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Should Electronic Cigarette Use be Allowed in Smoke-Free Environments?

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With smoke-free regulations widely spreading across the world in the past decades, a new device, electronic cigarette (EC), was conceptualized and produced by a Chinese pharmacist in 2003 to simulate smoking cigarette without burning tobacco, and it becomes increasingly popular in recent years. ECs are claimed as a less harmful alternative to smoking, as an aid for smoking cessation, and as a way to free smokers from most of the smoking bans [1]. However, more scientific evidence is needed for the first two claims, and there has been a hot debate on whether EC use or vaping should be included in smoke-free policies.

A typical EC device contains an electronic vaporization system, rechargeable batteries and cartridges of the liquid that is vaporized. The main ingredients of the liquids are nicotine, propylene glycol and/or glycerin and flavors (tobacco flavor, fruit flavors, and many others), although some products claim to contain no nicotine. Most ECs are shaped to look like their conventional tobacco counterparts (e.g. cigarettes, cigars, cigarillos, pipes). They are also sometimes made to look like everyday items such as pens and USB memory sticks, for people who wish to use the product without other people noticing [2]. ECs do not produce any combustion products, and they are claimed to be "smokeless and odorless" [1]. To examine whether ECs are as healthy as what the manufacturers have claimed to be, several studies have looked at the chemicals in the cartridge liquids or nicotine refill solutions and in the vapors inhaled or exhaled by their users.

Since ECs are generally not regulated worldwide, the quality of the fluid ingredients is not guaranteed and varies to a great extent. Besides the main ingredients of propylene glycol or glycerin used for vapor production, flavorings and varying levels of nicotine, carcinogenic Tobacco-Specific Nitrosamines (TSNAs) have been detected in 105 replacement fluids for eleven EC brands [3]. ECs contain fibers and metal components including wick, wires and coating materials, as results, tin, silver, iron, nickel, aluminum, silicate, tin, chromium and nickel have been found in the EC cartridge fluid, with levels higher than or equal to the corresponding concentrations in conventional cigarette smoke [4]. Many of the elements found are known to cause respiratory distress and disease. The aerosols inhaled by EC users have been shown to contain carbonyl compounds (e.g. formaldehyde, acetaldehyde, and acrolein), volatile organic compounds (VOCs, e.g. benzene, ethyl benzene, xylene and toluene), heavy metals (e.g. lead, chromium and nickel) and TSNAs [4-6]. Scientific evidence has shown that all these compounds have toxic and/or carcinogenic effects on human. With toxic and carcinogenic chemicals found in cartridge liquids or nicotine refill solutions and in vapors produced by heating, non-users close to EC users are expected to be exposed to similar chemicals from passive vaping. A recent study found ultrafine particles, nicotine, metals and carcinogens mentioned above in exhaled aerosol by an EC user [7].

It should be noted that EC products vary widely in design, contents and operational features. The liquids used may have ingredients that are not labeled on the containers, and people can create their own ratio of ingredients and add other substances, which may contain other carcinogens or toxic substances [2]. Currently only one single study has been conducted to examine chemicals in exhaled vapors of three EC brands, more studies including more brands are needed to examine whether other carcinogens or toxic substances exist in the exhaled vapors.

Most of the toxic chemicals found in the vapors inhaled or exhaled by EC users are in trace amount or much lower than those produced by traditional smoking. Thus, in the debate of whether EC vaping should be treated the same as traditional tobacco use, and banned in workplaces and public places like restaurants and bars, chemical levels detected in EC vapors are often compared to Occupational Safety and Health Administration (OSHA) Permissible Exposure Levels (PELs). On one hand, it is affirmative that EC vapors do add extra amount of toxic and carcinogenic pollutants to indoor environments. On the other hand, chemical levels detected in EC vapors are trivial comparing to the PELs. However, OSHA PELs are designed for occupational settings where the general public is typically not present, and to protect the worker population which usually does not include those sensitive and/or vulnerable populations like children and seniors. In addition, many OSHA PELs are out of date, and inadequate for ensuring protection of worker health [8]. For carcinogens, there is no threshold safe level. Thus, it is unfair to expose the majority of the public (i.e. none smokers and none-EC users) to extra amount of toxic and carcinogenic chemicals by allowing EC users to vape around in public places. In addition, many EC products look like real tobacco products, allowing EC products but not tobacco products to be used in public places or workplaces will make enforcement of smoking bans more difficult to implement.

EC products do produce lower toxic chemicals and carcinogens in general and they are potential effective aids to help smoking cessation. However, not allowing EC vaping in smoke-free environments is not equal to banning the products themselves, but to ask those users not to impose any potential extra adverse health effects to others.

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