EN_92413826 Research Introduction

In today's society, E-Cigarettes are constantly rising in popularity and ubiquity appealing to a broad variety of consumers (Arrazola et al., 2015; Wang et al., 2018; Gentzke et al., 2019). Patented by the Chinese pharmacist Hon Lik in 2003 (Grana, Benowitz, & Glantz, 2013), these electronic nicotine delivery systems have quickly solidified their position in the nicotine market over the past 21 years (Arrazola et al., 2015; Wang et al., 2018; Gentzke et al., 2019). This success can be attributed in part to a growing trend of individuals opting for E-Cigarettes as an alternative to conventional cigarettes, driven by perceptions of reduced harm, modern design, and the appeal of customizable flavors (Grana, Benowitz, & Glantz, 2013; Etter & Bullen, 2011). According to the U.S. patent application for E-Cigarettes, they are "[a]n electronic atomization cigarette that functions as substitutes (sic) for quitting smoking and cigarette substitutes." (Patent #8,490,628 B2) (Grana, Benowitz, & Glantz, 2013).

Because E-Cigarettes are commonly perceived and used as a healthier, cheaper, and more practical alternative to conventional cigarettes (Fould, Veldheer, & Berg, 2010), their popularity has significantly increased while conventional cigarettes became less appealing among U.S. adolescents (Arrazola et al., 2015; Wang et al., 2018; Gentzke et al., 2019). This alternative option leads many traditional smokers who want to quit to prefer E-Cigarettes over conventional cigarettes (Etter & Bullen, 2011). Coherent with this development is the aggressive advertisement of e-cigarettes, which shows fewer restrictions and deterrents than the marketing of conventional cigarettes (Glantz & Bareham, 2018). This marketing focused mainly on spreading and advertising E-Cigarettes as healthy, convenient, and socially accepted, whereas conventional cigarettes are usually perceived as unhealthy, inconvenient, and undesirable (Grana, Benowitz, & Glantz, 2013). Another reason for their popularity is the high nicotine consumption enabled by E-Cigarettes with nicotine salts; the risk for a nicotine addiction increases significantly, and quitting is more complex (E-cigarette use among youth, 2014).

The technology of an E-Cigarette is based on the battery-powered heating and vaporizing of liquids that contain, among other things, nicotine.

Unlike many conventional cigarettes, no tobacco is included in this process, and with each puff, a visible vapor is exhaled (Cahn & Siegel, 2010). Instead of the characteristic smell and taste of tobacco-containing cigarettes, E-Cigarettes use flavoring agents to increase the smoking experience by offering many different tastes to choose from. Alongside these flavoring agents and nicotine, a solution usually containing propylene glycol and/or glycerol (glycerin) is included in the liquid. When heating and vaporizing this liquid, nicotine-containing aerosol is produced and consumed (Grana, Benowitz, & Glantz, 2013). Moreover, toxicants such as carbonyl compounds, volatile organic compounds, and heavy metals occur in E-Cigarettes. However, these toxicants are proven to be less present in E-Cigarettes than in conventional cigarettes (Goniewicz et al., 2013). Nevertheless, the fine particles produced when vaporizing the liquid and subsequently inhaled when smoking E-Cigarettes promote many health risks, such as respiratory and cardiovascular problems and diseases (Pope et al., 2009; Brook et al., 2010).