described above [8].

Patients who have suffered throat injuries as a result of vaping nicotine may also be admitted to the emergency department. One clinical case was a 35-year-old patient who came to the emergency department with extensive burns to the oral cavity and swelling of the tissues around the neck. An ENT examination also revealed a burn to the glottis. Quick action is essential to prevent airway swelling in such patients. In the described patient, inhaled epinephrine and anti-inflammatory drugs proved effective [9].

The threat of smoking e-cigarettes with nicotine is also acute poisoning. Two young men who were not heavy smokers were described. They reported to the emergency department with impaired consciousness after smoking an e-cigarette. Both patients had high levels of cotinine in their urine and both showed signs of acute nicotine poisoning. E-cigarettes are dangerous not only for heavy smokers. They can lead to acute nicotine poisoning even after a single use, especially when they contain a high concentration of nicotine or other unknown substances. In acute nicotine poisoning, the nicotine acetylcholine receptor is blocked. A drop in blood pressure, bradycardia, and neuromuscular blockade occur. Ultimately, this can lead to apnea and circulatory and vascular collapse [10].

Another case that shows how important it is to quickly diagnose and start treatment is a 17-year-old woman. She was admitted to the emergency department because of worsening acute dyspnea, pain when breathing, and fever. It is worth noting that the symptoms appeared shortly after she started vaping. The patient developed respiratory failure, and tests allowed for the diagnosis of acute eosinophilic pneumonia [11].

Vaping marijuana products is becoming increasingly popular. A medical article describes the case of a 65-year-old man who came to the ER with fever, diarrhea, and wheezing. After being diagnosed with pneumonia, the patient was discharged home with oral antibiotics. Unfortunately, the patient developed ARDS. The patient then went into shock. The patient died of multiple organ failure within 3 days. Vaping marijuana can lead to respiratory failure and then multiple organ failure even in people without lung disease. It is important to take a thorough history and identify complications related to vaping early [12].

Health Complications, Long-Term Effects, and Patterns of Emergency Care Use

Emerging research suggests that the prolonged use of e-cigarettes may result in negative health outcomes, raising concerns among medical professionals. In a retrospective cohort study, Zhang et al. analyzed long-term outcomes of 41 EVALI patients admitted between 2019 and 2020. Most individuals in the cohort were young adults (median age - 21 years). While no inpatient deaths occurred, 7.3% of patients died within the 3-year follow-up period. Use of emergency department services more than doubled following EVALI, in contrast to a significant drop in outpatient

consultations. Improvement in radiographic abnormalities was observed in most individuals who underwent follow-up chest imaging. Despite a serious lung injury linked to vaping, e-cigarette use was insufficiently tracked after discharge, noted in only 17.9% of patients, of those, 57.1% had quit and 42.8% continued [13].

In another study, Triantafyllou et al. evaluated patients with EVALI over a one-year period. Nearly 50% of patients still had symptoms at their initial follow-up, but most became symptom-free by the end of the year. The study noted that hospital readmissions occurred in 24.4% of patients within one year, mostly for respiratory problems in those with prior health complications. Radiological follow-up revealed that lung changes generally improved within half a year, although localized lung scarring was detected in two cases. Initial pulmonary function tests were often abnormal, but normalized within one year in those reassessed. Despite a small sample, no control group, and unstandardized follow-up, the study highlighted elevated rates of emergency department visits and rehospitalizations rates among young patients [14]. Weight loss has also been reported among hospitalized adolescents with e-cigarette vaping-associated lung injury (EVALI), underscoring a significant adverse effect associated with e-cigarette use [15]. It is also important to highlight the study by Hassoun et al., who described three pediatric cases initially suspected of multisystem inflammatory syndrome in children (MIS-C) associated with COVID-19, but ultimately diagnosed with EVALI. Follow-up was successfully obtained for two out of three patients. One patient demonstrated quick symptom relief and normalization of inflammatory response markers, with pulmonary function tests indicating mild restrictive lung disease and moderate impairment of diffusing capacity that improved within two months. However, for the second patient, follow-up demonstrated symptom improvement and normalization of inflammatory response markers in ten days, with pulmonary function tests reflecting only minor diffusion abnormalities [16].

Health and policy actions on vaping

In response to the growing public health threat posed by vaping, coordinated actions from both governmental bodies and healthcare professionals are essential. The following recommendations highlight practical steps to curb usage and mitigate associated health risks. Governments should review reports on EVALI (e-cigarette or vaping-associated lung injury) to gain further insight into the clinical course and inform treatment guidelines; enforce appropriate regulatory reforms and manufacturing standards upon identification of the causative factor and

provide timely updates and guidance to healthcare providers and the public. Furthermore, advertising regulations comparable to those for tobacco and cannabis must be imposed to curb the expanding vaping market targeting nicotine-naive adolescents. It is also important to restrict the sale of flavored vaping products [17]. A coalition of nine international professional organizations, including the Federation of International Respiratory Societies (FIRS) and the European Respiratory Society, has issued recommendations regarding electronic cigarettes in children and young people (CYP) [2, 18, 19]. These include that electronic nicotine delivery systems should fall under the same regulatory and taxation framework as traditional tobacco products. All forms of promotion should be strictly regulated, with advertising accessible to children and adolescents—including on social media—being prohibited, and harsh penalties enforced for breaches of these youth-targeted marketing rules. The organizations advocate for plain packaging that includes a health warning stating that the acute effects of vaping can be life-threatening. Additionally, they call for a complete ban on vaping in public areas. [2].

Healthcare professionals should routinely ask about tobacco and vaping use when evaluating patients with respiratory or digestive symptoms. If EVALI is suspected, it must be reported to local or state health departments, or the regional poison control center. In the evaluation of suspected EVALI, clinicians should consider chest X-rays, CT scans, and tests for infectious causes to rule out other potential sources of severe lung injury, and corticosteroids may be considered as part of the treatment approach. In cases of suspected respiratory illness, it is important to gather detailed information about the vaping product used (such as composition, brand, and source), and, where possible, submit any remaining product to the local health department [17]. Clinicians should be familiar with the clinical features and current management strategies for vaping-related lung illness and incorporate evidence-based clinical guidelines into care [17,20]. Physicians should advise all patients — including youth, young adults, and pregnant women — to avoid vaping and encourage the use of FDA-approved therapies and behavioral strategies for smoking cessation [17].

DISCUSSION

Although public health statistics show a slightly decreasing interest in e-cigarettes and vaporizers, these devices are still widely used, so it is worth actively considering the negative experiences of their users [8]. Unfortunately, e-cigarettes are promoted to the public as a safer alternative to traditional cigarettes, which is also eagerly used by teenagers [10,11,12]. Scientific studies show

that e-cigarettes may contain many substances that have not been fully identified. They may have a cytotoxic effect on lung tissue. By smoking, patients are also exposed to heavy metals such as chromium, nickel, and lead. Importantly, these negative effects occur regardless of the presence of nicotine [5]. A study was conducted which showed that propylene glycol and glycerol used as additives in e-cigarettes can cause significant clinical disorders of the respiratory system. After using an e-cigarette with glycerol and propylene glycol, impaired gas exchange and damage to epithelial cells lining the respiratory tract were observed in patients [21]. Physicians, especially doctors working in hospital emergency departments, should be aware of the injuries and complications that may occur in patients as a result of using e-cigarettes and their vaporization [9]. It is important that they are up to date with the current knowledge about diseases related to e-cigarette use and vaping, because the symptoms of these conditions may overlap with other diseases, which makes it difficult to make an accurate diagnosis. An in-depth interview, a thorough physical examination, ordering appropriate laboratory and imaging tests - especially when ruling out infection are essential for the correct diagnosis and treatment of such patients [9,16]. The e-cigarette market is constantly developing, with increasingly better vaping devices being created, which deliver increasingly larger doses of substances to the body, including nicotine. In addition, the proper smoking technique allows for the absorption of smoked substances in larger quantities. The lethal dose of nicotine in the body is about 50-60 mg. This creates a danger, because there are products in which the nicotine concentration even exceeds 100 mg/ml [10]. The involvement of doctors in social issues, such as counteracting the advertising and promotion of e-cigarettes among young people, can play an important role in improving the health of patients in the long term. Informing patients about the risks resulting from the use of vaporization devices plays an important role in the prevention of complications [9].

CONCLUSIONS

The long-term consequences of using electronic cigarettes and EVALI on respiratory function remain poorly understood. Evidence suggests that even after clinical recovery, some patients may exhibit chronic respiratory symptoms that remain undetectable without formal, standardized follow-up. Comprehensive prospective research is needed to inform public policy, establish evidence-based guidelines and create prevention campaigns.

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