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Brief Original Report

Who is using e-cigarettes in Canada? Nationally representative data on the prevalence of e-cigarette use among Canadians

Jessica L. Reid [a,*], Vicki L. Rynard [a], Christine D. Czoli [b], David Hammond [b]

[a] Propel Centre for Population Health Impact, University of Waterloo, 200 University Ave. W., Waterloo, ON, Canada, N2L 3G1
[b] School of Public Health & Health Systems, University of Waterloo, 200 University Ave. W., Waterloo, ON, Canada, N2L 3G1

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ABSTRACT

The current study examined prevalence and correlates of electronic cigarette (e-cigarette) use in the Canadian population, using data from the nationally representative 2013 Canadian Tobacco, Alcohol and Drugs Survey ($n = 14{,}565$). Sociodemographic correlates of e-cigarette use (ever, and in the past 30 days) were examined using logistic regression models. Overall, 8.5% of Canadians aged 15 and older reported having ever tried an e-cigarette; 1.8% had used one in the past 30 days. E-cigarette use was particularly high among smokers and young people. Overall, prevalence did not differ between males and females, for ever ($P = 0.24$) or past 30-day use ($P = 0.30$). Smoking status was the strongest correlate of e-cigarette use (ever and in the past 30 days, $P < 0.0001$): 37.3% of current smokers had ever tried an e-cigarette (9.6% used in the past 30 days), compared to 3.0% of never-smokers (0.3% past 30-days), and 5.1% of former smokers (0.9% past 30-day). E-cigarette use also varied by age ($P < 0.0001$): prevalence was highest among youth aged 15–19 (19.8% ever; 2.6% past 30-day) and young adults aged 20–24 (20.1% ever; 3.9% past 30-day), and decreased with age. Among youth, the majority of e-cigarette users were never-smokers, while the majority of adult users were smokers. In Canada, e-cigarette use is particularly high among smokers and young people. Dual use with cigarettes was common, with most e-cigarette users also smoking conventional cigarettes. Continued monitoring of e-cigarette use and its relationship with smoking should be a priority, given the rapidly-evolving e-cigarette market and implementation of new policy measures.

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Introduction

Electronic cigarettes (e-cigarettes) are a diverse set of products that heat liquid to deliver a vapour, typically composed of propylene glycol and/or glycerin, additives such as flavourings, and sometimes nicotine (Britton and Bogdanovica, 2014; Hajek et al., 2014). E-cigarettes have rapidly gained popularity in recent years, both globally and within Canada (Britton and Bogdanovica, 2014; Hajek et al., 2014; Arrazola et al., 2015; King et al., 2015; Gravely et al., 2014), and their regulation varies by jurisdiction (Shiplo et al., 2015; Czoli et al., 2015a). In Canada, e-cigarettes containing nicotine are regulated as drugs/drug delivery devices and require pre-market authorisation before they can be imported, marketed or sold (Health Canada, 2009); to date, e-cigarettes containing any level of nicotine have not been approved. In contrast, e-cigarettes that do not contain nicotine and do not make health claims are legal. Nevertheless, both nicotine- and non-nicotine-containing e-cigarettes are widely available in Canada, regardless of approval status (Hammond et al., 2014; Geller, 2014).

Recent Canadian surveys suggest that trying e-cigarettes was fairly common among younger adults (aged 16–30), at approximately one in six overall (Czoli et al., 2014), and even more common among smokers, with estimates ranging from 4% in 2010/11 to 27–35% more recently (Shiplo et al., 2015; Czoli et al., 2014; Adkison et al., 2013). Studies in some provinces indicate similar and even higher levels of ever trying e-cigarettes among youth: 15% of Ontario high school students (43% of past-year tobacco users and 7% of never-smokers) (Hamilton et al., 2014), and 34% of Quebec secondary students (90% of smokers and 28% of non-smokers) (Canadian Cancer Society, 2014). Past-month use of e-cigarettes was lower but still prevalent among adolescent smokers (35% in Ontario and Alberta (Czoli et al., 2015b) and 30% in Quebec (Canadian Cancer Society, 2014)), but reported by few non-smokers (~4%) (Canadian Cancer Society, 2014; Czoli et al., 2015b).

The comprehensive tobacco control environment in Canada, as well as the mixed e-cigarette market (nicotine and non-nicotine products), makes it a unique context in which to examine population trends. Much of the existing Canadian evidence relies upon non-representative surveys with limited geographic scope, and is focused primarily on young people. The current study examines prevalence and some sociodemographic correlates of e-cigarette use in a nationally representative sample of the Canadian population.

* Corresponding author.
E-mail addresses: jl3reid@uwaterloo.ca (J.L. Reid), vrynard@uwaterloo.ca (V.L. Rynard), cczoli@uwaterloo.ca (C.D. Czoli), dhammond@uwaterloo.ca (D. Hammond).

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Methods

Secondary analysis was conducted using data ($n = 14,565$) from the 2013 Canadian Tobacco, Alcohol and Drugs Survey (CTADS), conducted by Statistics Canada (Canada, 2013). Data were collected from February to December 2013, using computer-assisted random-digit-dialled telephone interviews. The target population included all persons living in Canada who were 15 years of age and over with the exception of those living in the territories and those living full-time in institutions. The sample was selected using stratified random sampling of telephone numbers, and thus excluded residents of households without telephones or with cell phones only (~22% of the target population). Responses were weighted to represent the target population.

Measures

Dependent variables included ever use and past 30-day use of e-cigarettes, assessed by asking "Have you ever tried an electronic cigarette, also known as an e-cigarette? (Yes/No)" and "In the past 30 days did you use an electronic cigarette, also known as an e-cigarette? (Yes/No)", respectively. Covariates included sex, age group (15–19, 20–24, 25–44, 45+ years), and smoking status [current smoker (smoked "every day" or "occasionally"), former smoker (not a current smoker, ever smoked at least 100 cigarettes), never-smoker (not a current smoker, has not smoked at least 100 cigarettes)].

Statistical analyses

Logistic regression models for each dependent variable were conducted separately using SAS 9.4, applying bootstrap weights. Base models included the covariates sex, age group, and smoking status. Two-way interactions between covariates were tested individually, and added to the base model where significant (at $P = .05$).

Results

In 2013, 8.5% of all Canadians aged 15 and older (approximately 2.5 million) reported having ever tried an e-cigarette, including 1.8% (~521,000) who had used an e-cigarette in the past 30 days. Among current smokers, 37.3% (~1.6 million) had ever tried an e-cigarette, and 9.6% (~405,000) used one in the past 30 days. Among former smokers, 5.1% (~381,000) ever tried, while 0.9% (~65,000) used in the past 30 days. Lastly, among never-smokers, 3.0% (~514,000) had ever tried, while 0.3% (~52,000) used in the past 30 days.

Ever use

In the base logistic regression model ($n = 14,491$), smoking status ($P < 0.0001$) and age group ($P < 0.0001$) were significantly associated with ever use, although sex was not (8.9% prevalence among males and 8.1% among females; $P = 0.24$). Current smokers (OR = 38.09; 95% CI: 27.21–53.32; $P < 0.0001$) and former smokers (OR = 5.23; 95% CI: 3.43–7.96; $P < 0.0001$) were more likely to have ever used an e-cigarette than never-smokers. Ever-use was highest among youth aged 15–19 (19.8%) and young adults aged 20–24 (20.1%), and decreased with age to 10.5% of 25 to 44-year-olds and 3.7% of those aged 45 and older. Youth aged 15–19 (OR = 22.55; 95% CI: 15.55–32.71; $P < 0.0001$), young adults aged 20–24 (OR = 12.72; 95% CI: 9.00–17.98; $P < 0.0001$), and adults aged 25–44 (OR = 3.32; 95% CI: 2.42–4.55; $P < 0.0001$) were all more likely to have used an e-cigarette than adults aged 45 and older.

In a model including the significant interaction of sex with age ($P = 0.003$), the odds of ever using an e-cigarette were lower for females than males in the 15–19 (OR = 0.66, 95% CI: 0.46–0.95; $P = 0.03$) and 20–24 age groups (OR = 0.63, 95% CI: 0.42–0.95; $P = 0.03$), but higher for females aged 25–44 (OR = 1.90, 95% CI: 1.17–3.08; $P = 0.01$) and not significantly different among those aged 45 and older ($P = 0.94$).

Past 30-day use

In the base model ($n = 14,490$), smoking status ($P < 0.0001$) and age group ($P < 0.0001$) were significantly associated with past 30-day use, although sex was not (1.8% prevalence among males and females; $P = 0.30$). Current smokers (OR = 39.71; 95% CI: 23.05–68.40; $P < 0.0001$) and former smokers (OR = 4.63; 95% CI: 2.27–9.47; $P < 0.0001$) were more likely to have used an e-cigarette than never-smokers. Past 30-day use was highest among youth (2.6%) and young adults (3.9%), and lowest (1.0%) among adults aged 45 and older; use among adults 25–44 was 2.4%. Youth aged 15–19 (OR = 4.37; 95% CI: 2.22–8.58; $P < 0.0001$), young adults aged 20–24 (OR = 4.28; 95% CI: 2.21–8.30; $P < 0.0001$), and adults aged 25–44 (OR = 2.30; 95% CI: 1.21–4.35; $P = 0.01$) were all more likely to have used an e-cigarette than adults aged 45 and older. There were no significant two-way interactions between demographic covariates.

Smoking behaviour of e-cigarette users

As shown in Fig. 1, the majority (63.6%) of e-cigarette ever users were smokers, and the proportion of smokers was even higher for past 30-day use (77.7%). The proportion of e-cigarette ever users who were never-smokers was around half of youth, and declined with age. Conversely, the proportion of users who were smokers (particularly daily smokers) increased with age.

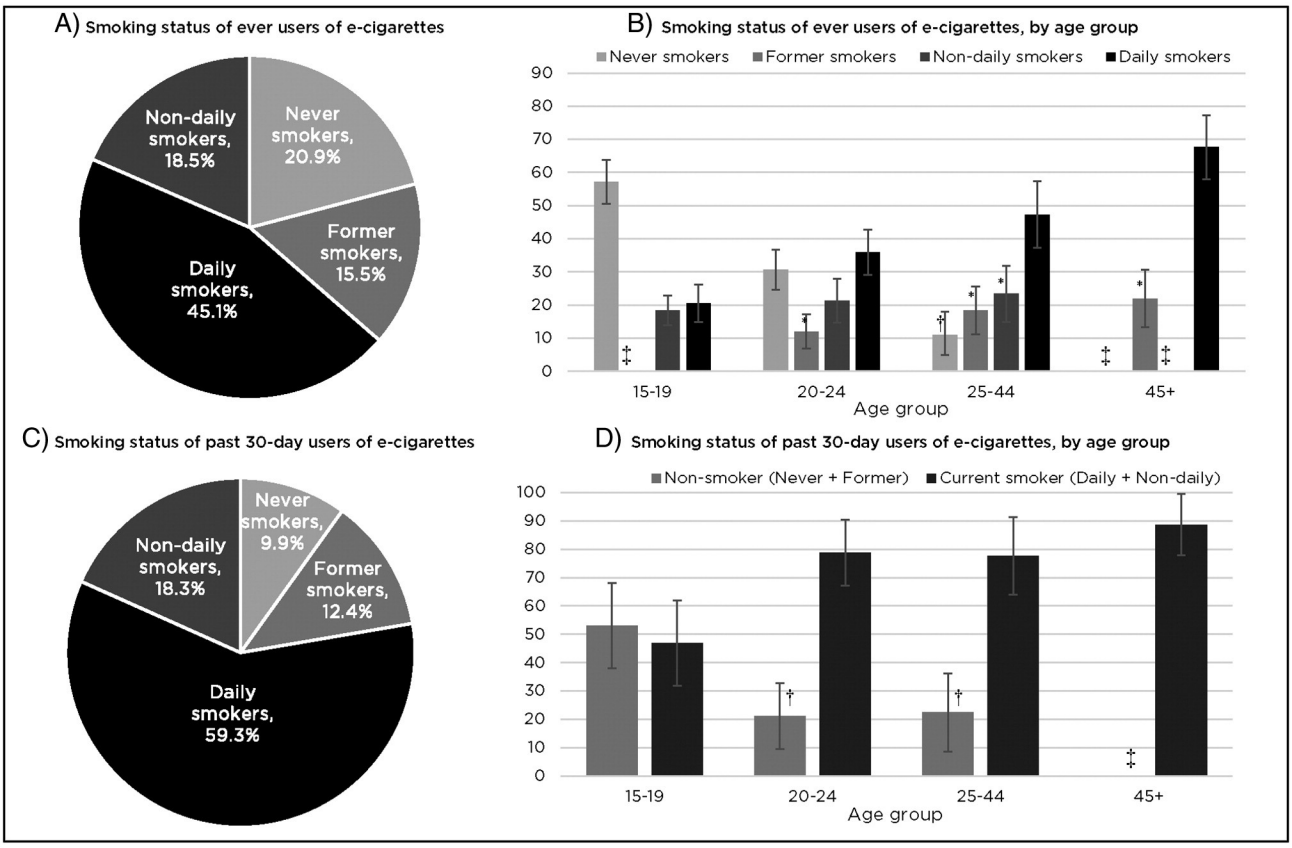
Discussion

The current study presents the first nationally-representative, comprehensive data on e-cigarette use in Canada. Estimates indicate that while a substantial number of Canadians had tried an e-cigarette (8.5%), fewer had used one within the past month (1.8%). These figures are similar to recent prevalence estimates among adults in the United States of 8.5% ever use and 2.6% past-month use of e-cigarettes. (King et al., 2015)

Prevalence of use was similar among males and females, but varied greatly by smoking status and age. E-cigarette use was highest among youth and young adults. Whereas older users were almost exclusively current or former smokers – not a single never-smoker over age 45 reported using e-cigarettes in the past month – e-cigarette use among youth was reported by more never-smokers than smokers. Overall, one-fifth of ever users and one in ten recent e-cigarette users had *never* been a smoker, most of whom were youth and young adults.

The current findings are consistent with previous studies that have associated youth ever use of e-cigarettes with male gender and past tobacco use (Hamilton et al., 2014; Czoli et al., 2015b; Carroll Chapman and Wu, 2014) and identified current cigarette smoking as the strongest predictor of e-cigarette use among both youth and young adults (Czoli et al., 2014, 2015b; Camenga et al., 2014). Prevalence estimates for past 30-day use among youth in this study (2.6%) were lower than recent estimates among high school students in a large Ontario and Alberta sample (7.2%) (Czoli et al., 2015b) and in the United States (13.4%) (Arrazola et al., 2015).

Among never-smokers, only 0.3% reported past 30-day use; therefore, relatively common experimentation with e-cigarettes among non-smokers in Canada has yet to translate into regular use. It is unclear whether the high proportion of non-nicotine e-cigarettes in Canada has contributed to the low conversion rate from experimentation to regular use. For example, only 15% of never-smokers who had tried an e-cigarette reported that their last e-cigarette contained nicotine (Czoli et al., 2015a). However, testing conducted on behalf of Health Canada in 2014 indicated that approximately half of Canadian e-cigarettes labelled as nicotine-free actually contained nicotine (Geller, 2014). Therefore, the actual proportion of e-cigarette use in Canada that involves nicotine administration remains unclear.



CV=coefficient of variation
*Marginal quality due to high sampling error (n>=30 and 0.166 <= CV <= 0.333)
†Unacceptable quality due to small sample size. These estimates do not meeet Statistics Canada's quality standards. Conclusions based on these data will be unreliable, and most likely invalid. (n<30 and 0.166 <= CV <= 0.333)
‡Estimates suppressed: Unacceptable quality due to very high sampling error (CV>0.333).

Fig. 1. Smoking status of ever users (A/B; $n = 1978$) and past 30-day users (C/D; $n = 361$) of e-cigarettes, overall (A/C) and by age group (B/D), Canada, 2013.

Dual use of e-cigarettes and conventional cigarettes was common, with most e-cigarette users also smoking conventional cigarettes. In addition, only a minority of smokers who had tried e-cigarettes also reported past-month use. The current study did not examine weekly or daily use; however, other studies indicate that most smokers who use e-cigarettes do not use them daily (Shiplo et al., 2015). Therefore, although many smokers report using e-cigarettes to quit or smoke fewer cigarettes (Hajek et al., 2014; Adkison et al., 2013; Carroll Chapman and Wu, 2014), infrequent e-cigarette use is more likely to be associated with use in situations when/where smoking is prohibited, rather than meaningful reductions in smoking behaviour (Shiplo et al., 2015). While a small but substantial proportion of e-cigarette users (15.5% ever; 12.4% past 30-day) in the current study were former smokers, the cross-sectional nature of the data does not allow for inferences regarding the role of e-cigarettes in smoking cessation. Controlled longitudinal studies are needed to assess the potential role of e-cigarettes in sustaining cigarette use and/or contributing to reductions or cessation of smoking, as well as in preventing and/or encouraging smoking initiation among youth.

Conclusions

E-cigarette use in the Canadian population appears to be concentrated among smokers and young people. While experimentation with e-cigarettes is common among both smokers and young non-smokers, regular use is much less prevalent. Continued monitoring of e-cigarette use and its relationship with smoking should be a priority, particularly given the rapidly-evolving nature of e-cigarette design, as well as the implementation of policy measures in a number of Canadian provinces that seek to reduce e-cigarette use among youth.

Contributors

DH and JR conceived of the analysis, and VLR conducted the analysis. All authors contributed to interpretation of the data and drafting the manuscript; all approved the final version.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

Acknowledgments

This study analysed public-use data collected by Statistics Canada. The results and views expressed in this paper are those of the authors and not Statistics Canada.

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