



Patterns of awareness and use of electronic cigarettes in Mexico, a middle-income country that bans them: Results from a 2016 national survey



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ABSTRACT

Among high-income countries, awareness and use of e-cigarettes is lower in countries with more restrictive e-cigarette regulations. Little is known about e-cigarettes in middle-income countries, many of which like Mexico, ban e-cigarette sales and marketing. The current study determined the national-level prevalence and correlates of e-cigarette awareness and consumption in Mexico. Data were analyzed from a 2016 nationally representative survey. Prevalence of e-cigarette awareness, trial and current use was estimated separately for adolescents ($n = 12,436$), adult nonsmokers ($n = 36,966$), and adult smokers ($n = 7347$). For each group, crude and adjusted logistic models regressed e-cigarette outcomes on sociodemographic and smoking-related variables, adjusting for the sampling design and weights. Prevalence varied across subgroups for e-cigarette awareness (adolescents = 45.3%; adult nonsmokers = 33.9%; adult smokers = 54.3%), e-cigarette trial (adolescents = 6.5%; adult nonsmokers = 2.6%; adult smokers = 18.2%) and current use of electronic cigarettes (adolescents = 1.1%; adult nonsmokers = 0.3%; adult smokers = 4.5%). Among adolescents and adults, current smoking and higher smoking frequency were significantly associated with e-cigarette awareness, trial and use. Among adolescents and nonsmokers, awareness, trial and use of e-cigarette were significantly lower among females than males. Among adult smokers, however, females were more likely to use e-cigarettes than males (AOR = 1.80; 95% CI = 1.08–3.02). Higher education and greater wealth increased the likelihood of trial of e-cigarettes among adult nonsmokers and smokers. Despite the ban on the distribution and sales of e-cigarettes, a substantial number of Mexicans, have access to e-cigarettes. Decision makers and advocates should consider e-cigarette regulations as recommended by the WHO, at the same time Mexico must invest in the infrastructure needed to enforce these regulations.

1. Introduction

Use of electronic cigarettes (e-cigarettes) is rapidly increasing worldwide, although previous studies of their uptake and use are primarily limited to high-income countries (HICs) (Hartwell et al., 2016; Kinnunen et al., 2015; Vardavas et al., 2015). E-cigarettes are battery-operated devices that produce an aerosol that can contain different levels of nicotine, which is a highly addictive substance and can affect the neurological development of adolescents (Carroll-Chapman & Wu, 2014; WHO, 2016; King et al., 2017; Annon., 2014). In addition, e-cigarette liquids contain flavorings that are potentially hazardous, especially for the respiratory system (WHO, 2016). Marketing of e-cigarettes often emphasized their being a safe alternative to conventional cigarettes and as an effective method for smoking cessation (Cobb et al.,

2015; Yamin et al., 2010; De Andrade et al., 2013; Pokhrel et al., 2015). Nevertheless, studies that have evaluated the effectiveness of e-cigarettes for smoking cessation have produced mixed results (WHO, 2016; McRobbie et al., 2014). Moreover, longitudinal studies in the US, Canada and the UK indicate that e-cigarette use among non-smoker adolescents substantially increases the risk of initiating cigarette use (Wills et al., 2017; Barrington-Trimis et al., 2016; Leventhal et al., 2015; Primack et al., 2015; Conner et al., 2017; Hammond et al., 2017), raising concerns that e-cigarettes may promote cigarette smoking among youth who would not have otherwise become smokers. Indeed, a recent longitudinal study of Mexican adolescents found similar results (Lozano et al., 2017); however, more research is sorely needed to better understand the patterns of use and potential public health impact of e-cigarettes in low- and middle-income countries (LMICs).

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Prior research indicates that high-income countries (HICs) with e-cigarette bans have a lower prevalence of awareness (e.g., Canada = 40%, Australia = 20% in 2011) than in similar countries that allow marketing and sales of e-cigarettes (e.g., USA = 73%, UK = 54%) (Hartwell et al., 2016; Adkison et al., 2013). A similar pattern has been found in upper middle income countries (UMIC), where awareness was found to be lower when e-cigarettes are banned (Mexico = 34% in 2012; Brazil = 35% in 2013) (Gravelly et al., 2014) compared to when they are not banned (Costa Rica = 52.5% in 2015 (Annon., n.d.); Malaysia = 62.0% in 2013 (Gravelly et al., 2014). Nevertheless, these levels were significantly higher than in the low-income country of Indonesia (10.9% in 2011) (Palipudi et al., 2016). While it is difficult to separate out the different temporal and contextual factors that account for differences across countries, the population-level of awareness may depend both on policy context and the level of economic development.

Correlates of e-cigarette awareness and use have been studied almost exclusively in HICs. A systematic review of 26 studies in HICs indicates that e-cigarettes awareness and trial is associated with higher levels of education (Hartwell et al., 2016), with current use additionally associated with younger age and being male (Hartwell et al., 2016; Adkison et al., 2013; Goniewicz & Zielinska-Danch, 2012). Across 27 European Union countries, those who lived in urban areas had higher e-cigarette awareness and trial compared to rural inhabitants (Vardavas et al., 2015). In general, being a current smoker has been associated with awareness and use of e-cigarettes (Vardavas et al., 2015), with even higher levels found among smokers who have attempted to quit in the last year (Kinnunen et al., 2015; Rutten et al., 2015). In addition, trial of e-cigarettes appears higher in former smokers than never smokers (Pearson et al., 2012; Jiang et al., 2016).

The few studies to examine these patterns in UMICs have found similar results. A cross-sectional study among university students (Age 19–24) in the UMIC of Romania in 2015 found that e-cigarette trial was associated with being male, a smoker, having friends who experimented with e-cigarettes, and having beliefs that e-cigarettes could help them quit smoking (Lotrean, 2015). Studies of early adolescents in the UMICs of Argentina (Morello et al., 2016) and Mexico (Thrasher et al., 2016) found that e-cigarette use was associated with cigarette smoking, as well as an array of traditional risk factors for cigarette smoking (e.g., sensation seeking, having friends who smoke). Among the general population in Indonesia a higher prevalence of e-cigarette awareness and use were found among the subgroup with higher wealth in comparison with group with very low wealth (e-cigarette awareness 24.7% vs 1.6% and e-cigarette current use 0.7% vs 0.0% respectively) (Palipudi et al., 2016).

In Mexico, however, some risk factors that appear unique to e-cigarette use have been identified (i.e., internet ad exposure, “technophilia” or the appeal of electronic devices) (Thrasher et al., 2016), supporting other research that has found e-cigarettes attract a somewhat different, lower risk population segment than cigarettes (Wills et al., 2015). For example, a longitudinal study of Mexican students found that those who had tried only e-cigarettes were more likely than those who had tried no tobacco product to initiate cigarette smoking (Lozano et al., 2017), although the risk of initiation was somewhat lower than that found in studies from HICs (Soneji et al., 2017).

To the best of our knowledge, there are no studies that have examined sociodemographic or smoking-related correlates of e-cigarette awareness, trial and use in nationally representative samples from LMICs. Such studies are important because of the potential for e-cigarettes to undermine the significant strengthening of tobacco control policies that the World Health Organization Framework Convention on Tobacco Control has promoted around the world over the last decade (WHO, 2016). Furthermore, it is important to understand whether strong e-cigarette policies appear effective in staving off their use or have resulted in different patterns of uptake than in HICs, whether from countries with relatively stronger or weaker policies. Such studies can also help identify potential issues with implementing strong e-cigarette

policies in LMICs, so that policies that address e-cigarettes and other novel tobacco products are effective.

1.1. Study context

The importation, distribution, marketing and sales of e-cigarette are banned in Mexico (Annon., 2008), as in many countries in Latin America (Institute for Global Tobacco Control, n.d.). Nevertheless, a 2012 population-based survey of adult smokers in Mexico found that 34% had heard of e-cigarettes and 4% had tried them (Gravelly et al., 2014), which is similar to other UMICs with strong e-cigarette regulations (e.g., Brazil) (Gravelly et al., 2014), but substantially lower than in HICs. Three years later, the 2015 Global Adult Tobacco Survey (GATS), a nationally representative survey of Mexicans 15 years old and older, found the general population had similar levels of awareness (34%) and trial (5%), with 0.6% of the population reporting current e-cigarette use (Annon., 2010). Estimates were higher in a 2015 representative survey of first-year middle school students (average age = 12.5 years) in the three largest cities in Mexico, in which half were aware of e-cigarettes (51%) and 10% had tried them (Thrasher et al., 2016). The aim of the current study was to determine the correlates of e-cigarette awareness, trial and use in a large, nationally representative survey of Mexico conducted in 2016. Based on the literature reviewed above, we hypothesized that e-cigarette awareness and use will be higher among current smokers than non-smokers. We also hypothesized that current smokers who tried to quit in the last year will be more likely to currently use e-cigarettes compared to current smokers who had not tried to quit. Finally, we expected that former smokers would be more likely to be aware of and use e-cigarettes compared to never smokers.

2. Methods

2.1. Sample

Data from this study came from the National Survey of Drugs, Alcohol and Tobacco Use (ENCODAT), which were collected between June and November 2016. A multi-stage, cluster sample design was used to produce representative data at the national and state levels (32 states in Mexico). Sampling strata were constructed for urban and rural census tracts in each state. First, within each stratum, census tracts (Basic Geostatistical Area or AGEb) were selected with probability proportional to the number of inhabitants. Second, for each AGEb selected, 6 blocks were randomly chosen, again with probability proportional to population size. Third, for each block selected, groupings with < 80 households were created, then a grouping was randomly selected from which six households were selected using systematic sampling. Within each selected household, one 18 to 65 year old household member was randomly selected, as was one 12 to 17 year old (if there were any) (Reynales-Shigematsu et al., 2017). With an overall response rate of 74%, a total of 56,877 people (12 to 65 years old) were surveyed face-to-face. All adult participants signed written informed consent, and 12- to 17-year olds provided written assent and their parents provided written consent. Questions on tobacco were drawn from prior national and international surveys (Annon., 2010; Reynales-Shigematsu et al., 2017; Annon., 2011). The protocol was approved by the IRB at the Mexican National Institute of Public Health.

2.2. Measurement

2.2.1. Awareness, trial, and current use of e-cigarettes

E-cigarette awareness was evaluated by asking: “Before today, have you ever heard of e-cigarettes?” (yes/no). Respondents who indicated awareness were asked: “Have you ever, even once, used an e-cigarette?” Those responding, “yes” were categorized as trial users of e-cigarettes. Trial users were also asked: “Do you currently use e-cigarettes on a daily basis, less than daily, or not at all?” Participants who responded “daily or

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