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Editorial

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Electronic Cigarettes: Toxicity and Addiction

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Cigarette smoking remains a leading cause of preventable disease and premature death in the United States and other countries. More than 20 million Americans have died as a result of smoking since the 1st Surgeon General's report on smoking and health was released in 1964.[1] Approximately, 2.5 million were non-smokers who died from heart disease or lung cancer caused by exposure to secondhand smoke (SHS).[1] Generally, smoking causes 20% of deaths in the United States each year.[1] Premature death from complications of smoking is approximately 50%.[1] Electronic cigarettes [also known as e-cigarettes and electronic nicotine delivery systems (ENDS)] are battery-operated devices designed to deliver flavored nicotine to users in a vapor, as a substitute to conventional cigarettes, cigars, and pipes. E-cigarettes were invented and patented by the Chinese engineer Hon Lik in 2003. E-cigarettes are now the most commonly used tobacco products among youth and the rising popularity of e-cigarettes among teens. The Centers for Disease Control and Prevention (CDC) reported that more than 3 million middle and high school students were users of e-cigarettes in 2015, compared to 2.46 million in 2014.[2,3] In 2013-2014, 81% of youth e-cigarette users cited the availability of appealing flavors as the primary reason for use.[4] Candy-flavored, fruit-flavored and menthol-flavored e-cigarettes appeal to adolescents more than tobacco-flavored or alcohol-flavored e-cigarettes, as well as common beliefs that e-cigarettes offer reduced harm.[5] The online availability of e-cigarettes allows this age group to easily order them. In May 2016, the National Institute of Drug Abuse (NIDA) reported that, the Food and Drug Administration (FDA) has finalized new regulations to prohibit minors from buying e-cigarettes in person or online.[6] The FDA rule extended the regulatory authority to cover all tobacco products, including vaporizers, vape pens, hookah pens, electronic cigarettes, e-pipes, and all other ENDS. FDA now regulates the manufacturing, import, packaging, labeling, advertising, promotion, sale, and distribution of ENDS.

E-cigarettes usually contain major ingredients such as propylene glycol, glycerol, ethylene glycol and polyethylene glycol mixed with concentrated flavors, and optionally, a variable percentage of nicotine.[7-9] Other organic compounds can be found in liquid formulated products and/or the vapor phase produced by an e-cigarette unit. These include tobacco specific nitrosoamines such as N-nitrosonicotine, N-nitrosoanabasine, N-nitrosoanabatine and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone, or tobacco-specific impurities such as cotinine, anabasine, and myosmine.[7-9] Data on the daily exposure from liquid-phase aerosol particulate matter in e-cigarettes showed significant formation of formaldehyde and formaldehyde hemiacetals when high voltage (5 V) was applied.[10] Geiss et al[11] reported that, when considering concentrations in each inhaled puff, the short-term indoor air guideline value for formaldehyde was already exceeded at the lowest wattage of 5 W, which is the wattage applied in most second-generation e-cigarettes. The e-cigarette aerosol also contained metals such as silver, iron, nickel, aluminum, silicate, chromium, lead, tin, and cadmium.[12] The concentrations of these elements in e-cigarettes aerosol were higher than or equal to the corresponding concentrations in conventional cigarette smoke.[12] Evaluating the potential harm associated with e-cigarette use requires detailed analysis of various aspects of these products and their metabolites, including their toxicological profiles.[13]

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Sellers of e-cigarettes have made a variety of claims indicating that e-cigarettes are safer than conventional cigarettes and that their use facilitates smoking cessation.[14] However, e-cigarette manufacturers do not provide complete information on the chemicals used in the manufacturing process, or the chemicals that may be released or synthesized during the aerosol generation process that occurs during use.[14] Generally, e-cigarettes required stronger vacuums to smoke than conventional brands, and the effects of this on human health could be adverse.[15,16] Health risks associated with the intended use of electronic cigarettes cannot be excluded at present.[14]

Nearly 50 mg of nicotine are lethal for adults.[17] However, for children; a dose of only 6 mg is life-threatening.[17] Liquids used in e-cigarettes usually contain up to 36 mg/ml of nicotine. Study of Morean et al[18] reported that e-cigarettes smokers, males, and those who purchased their own e-cigarettes reported using the highest nicotine levels. Smoking is a highly efficient form of drug administration.[19] Inhaled nicotine enters the circulation rapidly through the lungs and moves into the brain within seconds and reinforces the effects of the drug.[19] However, nicotine addiction is more threatening than its toxic effects. This addiction consists of a physical and a psychological component, making cessation particularly hard.[19,20] It is possible that e-cigarettes smokers who were more experienced in using the products pulled harder at the devices leading to increased nicotine delivery.[16] Since users of electronic cigarettes absorb nicotine when vaping, it is possible that smokers who have switched to e-cigarettes or are using them in addition to conventional cigarettes may maintain nicotine dependence because of the smoking ritual being maintained.[16] It is particularly important to protect young people and children from toxicity and addition of e-cigarettes.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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