

Electronic Nicotine Delivery Systems: Are you prepared to have a conversation with your patients?

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Target audience: All health care workers

Purpose/Goal: To improve nurse's knowledge regarding electronic nicotine delivery devices and their health effects.

Learning Objectives: At the conclusion of this activity, the learner should be able to:

- 1.) Identify basic components of electronic nicotine delivery systems and various terminology used to describe them.
- 2.) Identify chemicals that could be in an electronic nicotine delivery system.
- 3.) Identify potential health problems and addiction potential with the use of an electronic nicotine delivery system.
- 4.) Identify the role of electronic nicotine delivery systems in quitting regular cigarettes.

Contact Hours: 1.0 (ANCC) and 1.2 (ABN). Contact Hours are valid February 1, 2017 through January 31, 2019.

Fees: ASNA Member \$ free ~ Non Member \$10 (Fees must be paid on line and the same time as the completing the evaluation.)

Accreditation: Alabama Board of Nursing (Provider Number ABNP0002) (*valid through April 6, 2021*)..

Instructions for Credit: Participants should read the purpose and learning objectives on line or printed out. After reading complete the post test at the end of the activity and compare your responses to the answers provided and review any incorrect response(s). Participants must complete the evaluation online and submit the appropriate fee to receive continuing nursing education credit. The Certificate of Attendance will be generated after the evaluation has been completed. ASNA will report the contact hours to the Alabama Board of Nursing within 2 weeks of completion. Visit <https://alabamanurses.org/cne/> and locate the program under the "Enduring" studies.

Introduction

Electronic nicotine delivery systems (ENDS) are simulated to imitate regular cigarettes and can be produced to look like regular cigarettes, or other objects, such as screwdrivers, lipstick, pens, cigars, etc. ENDS are devices that heat a liquid when initiated, thereby producing a vapor that the user inhales¹. Figure 1 shows common components of ENDS. The person using the ENDS is commonly referred to as the “vaper” in the ENDS community¹. ENDS do not burn tobacco and instead, comprise a battery- powered atomizer that



Figure 1. Common Components of ENDS

produces a vapor for inhalation from cartridges containing nicotine, flavors (e.g., mint, or fruit) and other substances such as humectant². When a person uses an electronic nicotine delivery system, the aerosol is delivered through the mouth to the lungs and is then exhaled into the environment³. There are three categories of ENDS: cigalikes (made to look like regular cigarettes), eGos (larger and with a removable tank), and mods (largest and customizable)⁴.

ENDS are known by many different names. When assessing patients for use of these devices it is important to be aware of the various names of devices in use. It is possible to get an answer of “no” when simply asking, “Do you smoke electronic cigarettes?” A patient may

believe that they do not use these devices because of what term they (or their peers) have been using. Other names used in the place of ENDS include electronic cigarettes, e-cigarettes, e-cigs, e-hookahs, hookah pens, vape pens, vape pipes, and the aforementioned, mods. A patient could also be asked if they smoke or use a device of any kind, or if they currently use a device to gain access to nicotine.

There are more than 460 brands, and over 7,000 possible additives of ENDS being manufactured⁴. Not all ENDS have the same additives, as it depends on the manufacturer. Out of all the brands available, only a handful has been tested for their constituents. The following chemicals are common in the manufacture of various ENDS: nicotine, aldehydes (formaldehyde, acetaldehyde, acrolein, and acetone), nitrosamines (NNN and NNK), heavy metals (cadmium, nickel, lead, chromium, arsenic), alkaloids (cotinine, anatabine, B-nicotyrine, and nornicotine), and volatile organic compounds (VOCs) (toluene, xylene, propylene glycol, and glycerin)³. These chemicals were reported at varying levels, depending upon the specific manufacturer of the ENDS. There are health problems associated with these chemicals, including cancer, asthma, and allergic reactions, Alzheimer, Parkinson’s disease, and many more. Various manufacturers have reported that the fluids and flavors used in their particular ENDS brand are “food grade” or “generally recognized as safe” (GRAS)⁵. The problem with this statement rests in the fact that chemicals are labeled GRAS for ingestion only, not inhalation; therefore, potentially misleading consumers⁵. There are various methods of testing ENDS chemicals; therefore, it is quite difficult to assess constituents of ENDS overall.

The purpose of this paper is to attempt to familiarize nurses with ENDS. The following paragraphs discuss the incidence and prevalence of use, the potential as a gateway with the use of ENDS, ENDS for smoking cessation, concerns with secondhand emissions from ENDS, and ENDS use during pregnancy. This paper will also discuss ENDS use with asthma, questions to ask when assessing patients, and concludes with a series of questions to assess knowledge.

What is the prevalence of use of ENDS?

Twenty percent of Americans currently use ENDS⁶. The researchers revealed that 12.6% of adults reported having tried an ENDS device with the greater use among males and young adults (aged 18-24 years old) with use decreasing with increasing age⁷. They found greater use of ENDS with Non-Hispanic American Indian or Alaskan Native (20.2%) and non-Hispanic Caucasians (14.8%) and reported that 47.6% of current

cigarette smokers, 55.4% of recent former smokers, 8.9% of long-term former smokers, and 3.2% of adults who had never smoked reported that they had tried ENDS⁷. Studies showed that ENDS are more commonly used by males, people who currently smoke traditional cigarettes, people who have family members who smoke⁸.

What is the concern with ENDS being used by adolescents?

Given that there is not an acceptable level of nicotine for all including children⁹, six thousand people per day in the United States try cigarettes (traditional) for the first time with half of those people being under the age of 18³. The 2016 Surgeon General reported that one in six high school students reported ENDS use in 2015⁹. High school students reported greater use of ENDS, when compared to traditional cigarettes¹⁰. The CDC revealed that in between 2011 and 2012, ENDS use among middle and high school students increased from 3.3% to 6.8%¹¹. Moreover, of the middle school students who were participating, 20% had never tried a traditional cigarette before¹¹. Others showed that current use of ENDS had doubled at that same period from 1.1% to 2.1%.¹² This data indicates that ENDS could potentially serve as a starter product in the youth population¹². Research shows that adolescents who have tried ENDS had never smoked regular cigarettes before, which suggests that they may initiate tobacco use later³. Furthermore, young people are the target for ENDS advertisements and the corresponding social media. The ENDS are advertised with various flavors and there is increasing concern that these flavors will be appealing to younger populations¹³. Flavors available include bubblegum, cotton candy, shortcake, pumpkin spice latte, banana cream pie, berry bash, strawberry, and various others. A well child visit is an appropriate time to assess the use of ENDS¹⁴. The 5A method is recommended for cessation of ENDS¹⁰. The 5A Method includes *asking* if your patient uses ENDS, *advising* them to stop using, *assisting* them in quitting, *arranging* for follow-up, and *anticipatory* guidance¹⁰.

Where are we in regards to using ENDS for smoking cessation?

One feature that is commonly advertised regarding ENDS is the potential as a quit aid for people who use traditional or regular cigarettes. Despite these claims and the various people who proclaim that these devices have helped them cease the use of traditional cigarettes, the evidence shows inconclusive results and the Food and Drug Administration (FDA) has not approved the use of ENDS as a smoking cessation device. Until recently, there was no regulation for ENDS. The FDA issued a statement in 2014 designating that ENDS could potentially be subject to regulation and finally extended its authority regarding ENDS in August 2016. Therefore, in a near future, manufacturers are required to report the constituents and health warnings on packaging of the ENDS and only market after FDA's approval. In addition, they would not be allowed to distribute free samples. According to the FDA, this will prevent young people from beginning these products, assist users in understanding the risks, and exclude misleading information on the products. This information will be important for nurses and other healthcare providers to convey to their patients.

Despite FDA regulation of ENDS in 2016, the popularity and growth of the industry overall has increased¹. Before the advertisements of ENDS were mainstream in the U.S., an estimated 2 to 3% of people were using them in 2010, while 8% had tried them by 2012¹. The main reason that people begin using ENDS is the possibility of smoking cessation¹. Not only there was a spike of ENDS users in the general population in the U.S., but also in the cancer patient population¹. This increased use was seen mainly as for smoking cessation after a diagnosis of cancer, particularly, lung cancer. A study found that ENDS users were mostly current or former smokers, who thought that ENDS could be used to help them stop smoking and were safer to use. It was also reported that a person's new use of an ENDS was often connected with a failed smoking cessation attempts via traditional means, such as medication, nicotine gum, or nicotine patch¹. A few studies revealed that some levels of smoking cessation may be achieved using ENDS, in one study the success rate was 31%¹⁵.

A study compared the puffs that an ENDS offers in contrast to a traditional cigarette and found that traditional cigarettes offer approximately 15 puffs and ENDS offered around 150 to 300 puffs¹⁶. Furthermore, the researchers reported that ENDS toxicity was comparable to nicotine replacement therapy but was found to be less harmful than traditional cigarettes. The nicotine free ENDS, which are being advertised by companies, still tend to have trace amounts of nicotine, and should not be taken lightly since nicotine even in small amounts can be addictive, especially for young populations, and a consumer may become addicted to nicotine

unknowingly¹⁶. Although the research on ENDS as a smoking cessation device is scarce and inconclusive, some European countries are allowing ENDS to be written for prescriptive purposes only for the use of smoking cessation, depending on a person's medical history.

What are the concerns with common chemicals found in ENDS and secondhand exposure?

ENDS are becoming popular with many age groups. Coupled with this new popularity, there is the concern for secondhand exposure to those who are not actively using ENDS. Not enough studies have been performed solely on chemicals emitted from ENDS. Traditional cigarettes release chemicals via a combustion process that produces smoke, whereas ENDS release chemicals via evaporation⁷. This is where the term "vaping" originated and has become a term that is widely used. Certain characteristics of ENDS may have effects on what chemicals are released. These characteristics include what is actually added in the ENDS device during manufacturing process, how old the ENDS device is, how long the puff lasts, and the time in between puffs¹⁷. ENDS can release nicotine in the air, however, they do not release significant amounts of carbon dioxide¹⁸. A study compared passive exposure at homes of ENDS users versus traditional cigarette users and found that in the dwellings of traditional cigarette users, nicotine concentration was 5.7 times higher than that in the homes of the ENDS users¹⁹.

ENDS could cause emissions of aerosol, VOCs, various flavoring additives, and nicotine into indoor air⁷. The levels of emission vary depending on the type of ENDS. Also, it is unclear what VOCs are emitted from an ENDS unless that specific one is tested. This is due to the vast majority of manufacturers and retailers of ENDS. Moreover, After inhalation, aerosol's size is changed in the lung via evaporation and is exhaled as smaller particles to the environment⁷. In a study, investigators compared the chemicals emitted from different brands of ENDS and traditional cigarettes and found nicotine to be detected in all brands, with a higher amount being discovered in traditional cigarettes¹⁸. Although ENDS may sound better and may emit fewer chemicals, in addition to nicotine and VOCs, the vapor might contain dangerous chemicals, such as carbonyls, traces of nitrosamines, heavy metals, ultrafine particles, and glycols¹⁸. Aerosol particles were detected in all brands with the mean concentration from traditional cigarettes rated at seven times higher than that of ENDS¹⁸. Additionally, ENDS produce toluene, while the traditional cigarettes produced toluene, ethylbenzene, and xylene¹⁸. Smoke from traditional cigarettes after exhalation can increase the toxicity of tobacco smoke two to four fold¹⁸. Therefore, although based on Surgeon General's 2016 report, aerosol from ENDS is not harmless⁹ and the vapors emitted from ENDS and their components may be toxic to some degree, it is still unlikely that they are as harmful as secondhand smoke from regular cigarettes.

Are ENDS safe to use during pregnancy?

There are concerns regarding the use of ENDS during pregnancy and exposure to secondhand smoke. Due to the known serious dangers of smoking while pregnant, many women have opted to switching to ENDS from traditional cigarettes¹¹. Based on the Surgeon General, no level of nicotine is safe for the fetus (i.e. nicotine that exists in traditional cigarette or ENDS). Nicotine crosses the placenta in pregnancy and causes certain effects in utero including congenital malformations, reduction in internal surface area of the lung, low birth weight, and premature birth¹¹. Moreover, offspring could potentially have elevated blood pressure in adulthood and decreased serum insulin, potentially leading to future diagnoses of hypertension and diabetes^{9,11}. Nicotine can also be found in breast milk¹¹. There are not enough research regarding the effects of using ENDS during pregnancy; therefore, the use of ENDS and exposure to its secondhand smoke in pregnant women should be discouraged due to the unknown risks to the fetus⁶.

What is the relationship between ENDS use and asthma?

ENDS are becoming popular in smokers and former smokers with asthma²⁰. A study on adults revealed that smokers with asthma who quit or considerably decreased smoking by switching to regular ENDS showed significant improvement of their asthma signs and symptoms²⁰. On the other hand, another study showed that asthma was more common in high school students who had used ENDS²¹. In addition, more studies support the fact that high school age ENDS users had an increased chance of asthma and are more likely to be absent from school due to asthma symptoms as compared to non ENDS users in the same study²². Therefore, switching to

ENDS for smokers, who have asthma, may help them with asthma symptoms; however, younger people should be informed that ENDS is a risk factor for asthma development and nurses should consider ENDS as a reason for newly developed asthma in younger clients.

Summary

ENDS may begin to be seen in public at a higher rate than regular cigarettes which runs the potential of reversing the de-normalization of smoking behavior¹⁸. Moreover, ENDS are commonly marketed to have various flavors, which could cause them to seem more appealing to the younger population². Education needs to be conveyed to the ENDS user in that use of these devices needs to be decreased in general, but more importantly, around children and adolescents who may not be able to leave an area where one is in use. ENDS do cause secondhand exposure and not all ENDS are comparable to another. Health care workers should educate young people on the growing popularity of these devices and dangers on initiating use. Regarding adolescents, a well-child visit is an appropriate occasion to assess health behaviors and provide guidance if needed.

In regards to nursing care, simply asking, "Do you smoke?" in a comprehensive health history exam may not be sufficient to assess exposure to nicotine. This would be especially important for inpatient care when a potential nicotine withdrawal is likely or in the area of preoperative care, when nicotine use from devices other than regular cigarettes could potentially affect outcomes. Health care providers should also assess the reasons one is using ENDS. Are they being used for recreation or were they, as a past cigarette smoker, trying a new potential smoking cessation aid? If the first is true, you should educate them on nicotine addiction and second-hand smoke exposure and address the possibility of exposure to other chemical components. Your clients should know that even low amounts of nicotine can lead to nicotine addiction and people can develop nicotine dependence even if using intermittently. If the latter is true, you should talk to them about current clinical practice guidelines for smoking cessation and other available smoking cessation devices, and educate them about the risks of using ENDS. Although there are numerous personal reports about the efficacy of smoking cessation with ENDS, the evidence about ENDS efficacy on smoking cessation is inconclusive. If a patient has attempted other smoking cessation methods to no avail and he decides to choose ENDS as a smoking cessation option, proper education and support of the patient is vital.

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Questions

What are other common names of electronic nicotine delivery devices?

- a.) Electronic cigarettes
- b.) Vaporizers
- c.) E-hookahs
- d.) Vape pens
- e.) Mods
- f.) All of the above

Which one is NOT a chemical that has been reported in various electronic nicotine delivery devices (that have undergone chemical testing)?

- a.) Nickel
- b.) Lithium
- c.) Formaldehyde
- d.) Acetone
- e.) Propylene glycol

What are some electronic cigarettes made to look like?

- a.) Pens
- b.) Lipstick
- c.) Screwdriver
- d.) Cigarette or cigar
- e.) All of the above

Is electronic cigarette use reported to be greater in males or females?

- a.) Females
- b.) Males

What age group was reported to have the greatest use of electronic cigarettes?

- a.) Age group younger than 25 years old
- b.) Age group older than 25 years old

What is the estimated number of brands of electronic cigarettes that are currently in use?

- a.) Less than 400 brands
- b.) More than 400 brands

What are potential methods for secondhand exposure with the use of ENDS?

- a.) Inhaling chemicals from an ENDS that is in use close by
- b.) The use of ENDS during pregnancy
- c.) Both A and B
- d.) None of the above

What are some advertised flavors available for electronic cigarettes?

- a.) Pumpkin spice latte
- b.) Bubblegum
- c.) Cotton candy
- d.) Berry Bash
- e.) All of the above

There is a correlation between the use of ENDS and the likelihood of that person trying other products (for example, ENDS can be considered a gateway to the use of tobacco products or other drugs).

- a.) True
- b.) False

It was reported that adolescent students who use ENDS have an increased chance of asthma and are more likely to absent from school due to asthma related symptoms.

- a.) True
- b.) False

Researchers and public health officials are concerned with secondhand exposure of ENDS?

- a.) True
- b.) False

Answers: 1-F, 2-B, 3-E, 4-B, 5-A, 6-B, 7-C, 8-E, 9-A, 10-A, 11-A