

Adolescents and E-cigarette Use: The Hidden Danger of Developing E-Cigarette and Vaping Associated Lung Injury

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Introduction

Electronic Cigarettes (EC) are becoming a coping mechanism used by adolescents to handle the struggles of everyday life. Adolescents today are the biggest consumers of EC. The flavors, such as bubble gum, crème Brulé, mint, that ECs come in are designed to attract this specific age group. EC are concealable making it easier to smoke in public places discreetly without facing consequences.

Electronic cigarettes are not without health risks. The most serious health complication from smoking is EVALI (E-cigarette/Vaping Associated Lung Injury). Adolescents who develop EVALI often require admission to critical care units and run the risk of death. It is for this reason that studying adolescent use of EC is necessary to inform healthcare providers and the public of the risk of using EC and developing EVALI.



Background

ECs delivers nicotine through a battery-operated portable machine that aerosolizes it through heat for a nicotine rush. The devices can be reused, and the consumer can buy different flavorings such as bubble gum, mint etc. to enhance their smoking experiences (as pictured above). The use of ECs has grown exponentially in middle and high school students since 2014 with the greatest growth between 2017 and 2019. Adolescents became the biggest purchasers for buying EC and increasing the numbers of young people smoking today.

There are five different generations or modifications of EC. There was the 1st module that looked like the traditional cigarettes. Noting the popularity of their product among adolescents, companies started to make the models a bit more attractive to adolescents. The last and most common version of EC is a pod- mod device, known as JUUL, making them easily concealed so that people can use them indiscreetly in non-smoking areas.

EC was first introduced in 2006 in the US and was promoted as a coping tool to help with smoking cessation. While in fact, it is even more toxic and causes severe health issues such as a new phenomenon called Electronic/Vaping Associated Lung Injury also known as EVALI. EVALI is only applied as a diagnosis to a patient, when all other possible respiratory and gastrointestinal diseases are eliminated through bloodwork. Since there is no current treatment, it often leads to death.

As an adolescent was hospitalized, the nursing staff and doctors would perform patient centered care including several types of respiratory interventions to combat EVALI symptoms. This includes deep breath and cough techniques, medications such as bronchodilators, oxygen delivered through a nasal cannula, and as the condition worsens the use of mechanical ventilation, chest x-rays, lung biopsies, and the use of steroids that treats EVALI well.

Methods

A systematic review was conducted using the Cumulative Index of Nursing and Allied Health Literature (CINHAL) Plus Full Text databases to obtain relevant articles to review the health consequences of E-cigarettes or Vaping Associated Lung Injury (EVALI) from the excessive use of smoking Electronic Cigarettes (EC). Several articles and journals were reviewed to determine which were suitable for the study of the topic. Keywords were used to narrow the topic for this literature review. Each article used was peer reviewed, and written by registered nurses, doctors and qualified medical professionals in English. 14 of these articles met the criteria of presenting data on EC use with adolescents, the psychosocial drive of smoking and the progression of EVALI.

Results

- 4 themes were identified when it came to understanding EC and progression of EVALI. These four themes include: the perception with adolescents smoking EC, THC (tetrahydrocannabinol, the psychoactive compound in marijuana) involvement with EVALI, predicting EVALI, and presenting signs and symptoms often lead to a misdiagnosis of EVALI.
- Perceptions and likelihood of smoking EC:**
 - Adolescents who self-reported smoking EC and marijuana believe there is minimal risk of health consequences and perceive it to be harmless
 - Adolescents who had minimal perception on EC, are less likely to smoke EC.
 - Adolescents have environmental or internal factors that may drive an individual to smoke EC in a way to cope with every-day life.
 - These internal and external factors can include home life, academia, mental health, and school environment
 - Any of these stressor domains were found in patients admitted to the hospital for EVALI, contributing to the excessive use of nicotine and marijuana using EC devices.
- THC is frequently associated with EVALI:** THC is screened when a patient is admitted to the hospital, along with VEA (Vitamin E Acetate), and usually both are linked to EVALI
 - 1 in 4 adolescents excessively vape THC
 - Adolescents tend to buy off the street when purchasing marijuana pods, unaware of vitamin E in the product, making them susceptible to EVALI.
 - Each patient who had THC in their system responded well to steroids given compared to other medications
- Predictors of EVALI are unreliable:**
 - Patients diagnosed with EVALI underwent extensive evaluation for other conditions such as asthma, typical and atypical pneumonia, appendicitis, sepsis, and pulmonary embolism in order to determine if there was a common factor to EVALI
 - Patients typically did not have any previous health problems but in the span of couple of days, each patient will experience multitude of symptoms that mimic other systemic issues.
- Presenting signs and symptoms of EVALI frequently lead to a misdiagnosis:** Typically, at first each patient with EVALI presents with respiratory and or gastrointestinal symptoms.
 - Patients present symptoms that are mild at first. When they visit a clinic, doctors prescribe antibiotics to fight off respiratory infections such as pneumonia or the flu.
 - However, after a couple of days pass by, symptoms worsen causing patients to go into respiratory arrest/failure causing young adults to have machines breathing for them
 - If not intervened quickly enough, adolescents can succumb to EVALI causing permanent damage such as death
 - In all EVALI patients, most of them mimic respiratory symptoms such as shortness of breath, and gastrointestinal symptoms, like nausea and vomiting.
 - With little to no knowledge of pathophysiology and etiology, in order to diagnose EVALI a substantial number of symptoms must be presented with the history of smoking EC products.

Discussion

Based on the four themes identified: perceptions adolescents have when it comes to EC, how THC is involved with EVALI, predictors of EVALI, as well as the presenting signs and symptoms are critical to assess and identify to avoid hospitalization and death. All four of these theme provide a picture on identifying which youth is at risk for smoking EC and developing EVALI. Adolescents who smoke EC may or may not be aware of EVALI, can either stop smoking or continue to smoke EC excessively regarding their perceptions of EC. Adolescents who had low perception of smoking EC are less likely to smoke EC. Their environment and stress can contribute to them smoking but it is not a guarantee it will. Along with nicotine, THC and VEA may be the cause of EVALI resulting in hospitalization or death. An adolescent health history is not a predictable factor when it comes to developing EVALI. Some may or may not have respiratory issues prior to developing EVALI because health history is not a reliable predictor.

Adolescents who are at high risk of developing EVALI will experience mild respiratory complications, specifically coughing and shortness of breath, before going into respiratory arrest/failure. After a first visit to a clinic or urgent care, the patient may be sent home on the assumption of a respiratory infection, such as the flu, COVID or pneumonia, before being admitted to the hospital's critical care unit for EVALI. Essential information, such as the patient's past medical and everyday habits, is needed to treat adolescents promptly. As well with history, taking in the signs and symptoms of EVALI is crucial to avoiding intubating adolescents. Adolescents who present respiratory and gastrointestinal symptoms with confirming negative lab work of respiratory infections can lead to a diagnosis of EVALI. Educating adolescents on these substances and EC device products may result in fewer cases of EVALI but it is up to the individual whether to smoke EC or not. Public health administrators, healthcare workers and schools should all work together and educate adolescents on EVALI and the impact it could have on their health.

Conclusions

Electronic cigarettes were first introduced to ween from nicotine, but it has an opposite effect on the public, especially with adolescents who are now addicted. This new smoking device has single-handedly been the cause of EVALI, affecting an overall healthy age population to become admitted to hospitals after being misdiagnosed the first-time presenting symptoms. Understanding the perceptions adolescents have when it comes to EC, THC involvement with EVALI, predicting EVALI and presenting signs and symptoms of EVALI are all important when it comes to educating adolescents on the risk of smoking EC.

Adolescents who often are misdiagnosed die due to the lack of evidence collected to properly treat EVALI. Once again, it is up to healthcare providers to be aware of the signs & symptoms of EVALI. Public health administrators and schools should understand the perceptions adolescents have when it comes to EC and to educate the adolescents in their community of the risks when it comes to smoking electronic devices and help adolescents seek care if needed.

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