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**Effects of Vaping**

 Many Americans have turned to electronic cigarettes (ECs) to limit or stop the habit of traditional cigarette use due to beliefs that EC use, or “vaping” is better than conventional smoking. Since ECs have only been around for about a decade, limited long-term effects are available, but researchers have been investigating the effects of ECs in communities. Being aware of how these devices will alter tobacco use for different demographics, especially the youth, and the health effects is vital for the nation’s health system.

 Popularity of ECs within the recent years has increased as they have become more readily available to purchase, more convenient to use, and extensive flavors. While “old school” tobacco cigarette smoking has continued to drop to all-time lows, the use of ECs, introduced in the United States (U.S.) in 2007, has been rising dramatically, especially among youth (MacDonald & Middlekauff, 2019, p.159). There are different forms of ECs, but they all essentially work the same way. ECs are comprised of a battery that heats a flavored liquid, typically containing nicotine, to form an aerosol that the user inhales by puffing on the device (MacDonald & Middlekauff, 2019, p.159). Puffing on the device and having the aerosol expelled is how the term “vaping” was coined. This may give the illusion that there are less toxins or chemicals with vaping due to the fact that it is puffing on aerosols, but studies are showing that toxins are still present in concerning amounts. Andrikopoulos et al., 2019 stated that,

“Studies comparing EC aerosol to traditional tobacco smoke showed lower levels (9- to 450- fold lower) of potentially toxic compounds (formaldehyde, acetaldehyde, acrolein, and toluene), but considerable levels of potential carcinogens including toxic metals (aluminum, cadmium, chromium, copper, lead, magnesium, manganese, nickel, and zinc), a number of organic compounds including carbonyls (acrolein from glycerol/glyceride), and potentially harmful compounds such as silicate beads, tin, and flavorings as well as propylene oxide (from propylene glycol) that are not present in traditional tobacco cigarettes are found in these aerosols” (Andrikopoulos et al., 2019, p.2).

There is also the large concern of nicotine still being delivered through ECs, and now being used more by adolescents. Nicotine levels in the EC depend on the generation of the device: first-generation “cig-alikes”, second-generation “tanks”, third-generation “mods”, and fourth-generation “mod pods” (the popular USB-like devices) (MacDonald & Middlekauff, 2019, p.161). As the generations advanced, so did the technology and the amount of nicotine being delivered. In 2015, the market introduced the Juul, a mod-pod EC using nicotine salts rather than alkalinized nicotine, producing more efficient delivery of nicotine, with a time course similar to traditional tobacco cigarettes (MacDonald & Middlekauff, 2019, p.161). The increase in nicotine being available in ECs stresses the need for better regulation over manufacturing of the product. The Food and Drug Administration (FDA) regulates the manufacture, marketing, sale, and distribution of ECs and their components, however, there are variations in state and local policies (Kowitt et al., 2019, p.2).

 Serious health effects have been researched from nicotine and EC use by numerous studies. A report done by Goel et al., stated that the level of free radicals, both short- and long-lived in EC emissions is at least ten times that of air pollution alone and likely increases cardiovascular risk (MacDonald & Middlekauff, 2019, p.165). Increased platelet aggregation, inflammation, and oxidative stress, with protentional predisposition to atherosclerosis are all being seen in studies pertaining to use of ECs (MacDonald & Middlekauff, 2019, p.166). Having this much stress on the lungs, heart, and other organs can cause complications that may be irreversible overtime. Andrikopoulos et al., 2019 explains,

“nicotine plays a significant role in periodontal disease. It is also shown to contribute to migration inhabilitation, cytoskeleton alterations, extracellular matrix remodeling in human gingival fibroblasts (HGFs), and to increase the amount of pro-inflammatory cytokines secreted in cultured gingival keratinocytes and fibroblasts. Nicotine is indicated as a contributing cause of periodontal degradation by affecting the attachment ability of fibroblasts, as well as collagen and integrin production” (Andrikopoulos et al., 2019, p.3).

There is a great risk of negative oral effects due to the toxins and vapors on the gums in the mouth. This could cause increase risk for oral cancers and as mentioned in the previous study periodontal disease, or gum disease. There may be an association between EC usage and higher odds of cracked/broken teeth, pain in the tongue, and/or inside the cheek as compared to those who have never used ECs, among adolescents (Andrikopoulos et al., 2019, p.8).

 While some middle- to older-aged groups in populations may be using ECs for tobacco cessation, research is showing it is not the best alternative to stop the habit. A meta-analysis by Kalkoran and Glantz concluded that EC use to help quit traditional tobacco cigarette smoking was associated with even lower quitting rates than not use ECs in the cessation strategy, possibly because ECs can prolong nicotine addiction (MacDonald & Middlekauff, 2019, p.170). Since EC still use a significant amount of nicotine depending on the generation you buy, it may be a contraindication to quit smoking and may cause the same, if not worse, health effects. The biggest public health concern with ECs is the increased use of adolescents using them. The increased use of ECs among youth has been declared an epidemic by the Office of the Surgeon General and the FDA (MacDonald & Middlekauff, 2019, p.171). Rates in the recent years are on the rise in high school and middle school aged youth. The National Youth Tobacco Survey estimated past 30-day vaping among high school students at 20.8% in 2018, compared with 11.7% in 2017, consistent with trends from the 2018 Monitoring the Future study (Hammond et al., 2019, p.3). MacDonald & Middlekauff, 2019 stated,

“Data from Monitoring the Future survey showed a 5.2% increase in the use of any nicotine products among youth from 2017 to 2018, such that 28.9% of adolescents use at least one nicotine product. This increase has been driven entirely by EC use. There was a 78% increase among high school students and 48% increase among middle school students from 2017 to 2018 in EC use” (MacDonald & Middlekauff, 2019, p.171).

These statistics are scary to think about the health effects the youth will be facing with continued nicotine use. Marketing ECs toward adolescents is one of the major problems. More aggressive regulation with better attention to new devices as the enter the market, restrictions on where EC are sold, limiting candy flavors, and stricter penalties for selling to youth may need to be put into action (MacDonald & Middlekauff, 2019, p.171). A study done comparing middle school and high school student differences between South Korea and the U.S. found lower rates of vaping and smoking in South Korea, where regulations on vaping are stricter (Hammond et al., 2019, p.3).

 Comparing ECs to the argument that it is reducing the use of traditional tobacco cigarettes is not a justified point to make. ECs are causing more harm in the health of adolescents, continuing to promote cardiovascular issues, inflammation throughout the body, gum disease, and poor vascular health. While stricter policies may help limit the selling to youth, education in communities so that adolescents understand the dangers of ECs is most important. This will keep healthcare spending down with less secondary and tertiary care with the focus being on prevention.

**References**

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