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Use of Conventional and Alternative Tobacco and Nicotine Products Among a Sample of Canadian Youth



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A B S T R A C T

Purpose: The purpose of this study was to examine the use of conventional and alternative tobacco and nicotine products among secondary school students.

Methods: Respondents were 44,163 grade 9–12 students who participated in Year 2 (2013–2014) of COMPASS, a cohort study of 89 purposefully sampled secondary schools in Ontario and Alberta, Canada. Past-month use of various tobacco and nicotine products was assessed, as well as correlates of use, using a generalized linear mixed effects model.

Results: Overall, 21.2% of the sample reported past-month use of any tobacco or nicotine product, with 7.2% reporting past-month use of e-cigarettes. E-cigarette users reported significantly greater prevalence of current use for all products. Students who were male, white, had more spending money, and had a history of tobacco use were more likely to report past-month use of e-cigarettes.

Conclusions: Approximately one fifth of youth reported past-month use of a nicotine product, with e-cigarettes being the third most common product. Overall, the findings suggest a rapidly evolving nicotine market.

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IMPLICATIONS AND CONTRIBUTION

This study demonstrates the varied use of tobacco and nicotine products, including e-cigarettes, among a large sample of Canadian youth. To assess patterns of use in a complex nicotine market, future research should examine comprehensive measures of use for all products, including frequency, quantity, and duration of use.

Although use of conventional tobacco cigarettes has declined, the nicotine market has expanded in terms of the number of alternative products and its use among youth. The past decade

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has seen two notable transitions in the tobacco market. First, the use of cigarillos/little cigars increased dramatically in the early 2000s, to the point where, in 2012, similar proportions of Canadian youth reported having ever smoked a whole cigarette (24%) or a cigarillo/little cigar (25%) [1]. Alternative tobacco products, such as cigarillos and waterpipe, are popular among youth, partly because of lower cost and attractive flavors [2].

The second transition has been the emergence of vaporized nicotine products. Electronic cigarettes (e-cigarettes) are novel nicotine delivery devices that have quickly gained popularity, despite their uncertain long-term health effects. A 2013 survey indicated that 15% of Ontario high school students had ever used e-cigarettes, with greater odds of use among males, Caucasians, rural residents, and tobacco users [3]. Findings on current use of e-cigarettes among young Canadians are limited, although a 2012 online survey found that approximately 6% of Canadians aged 16–30 years reported past-month use [4]. Presently,

Table 1Sample characteristics, e-cigarette use, and associated correlates^a in the COMPASS Year 2 sample (2013–2014), Ontario and Alberta, Canada (N = 44,163)

Characteristic	% (n)	Used e-cigarette in past 30 days, % (n)	OR (99% CI) ^a
Age, years			F(4, 43,842) = 18.7***
14 or younger	22.1 (9,743)	4.7 (458)	1.0
15	25.6 (11,283)	6.8 (765)	1.07 (.90–1.27)
16	25.3 (11,175)	8.6 (962)	1.01 (.85–1.20)
17	20.7 (9,122)	8.1 (738)	.73 (.61–.87)***
18 or older	6.4 (2,840)	8.6 (243)	.62 (.48–.79)***
Sex			F(1, 43,842) = 157.4***
Female	49.6 (21,901)	5.1 (1,117)	1.0
Male	50.4 (22,262)	9.2 (2,049)	1.70 (1.53–1.90)***
Race ^b			F(5, 43,842) = 8.0***
White	74.8 (32,886)	6.8 (2,236)	1.0
Black	3.8 (1,689)	9.0 (152)	1.10 (.85–1.43)
Asian	5.1 (2,241)	4.3 (96)	.68 (.50–.92)*
Aboriginal	3.5 (1,546)	9.0 (139)	.68 (.52–.89)**
Latin American/Hispanic	1.9 (830)	7.4 (61)	.89 (.61–1.30)
Other/mixed	10.8 (4,759)	9.8 (467)	1.21 (1.04–1.42)*
Spending money			F(4, 43,842) = 19.7***
Zero	16.0 (7,046)	4.4 (312)	1.0
\$1–\$20	28.7 (12,680)	5.9 (748)	1.33 (1.10–1.62)***
\$21–\$100	26.6 (11,749)	8.2 (968)	1.63 (1.35–1.97)***
>\$100	15.8 (6,994)	11.6 (813)	1.79 (1.47–2.19)***
Don't know/not stated	12.9 (5,694)	5.7 (325)	1.21 (.97–1.52)
Smoking status ^c			F(6, 43,842) = 522.0***
Never tried, not susceptible	21.6 (9,537)	4.3 (412)	1.0
Never tried, susceptible	50.2 (22,187)	1.6 (343)	.36 (.30–.44)***
Puffer	10.1 (4,465)	10.5 (468)	2.82 (2.34–3.40)***
Experimental smoker	10.9 (4,819)	19.2 (924)	5.67 (4.79–6.71)***
Former smoker	.8 (372)	13.2 (49)	3.80 (2.47–5.83)***
Current occasional smoker	3.2 (1,409)	29.0 (409)	10.43 (8.44–12.90)***
Current daily smoker	3.1 (1,374)	40.8 (561)	17.70 (14.38–21.80)***

Bolding indicates statistical significance.

^aDenotes significant difference (compared to the reference group, where applicable) in the generalized linear mixed model: * $p < .01$; ** $p < .001$; *** $p < .0001$.^b From a generalized linear mixed model for using an e-cigarette in the past 30 days, including the covariates in the table, and school as a random effect ($n = 43,951$).^c Because of missing information on race, 212 participants were dropped from the model.^c Smoking status categories were defined as follows: *Never tried* was defined as never having tried smoking; *Susceptibility* was defined as the absence of firm commitment not to smoke (i.e., any response other than “definitely not”) on all the following three susceptibility questions: (1) “Do you think in the future you might try smoking cigarettes?”; (2) “If one of your best friends was to offer you a cigarette, would you smoke it?”; and (3) “At any time during the next year, do you think you will smoke a cigarette?”; *Puffer* was defined as having tried smoking but had not smoked a whole cigarette; *Experimental smoker* was defined as having smoked a whole cigarette, but less than 100 cigarettes (lifetime); *Former smoker* was defined as having smoked 100 cigarettes (lifetime), but not having smoked in the last 30 days; *Current occasional smoker* was defined as having smoked 100 cigarettes (lifetime) and having smoked on at least 1 day, but less than 30, of the last 30 days; *Current daily smoker* was defined as having smoked 100 cigarettes (lifetime) and having smoked every day of the last 30 days.

although nicotine-containing electronic smoking products have not been approved for sale in Canada [5], these illicit products are widely available in retail venues.

Given the recent developments in the Canadian nicotine market and the limited evidence regarding use of these products among Canadian youth, the present study examined prevalence of use of various tobacco and nicotine products among a large sample of secondary school students in Ontario and Alberta, Canada.

Methods

COMPASS is a cohort study designed to collect longitudinal data from a sample of grade 9–12 secondary school students in Ontario and Alberta, Canada. The present article reports findings from Year 2 (2013–2014; the first time e-cigarette use was assessed), conducted in 89 secondary schools (79 in Ontario; 10 in Alberta). A full description of the design and methods of the COMPASS study is published elsewhere [6] and available online at www.compass.uwaterloo.ca. After removing respondents with missing data or inconsistencies on tobacco use status ($n = 1,135$), 44,163 participants were included in the analyses.

Measures

Use of alternative nicotine and tobacco products was assessed by asking, “In the last 30 days, did you use any of the following? (Mark all that apply),” with the list of products shown in Table 2. Past 30-day cigarette use was defined as use on one or more days. Smokers were defined as having made a quit attempt if they reported “once” or more to the question, “Have you ever tried to quit smoking cigarettes?”

Statistical analyses

Analyses were conducted using SAS 9.4. Chi-square tests (SAS Institute Inc., Cary, NC) were used to examine subgroup differences in product use. To examine variables associated with use of e-cigarettes in the past 30 days, a generalized linear mixed model, including a random effect of school to account for student clustering within schools, was conducted with 43,951 respondents who had complete data for all covariates ($n = 212$ were missing race). Statistical significance was set at $\alpha = .01$ because of the large sample size. The COMPASS study was reviewed by and received ethics clearance from the University of Waterloo Office of Research Ethics, and appropriate school board review panels.

Table 2

Frequency of past-month use of conventional and alternative tobacco and nicotine products, overall and by e-cigarette use status, in the COMPASS Year 2 sample (2013–2014), Ontario and Alberta, Canada

	Total sample (N = 44,163), % (n)	E-cigarette users (N = 3,166), % (n)	E-cigarette nonusers (N = 40,997), % (n)
E-cigarettes	7.2 (3,166)	—	—
Cigarettes	11.4 (5,014)	49.8 (1,577)*	8.4 (3,437)*
Cigarillos or little cigars	7.6 (3,344)	44.5 (1,410)*	4.7 (1,934)*
Cigars	5.0 (2,222)	31.3 (992)*	3.0 (1,230)*
Pipe tobacco	2.2 (984)	14.7 (466)*	1.3 (518)*
Loose tobacco mixed with marijuana	5.8 (2,565)	31.7 (1,002)*	3.8 (1,563)*
Blunt wraps	3.0 (1,336)	20.3 (644)*	1.7 (692)*
Hookah to smoke tobacco	2.2 (964)	17.5 (553)*	1.0 (411)*
Hookah to smoke herbal shisha	4.3 (1,885)	27.3 (864)*	2.5 (1,021)*
Smokeless tobacco	4.3 (1,907)	24.9 (789)*	2.7 (1,118)*
Nicotine patches, gum, lozenges, inhalers	.7 (232)	8.1 (257)*	.2 (66)*

*Denotes significant difference ($p < .0001$) in use by e-cigarette user status in chi-square testing.

Results

Overall, 7.2% of the sample ($n = 3,166$) reported having used an e-cigarette in the past 30 days. Table 1 shows the characteristics of the sample, as well as the percentage within each demographic group that had used an e-cigarette in the past 30 days. Results of the generalized linear mixed model, which indicated that all covariates were significantly associated with e-cigarette use, are also shown in Table 1.

Table 2 presents the percentage of past 30-day use of tobacco and alternative products, among all users and also by e-cigarette use status. Overall, 21.2% ($n = 9,353$) reported using any tobacco, shisha, or nicotine product in the past 30 days. E-cigarette users reported a significantly greater prevalence of all other products in the past 30 days. Among e-cigarette users, 75.5% ($n = 2,390$) reported also using another tobacco or shisha product in the past 30 days.

Among current smokers ($n = 2,783$), 34.8% had used e-cigarettes in the past 30 days. Of the 63.8% of current smokers who had ever tried to quit ($n = 1,623$), 32.8% had used e-cigarettes, significantly less ($\chi^2 = 8.2$; $p = .004$) than the 38.4% e-cigarette use among those who had never tried to quit ($n = 919$).

Discussion

This study provides novel evidence regarding use of e-cigarettes among a large sample of Canadian youth. Approximately 7% of youth reported currently using e-cigarettes, higher than the recent U.S. estimate of 4.5% among high school students [7]. Although the current findings are not necessarily reflective of all Canadian youth, this difference is noteworthy given the greater degree of regulation on advertising, marketing, import, and sale of nicotine-containing e-cigarettes in Canada [5]. Together with other published evidence [3,4], these findings demonstrate the accessibility and popularity of these products among youth, and the importance of considering this subpopulation in the development of regulatory frameworks as evidence regarding e-cigarettes continues to emerge. This is particularly relevant for jurisdictions such as Ontario, where the provincial government is considering new regulations that would prohibit the sale of e-cigarettes to minors, as well as restrict e-cigarette use in public places [8].

Previous studies have found that male gender and past tobacco use are associated with e-cigarette ever use among adolescents [3,9]. Consistent with this evidence, the present study indicates that current e-cigarette use is higher among males, those with greater spending money, and those with a history of tobacco use. Although prevalence of e-cigarette use appeared to

increase with age, controlling for smoking status in the multivariate model showed a seemingly contradictory relationship, because of the strong association of age and smoking. Consistent with previous findings [4,10], current cigarette smoking was found to be the strongest predictor of current e-cigarette use. Interestingly, current use of e-cigarettes was lowest among never smokers considered susceptible to future smoking, suggesting that e-cigarettes may not be a gateway product leading to conventional cigarette use.

E-cigarette users reported a significantly greater prevalence of current use for the full spectrum of alternative tobacco and nicotine products, indicating the complexity of today's nicotine market. Future research should examine comprehensive measures of use for all products, including frequency, quantity, duration, and context of use, which the present study was unable to assess. Furthermore, prospective studies are required to assess whether youth transition from particular products to others or whether youth are simply interested in trying multiple products.

References

- [1] Reid JL, Hammond D, Rynard VL, et al. Tobacco use in Canada: Patterns and trends, 2014 edition. Waterloo, ON: Propel Centre for Population Health Impact. Available at: <http://tobaccoreport.ca/2014/>; 2014. Accessed January 10, 2015.
- [2] Richter P, Caraballo R, Gupta N, Pederson LL. Exploring use of non-traditional tobacco products through focus groups with young adult smokers, 2002. *Prev Chronic Dis* 2008;5:1–8.
- [3] Hamilton HA, Ferrence R, Boak A, et al. Ever use of nicotine and non-nicotine electronic cigarettes among high school students in Ontario, Canada [e-pub ahead of print]. *Nicotine Tob Res* 2014. doi: 10.1093/ntr/ntu234.
- [4] Czoli CD, Hammond D, White CM. Electronic cigarettes in Canada: Prevalence of use and perceptions among youth and young adults. *Can J Public Health* 2014;105:e97–102.
- [5] Health Canada. Notice—To all persons interested in importing, advertising or selling electronic smoking products in Canada. Available at: http://www.hc-sc.gc.ca/dhp-mps/prodpharma/applic-demande/pol/notice_avis_e-cig-eng.php; 2009. Accessed January 10, 2015.
- [6] Leatherdale ST, Brown KS, Caron V, et al. The COMPASS study: A longitudinal hierarchical research platform for evaluating natural experiments related to changes in school-level programs, policies and built environment. *BMC Public Health* 2014;14:331.
- [7] Arrazola RA, Neff LJ, Kennedy SM, et al. Tobacco use among middle and high school students—United States, 2013. *MMWR Morb Mortal Wkly Rep* 2014;63:1021–6.
- [8] Legislative Assembly of Ontario. Bill 45, Making Healthier Choices Act, 2014. Available at: http://www.ontla.on.ca/web/bills/bills_detail.do?BillID=3080; 2014. Accessed March 3, 2015.
- [9] Carroll Chapman SL, Wu L. E-cigarette prevalence and correlates of use among adolescents versus adults: A review and comparison. *J Psychiatr Res* 2014;54:43–54.
- [10] Camenga DR, Delmerico J, Kong G, et al. Trends in use of electronic nicotine delivery systems by adolescents. *Addict Behav* 2014;39:338–40.