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Prevalence trends and factors associated with vaping in Ontario (2015 to 2018) and Quebec (2017 to 2019), Canada

by Christine D. Czoli, Gabriella Luongo, and Trevor Mischki

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ABSTRACT

Background
Robust surveillance of vaping product use (with or without nicotine) in Canada has been limited by the use of multiple tools with varying designs and content. The objective of the current study was to examine trends over time in vaping prevalence and to examine associated factors using data from the Canadian Community Health Survey (CCHS).

Data and methods
Trends in the prevalence of past-30-day vaping over time were examined using data available from optional modules of the CCHS for Ontario from 2015 to 2018 and for Quebec from 2017 to 2019. Multiple logistic regression models were used to examine correlates of vaping in Quebec (2019) and Ontario (2018).

Results
Vaping increased in Quebec from 3.4% (233,000) in 2017 to 4.2% (296,000) in 2018 and 4.7% (333,000) in 2019. In Ontario, vaping remained stable in the years 2015 (3.1% or 357,000), 2016 (2.7% or 311,000) and 2017 (2.7% or 309,000), then increased in 2018 (3.4% or 404,000). Increases in vaping in both provinces were driven by youth. Vaping was significantly associated with young age and cigarette smoking in both provinces, as well as with cannabis use in the past 12 months among Quebec respondents.

Interpretation
In both provinces, increases in youth vaping were observed in recent years, and this is consistent with national trends. Study findings further our understanding of vaping behaviour and highlight the utility of the CCHS as an additional tool for surveillance of vaping product use among Canadians.

Keywords
public health surveillance; vaping, nicotine; electronic nicotine delivery systems.

AUTHORS

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What is already known on this subject?

- In Canada, monitoring the use of vaping products (with or without nicotine) has been challenging given the use of multiple surveillance tools with varying designs.

What does this study add?

- Increases in vaping prevalence were observed among Canadians aged 15 years and older in Quebec between 2017 and 2019 and in Ontario between 2017 and 2018 and were driven by youth.

- Past-30-day vaping was associated with young age and cigarette smoking among respondents in both provinces, as well as with cannabis use in the past year among Quebec respondents.

- This study highlights the use of the Canadian Community Health Survey as a tool for monitoring and understanding who is vaping in Canada.

There has been a substantial increase in the use of vaping products (also known as electronic cigarettes or e-cigarettes, with or without nicotine) among Canadians in recent years. Data from the Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS) indicate that the prevalence of vaping (or e-cigarette use) in the past 30 days among students in grades 7 to 12 doubled from 10% in 2015/2016 to 20% in 2018/2019.[1] While not directly comparable, results from the 2017 Canadian Tobacco, Alcohol and Drugs Survey (CTADS) and the 2019 Canadian Tobacco and Nicotine Survey (CTNS) show an increasing trend in vaping prevalence among Canadians aged 15 years and older, from 3% in 2017 to 5% in 2019.[2,3] This upward trend appears to have been driven primarily by uptake among youth aged 15 to 19 and young adults aged 20 to 24, among whom prevalence of vaping was 15% in 2019.[3] Findings from the CTNS also show a high frequency of use, with 44% of Canadians aged 15 years and older who vaped in the past 30 days reporting daily use.[3]

Changes in vaping prevalence have occurred against a backdrop of policy change. Canada's Tobacco Strategy is a comprehensive and integrated approach to addressing tobacco use and achieving the target of less than 5% tobacco use by 2035.[4] Under this strategy, a new legislative framework for vaping products was introduced in May 2018 in which vaping products are subject to the *Tobacco and Vaping Products Act* (TVPA) and either the *Food and Drugs Act* or the *Canada Consumer Product Safety Act*. Specifically, the TVPA grants authority to regulate the manufacture, sale, labelling and promotion of tobacco and vaping products.[5] Subsequently, regulations have been enacted to stipulate requirements and restrictions regarding the labelling and promotion of vaping products, as well as their maximum nicotine concentration.[6,7,8] A national public education campaign—*Consider the Consequences of Vaping*—was recently launched to inform Canadian youth and their parents of the risks of vaping.[9]

The use of vaping products is a complex public health challenge as it represents a potential health benefit as a cessation aid for the millions of Canadians who smoke tobacco cigarettes and a health harm to individuals, particularly youth, who use the products but have not smoked cigarettes. Recognizing this, a core objective of Canada's Tobacco Strategy is to protect young people and non-smokers from inducements to use nicotine and tobacco while allowing adults access to vaping products as a less harmful alternative to smoking.[4] A comprehensive review of scientific evidence reflects the two sides of this coin. On the one hand, vaping product use may result in nicotine dependence, and vaping products contain and emit numerous potentially toxic substances.[10] On the other hand, complete substitution of cigarettes by vaping products results in decreased exposure to toxic chemicals,[10] and vaping products have been shown to be more effective than nicotine replacement therapy for smoking cessation.[11] Importantly, the long-term health effects of vaping products remain unknown.[10] As evidence continues to develop and emerge, there is a critical need for robust surveillance of vaping behaviour. Data regarding who is vaping in Canada—including, but not limited to, examination by age and smoking status—is needed to inform and monitor efforts aimed at maximizing the potential public health benefits of vaping products while minimizing their potential harms.

Historically, Health Canada has used surveillance tools such as the CTADS (2013, 2015, 2017), the CSTADS (2014/2015, 2016/2017, 2018/2019) and, more recently, the CTNS (2019, 2020) to examine vaping product use among Canadians. However, consistent analysis of trends over time and factors associated with vaping has been limited by the use of multiple surveillance tools with differing designs and sampling methodologies, age ranges and covariates.[1,3,12,13] Thus, there is a need for a robust surveillance tool that captures key vaping and smoking indicators, sociodemographic characteristics and use of other substances that can further our understanding of vaping behaviour of youth and adults. The Canadian Community Health Survey (CCHS) was selected as a surveillance tool with which to examine this data gap. The aim of this secondary analysis was to assess changes in use of vaping

products (with or without nicotine) over time and to examine associated factors, including sociodemographic, health and substance use characteristics using available data for Quebec (2017 to 2019) and Ontario (2015 to 2018).

Data and methods

Data source

The CCHS is an annual cross-sectional survey that collects information related to health status, health care utilization and health determinants. The survey covers approximately 98% of the Canadian population aged 12 years and older; excluded from the sampling frame are individuals living on reserves and other Indigenous settlements, the institutionalized population, full-time members of the Canadian Forces, youth aged 12 to 17 living in foster care and residents of certain remote regions.[14]

Recent CCHS cycles included an optional "Tobacco products alternatives" module. The current study utilized data from this module to examine the prevalence of vaping over time among respondents in Ontario from 2015 to 2018 and in Quebec from 2017 to 2019 given that these provinces selected this content for multiple consecutive cycles.

Access to the CCHS data files was provided by Health Canada's Health Care Strategies Directorate.

Data analysis

The primary outcome was past-30-day vaping prevalence, assessed using the question, "In the past 30 days, did you use an electronic cigarette, also known as an 'e-cigarette'?" (Note that the substance used in electronic cigarettes was not explicitly specified.) Data were analyzed to examine trends in vaping prevalence over time among youth (aged 15 to 19) and adults (aged 20 years and older) in Ontario from 2015 to 2018 and in Quebec from 2017 to 2019. The analysis was limited to respondents aged 15 years and older to better align results with other surveillance tools used by Health Canada. Respondents with missing data for the primary outcome (less than 0.5%) were excluded from the analysis, yielding an analytical sample size of 14,166 in 2015, 15,372 in 2016, 15,737 in 2017 and 14,322 in 2018 for Ontario and 11,472 in 2017, 10,957 in 2018 and 10,862 in 2019 for Quebec.

Factors associated with vaping prevalence were examined using the most recent cycle of data available for each province (Ontario 2018, Quebec 2019). The selection of covariates was guided by the content of previous national surveys and data availability. Sociodemographic variables included age, sex and household income (derived as quintiles). Derived variables assessing perceived physical and mental health were also examined, and responses were collapsed into the following categories: poor or fair, good, or very good or excellent.

Substance use covariates included smoking status, cannabis use and alcohol use. Respondents were classified by smoking status

into the following categories: "lifetime abstinence" included respondents who have never smoked a whole cigarette, have not smoked more than 100 cigarettes in their life and do not smoke at the present time; "experimental smoking" included respondents who have smoked at least one whole cigarette, have not smoked more than 100 cigarettes in their life and do not smoke at the present time; "former smoking" included respondents who have smoked at least 100 cigarettes in their life but do not smoke at the present time and "current smoking" included respondents who smoke cigarettes either daily or occasionally (i.e., non-daily) at the present time. Use of cannabis and use of alcohol in the past 12 months were assessed using derived variables with the following categories: "non-use" included respondents who have never consumed these substances in their lifetime or did not report consuming these substances in the past 12 months, "occasional use" included respondents who reported consuming these substances less than once a month in the past 12 months and "regular use" included respondents who reported consuming these substances at least once a month in the past 12 months.
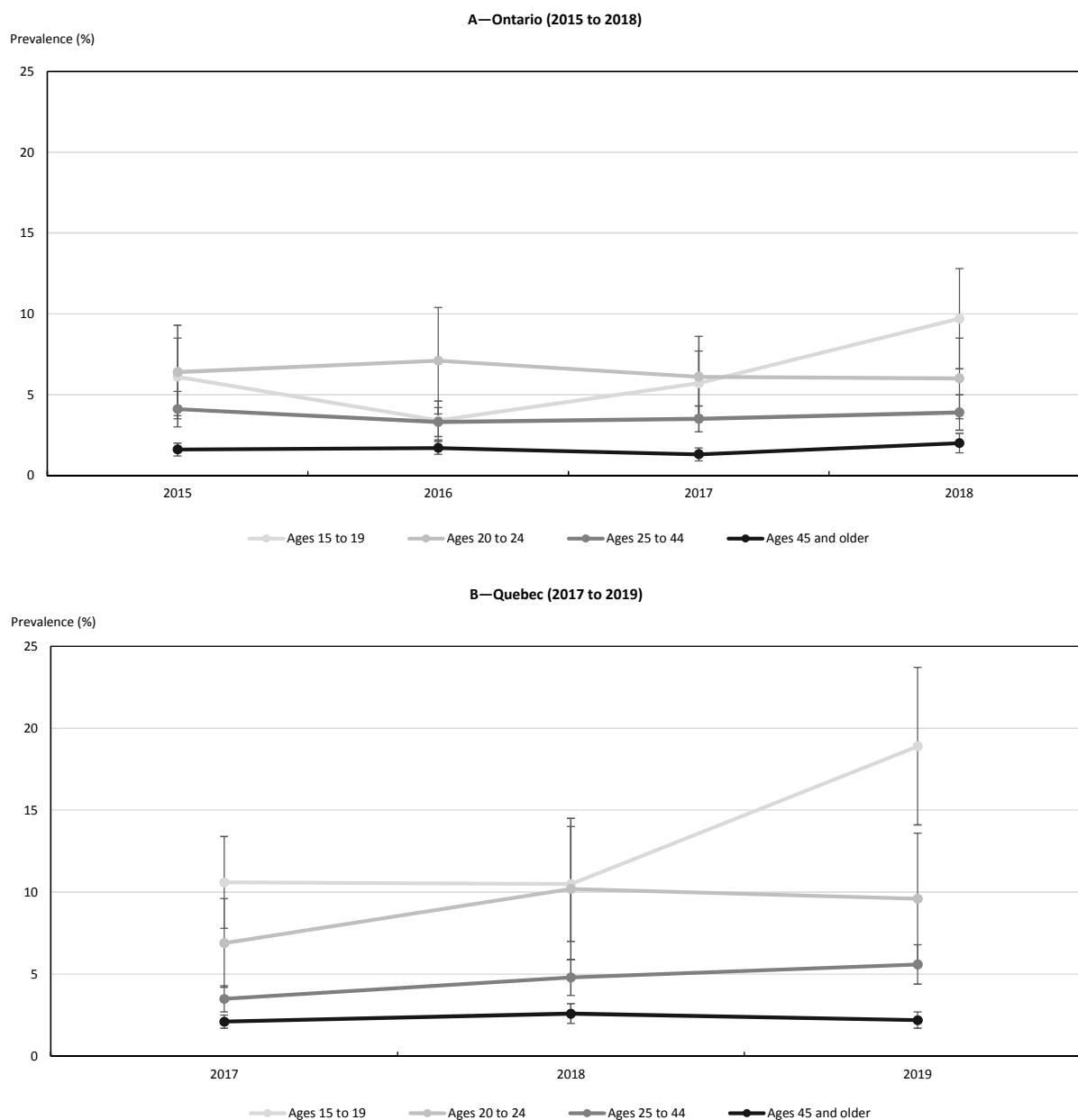
Analyses were conducted using weighted data, applying Statistics Canada survey sampling weights using the bootstrap method (1000 replicates) to estimate standard error and account for the complex survey design. Descriptive statistics were generated to estimate the weighted prevalence of past-30-day vaping by age and sex over time. Trends over time in vaping prevalence were examined using logistic regression analysis, adjusting for age and sex. A year by age group interaction term was added to the adjusted models to examine whether changes over time in vaping varied by age group. Additionally, for the most recent cycle of data available for each province, descriptive statistics were generated to estimate vaping prevalence by sociodemographic and substance use variables (such as smoking status and cannabis use), and Pearson chi-square tests with a Rao-Scott correction were used to examine univariable associations. Multivariable logistic regression models were used to examine correlates of vaping in each province, including age, sex, household income, perceived physical health, perceived mental health, smoking status, past-12-month cannabis use and past-12-month alcohol use. Analyses were conducted using Stata 17 (LP Stat Corp, College Station, Texas, United States) with a p-value set at <0.05.

Results

Ontario (2015 to 2018)

In Ontario, vaping among Canadians aged 15 years and older was 3.1% (95% Confidence Interval [95% CI]: 2.6, 3.7) in 2015, 2.7% (95% CI: 2.3, 3.1) in 2016, 2.7% (95% CI: 2.3, 3.0) in 2017 and 3.4% (95% CI: 2.9, 3.9) in 2018 (see Figure 1; detailed results available in Appendix Table A.1). As shown in Table 1, adjusting for age and sex, past-30-day vaping increased

Figure 1
**Prevalence of past-30-day vaping, household population aged 15 years or more, by age group,
Ontario (2015 to 2018) and Quebec (2017 to 2019)**

A—Ontario (2015 to 2018)

Prevalence (%)

Ages 15 to 19 Ages 20 to 24 Ages 25 to 44 Ages 45 and older

B—Quebec (2017 to 2019)

Prevalence (%)

Ages 15 to 19 Ages 20 to 24 Ages 25 to 44 Ages 45 and older

Note: Error bars represent 95% confidence intervals.
Sources: A - Canadian Community Health Survey 2015, 2016, 2017, 2018. B - Canadian Community Health Survey 2017, 2018, 2019.

by 2018. In that year, respondents had 1.30 (95% CI: 1.04, 1.62) times the odds of using a vaping product compared with 2017 (p=0.021); the contrast between 2018 and 2016 was just shy of statistical significance (Adjusted Odds Ratio [AOR]=1.26 (95% CI: 1.00, 1.59), p=0.051). There was also an interaction between year and age group such that, in 2017 and 2018, youth aged 15 to 19 years were significantly more likely to vape compared

with adults aged 45 years and older in 2016 (AOR=2.17 (95% CI: 1.13, 4.19), p=0.020, and AOR=2.59 (95% CI: 1.37, 4.90), p=0.003, respectively).

Weighted prevalence rates of vaping among Ontario respondents in 2018 are shown in Table 2. Univariable analyses showed that vaping prevalence varied by age (p<0.0001), sex

(p=0.0001), perceived mental health (p=0.0025), smoking status (p<0.0001), cannabis use in the past 12 months (p<0.0001) and alcohol use in the past 12 months (p<0.0001).

Results of logistic regression analyses examining factors associated with vaping among Ontario respondents in 2018 are shown in Table 2. Past-30-day vaping among Ontario respondents was similarly associated with young age and smoking status after adjusting for all other variables. Compared with respondents aged 45 years and older, younger respondents were significantly more likely to report vaping, including those aged 15 to 19 (AOR=13.29, 95% CI: 5.09, 34.65), 20 to 24 (AOR=2.90, 95% CI: 1.03, 8.17) and 25 to 44 (AOR=2.62, 95% CI: 1.40, 4.90). Vaping was also significantly associated with smoking status with those reporting experimental smoking (AOR=3.29, 95% CI: 1.07, 10.10), former smoking (AOR=8.98, 95% CI: 3.30, 24.46) and current smoking (AOR=33.06, 95% CI: 13.70, 79.81) being significantly more likely to report vaping in comparison with those who reported lifetime abstinence.

Table 1

Adjusted associations between prevalence of past-30-day vaping and year, household population aged 15 years or more, Ontario (2015 to 2018) and Quebec (2017 to 2019)

Characteristic	Adjusted odds ratio[a]	95% Confidence interval Lower	Upper	p-value
Ontario				
Year				
2016 versus 2015	0.88	0.69	1.11	p=0.281
2017 versus 2015	0.85	0.67	1.08	p=0.182
2018 versus 2015	1.11	0.87	1.41	p=0.414
2017 versus 2016	0.97	0.78	1.20	p=0.783
2018 versus 2016	1.26	1.00	1.59	p=0.051
2018 versus 2017	1.30	1.04	1.62	p=0.021
Age				
15 to 19 versus 45 and older	3.96	3.12	5.03	p<0.001
20 to 24 versus 45 and older	4.03	3.07	5.30	p<0.001
25 to 44 versus 45 and older	2.30	1.92	2.77	p<0.001
Sex				
Male versus Female	1.80	1.54	2.11	p<0.001
Year × age				
2016×25 to 44 versus 2015×45 and older	0.77	0.47	1.24	p=0.276
2016×20 to 24 versus 2015×45 and older	1.08	0.49	2.37	p=0.853
2016×15 to 19 versus 2015×45 and older	0.55	0.27	1.09	p=0.087
2017×25 to 44 versus2015×45 and older	1.08	0.67	1.73	p=0.759
2017×20 to 24 versus 2015×45 and older	1.25	0.60	2.62	p=0.551
2017×15 to 19 versus 2015×45 and older	1.19	0.58	2.41	p=0.638
2018×25 to 44 versus 2015×45 and older	0.77	0.45	1.32	p=0.340
2018×20 to 24 versus 2015×45 and older	0.75	0.35	1.61	p=0.465
2018×15 to 19 versus 2015×45 and older	1.41	0.72	2.78	p=0.319
2017×25 to 44 versus 2016×45 and older	1.41	0.87	2.28	p=0.165
2017×20 to 24 versus 2016×45 and older	1.16	0.54	2.48	p=0.697
2017×15 to 19 versus 2016×45 and older	2.17	1.13	4.19	p=0.020
2018×25 to 44 versus 2016×45 and older	1.01	0.59	1.73	p=0.981
2018×20 to 24 versus 2016×45 and older	0.70	0.32	1.53	p=0.370
2018×15 to 19 versus 2016×45 and older	2.59	1.37	4.90	p=0.003
2018×25 to 44 versus 2017×45 and older	0.72	0.42	1.21	p=0.210
2018×20 to 24versus 2017×45 and older	0.60	0.29	1.24	p=0.171
2018×15 to 19 versus 2017×45 and older	1.19	0.63	2.25	p=0.589
Quebec				
Year				
2018 versus 2017	1.28	1.05	1.55	p=0.014
2019 versus 2017	1.45	1.20	1.75	p<0.001
2019 versus 2018	1.14	0.92	1.40	p=0.228
Age				
15 to 19 versus 45 and older	6.50	5.14	8.22	p<0.001
20 to 24 versus 45 and older	4.10	3.08	5.45	p<0.001
25 to 44 versus 45 and older	2.04	1.70	2.45	p<0.001
Sex				
Male versus Female	1.55	1.31	1.83	p<0.001
Year × age				
2018×25 to 44 versus 2017×45 and older	1.15	0.72	1.84	p=0.551
2018×20 to 24 versus 2017×45 and older	1.29	0.64	2.61	p=0.477
2018×15 to 19 versus 2017×45 and older	0.84	0.48	1.45	p=0.528
2019×25 to 44 versus 2017×45 and older	1.56	0.97	2.52	p=0.065
2019×20 to 24 versus 2017×45 and older	1.35	0.67	2.74	p=0.402
2019×15 to 19 versus 2017×45 and older	1.93	1.13	3.30	p=0.016
2019×25 to 44 versus 2018×45 and older	1.36	0.84	2.20	p=0.216
2019×20 to 24 versus 2018×45 and older	1.05	0.50	2.18	p=0.902
2019×15 to 19 versus. 2018×45 and older	2.31	1.27	4.21	p=0.006

[a] Odds ratios adjusted for age and sex.

Notes: Analyses conducted using weighted data. Respondents with missing data are not included in weighted estimates.

Specific contrasts presented as comparisons between the first category noted and the reference (second) category.

Source: Canadian Community Health Survey 2015 to 2019.

As shown in Figure 2, the majority (62.0% or 251,000) of Ontario respondents who reported using vaping products in the past 30 days were currently smoking. In addition, 17.5% (71,000) reported formerly smoking and the remainder were experimentally smoking (10.4%[E] or 42,000) or reported lifetime abstinence (10.1%[E] or 41,000).

Quebec (2017 to 2019)

In Quebec, vaping among Canadians aged 15 years and older was 3.4% (95% CI: 2.9, 3.8) in 2017, 4.2% (95% CI: 3.7, 4.8) in 2018 and 4.7% (95% CI: 4.1, 5.4) in 2019 (see Figure 1; detailed results available in Appendix Table A.1). As shown in Table 1, adjusting for age and sex, past-30-day vaping increased since 2017. Respondents had 1.28 (95% CI: 1.05, 1.55) times the odds of using a vaping product in 2018 (p=0.014) and 1.45 (95% CI: 1.20, 1.75) times the odds of using a vaping product

in 2019 (p<0.001). There was also an interaction between year and age group such that, in 2019, youth aged 15 to 19 years were significantly more likely to vape compared with adults aged 45 years and older in 2017 (AOR=1.93, 95% CI: 1.13, 3.30, p=0.016) and 2018 (AOR=2.31, 95% CI: 1.27, 4.21 p=0.006).

Weighted prevalence of vaping among Quebec respondents in 2019 is shown in Table 2. Univariable analyses showed that vaping prevalence varied by age (p<0.0001), sex (p=0.0002), perceived mental health (p=0.0232), smoking status (p<0.0001), cannabis use in the past 12 months (p<0.0001) and alcohol use in the past 12 months (p<0.0001).

Results of logistic regression analyses examining factors associated with vaping among Quebec respondents in 2019 are shown in Table 2. After adjusting for all other variables, past-30-day vaping among Quebec respondents was significantly associated with young age, smoking status and cannabis use in

Table 2

Logistic regression analysis examining factors associated with past-30-day vaping, household population aged 15 years or more, Ontario (2018) and Quebec (2019)

Characteristic	Ontario, 2018 (N=11,863,000)							Quebec, 2019 (N=7,040,000)						
	Weighted prevalence (%)	95% Confidence interval		AOR[a]	95% Confidence interval		p-value	Weighted prevalence (%)	95% Confidence interval		AOR[a]	95% Confidence interval		p-value
		Lower	Upper		Lower	Upper			Lower	Upper		Lower	Upper	
Overall	3.4	2.9	3.9	...	...	...	...	4.7	4.1	5.4	...	...	...	...
Age (years)														
15 to 19	9.7	6.6	12.7	13.29	5.09	34.65	p<0.001	18.9	14.1	23.7	29.48	16.59	52.40	p<0.001
20 to 24	6.0 [E]	3.5	8.4	2.90	1.03	8.17	p=0.044	9.6 [E]	5.6	13.6	5.76	2.93	11.31	p<0.001
25 to 44	3.9	2.8	5.0	2.62	1.40	4.90	p=0.003	5.6	4.4	6.8	2.23	1.48	3.37	p<0.001
45 and older	2.0	1.4	2.5	Ref				2.2	1.7	2.8	Ref	...	...	...
Sex														
Male	4.5	3.7	5.3	Ref	...	...	...	5.9	4.9	6.9	Ref	...	...	...
Female	2.4	1.7	3.0	0.78	0.48	1.26	p=0.308	3.6	2.8	4.3	0.73	0.53	1.02	p=0.069
Household income														
Quintile 1	4.1 [E]	2.3	5.9	Ref	...	...	...	4.6 [E]	3.0	6.2	Ref	...	...	...
Quintile 2	1.9 [E]	0.9	2.9	0.52	0.21	1.26	p=0.145	4.1	3.0	5.2	0.89	0.53	1.50	p=0.667
Quintile 3	3.7 [E]	1.9	5.5	1.18	0.52	2.68	p=0.701	5.6	3.9	7.3	1.22	0.70	2.14	p=0.488
Quintile 4	2.5 [E]	1.3	3.7	0.71	0.29	1.78	p=0.470	4.1	2.9	5.2	0.79	0.46	1.34	p=0.383
Quintile 5	3.0 [E]	1.6	4.4	0.93	0.41	2.13	p=0.867	5.4	3.6	7.1	1.09	0.60	2.00	p=0.775
Perceived physical health														
Poor or fair	3.3 [E]	2.0	4.5	Ref	...	...	...	4.3 [E]	2.4	6.3	Ref	...	...	...
Good	3.4	2.5	4.4	1.36	0.59	3.13	p=0.470	5.0	3.7	6.3	0.96	0.48	1.92	p=0.906
Very good or excellent	3.4	2.7	4.2	1.41	0.53	3.75	p=0.493	4.7	3.9	5.5	0.96	0.50	1.85	p=0.907
Perceived mental health														
Poor or fair	7.4 [E]	4.8	10.0	Ref	...	...	...	10.5 [E]	5.5	15.5	Ref	...	...	...
Good	2.9 [E]	1.8	4.1	0.43	0.15	1.17	p=0.099	5.2	3.8	6.7	0.83	0.39	1.75	p=0.622
Very good or excellent	3.2	2.5	3.8	0.67	0.28	1.60	p=0.370	4.3	3.6	4.9	0.83	0.41	1.71	p=0.619
Smoking status														
Lifetime abstinence	0.7 [E]	0.4	1.0	Ref	...	...	...	1.9 [E]	1.2	2.6	Ref	...	...	...
Experimental smoking	2.8 [E]	1.2	4.4	3.29	1.07	10.10	p=0.037	3.5 [E]	1.7	5.3	2.62	1.31	5.24	p=0.007
Former smoking	2.6	1.8	3.5	8.98	3.30	24.46	p<0.001	5.0	3.7	6.2	7.84	4.53	13.56	p<0.001
Current smoking	13.3	10.8	15.9	33.06	13.70	79.81	p<0.001	11.7	9.5	14.0	9.08	5.32	15.51	p<0.001
Cannabis use status (past 12 months)														
No use	1.8	1.4	2.2	Ref	...	...	...	2.8	2.2	3.3	Ref	...	...	...
Occasional use	8.3 [E]	5.3	11.2	2.00	0.95	4.22	p=0.070	10.1 [E]	6.6	13.7	2.17	1.30	3.62	p=0.003
Regular use	13.7	10.6	16.9	1.74	0.93	3.24	p=0.081	18.5	14.4	22.6	2.87	1.78	4.63	p<0.001
Alcohol use status (past 12 months)														
No use	1.6 [E]	1.0	2.2	Ref	...	...	...	2.2 [E]	1.1	3.2	Ref	...	...	...
Occasional use	3.2	2.2	4.2	1.98	0.84	4.67	p=0.120	3.7	2.6	4.9	1.18	0.61	2.29	p=0.626
Regular use	4.2	3.4	5.0	1.52	0.71	3.26	p=0.279	5.6	4.7	6.5	1.76	0.95	3.28	p=0.073

... not applicable

[a] Odds ratios adjusted for age, sex, education, perceived physical health, perceived mental health, smoking status, cannabis use status, and alcohol use status.
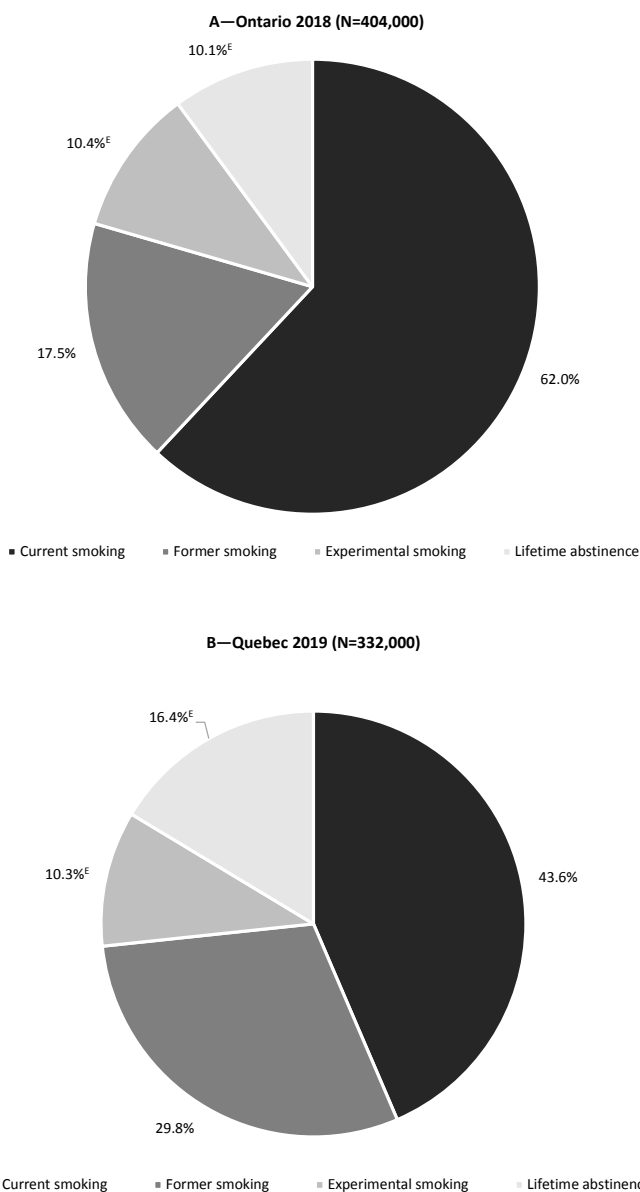
E use with caution

Notes: AOR=Adjusted Odds Ratio; Ref=Reference category. Analyses conducted using weighted data. Respondents with missing data are not included in weighted estimates.

Source: Canadian Community Health Survey 2018, 2019.

Figure 2
Smoking status, household population aged 15 years or more who reported vaping in the past 30 days, Ontario (2018) and Quebec (2019)

A—Ontario 2018 (N=404,000)

10.1%^E

10.4%^E

17.5%

62.0%

■ Current smoking   ■ Former smoking   ■ Experimental smoking   ■ Lifetime abstinence

B—Quebec 2019 (N=332,000)

16.4%^E

10.3%^E

43.6%

29.8%

■ Current smoking   ■ Former smoking   ■ Experimental smoking   ■ Lifetime abstinence

^E Moderate sampling variability, interpret with caution
Sources: A - Canadian Community Health Survey 2018. B - Canadian Community Health Survey 2019.

the past 12 months. Specifically, respondents aged 15 to 19 (AOR=29.48, 95% CI: 16.59, 52.40), 20 to 24 (AOR=5.76, 95% CI: 2.93, 11.31) and 25 to 44 (AOR=2.23, 95% CI: 1.48, 3.37) were significantly more likely to report vaping, compared with those aged 45 years and older. In addition, compared with respondents who reported lifetime abstinence, those who smoked experimentally (AOR=2.62, 95% CI: 1.31, 5.24), those who formerly smoked (AOR=7.84, 95% CI: 4.53, 13.56) and those who currently smoke (AOR=9.08, 95% CI: 5.32, 15.51)

were significantly more likely to report vaping. Respondents who reported use of cannabis in the past 12 months, including occasional use (AOR=2.17, 95% CI: 1.30, 3.62) and regular use (AOR=2.87, 95% CI: 1.78, 4.63), were significantly more likely to report vaping than those who did not use cannabis.

Smoking status of respondents who reported vaping in the past 30 days is shown in Figure 2. Among Quebec respondents who reported use of vaping products in the past 30 days, 43.6% (145,000) were currently smoking, 29.8% (99,000) were

formerly smoking, 10.3%[E] (34,000) were experimentally smoking and 16.4%[E] (54,000) reported lifetime abstinence.

Discussion

Findings from the CCHS indicate that the prevalence of vaping increased in Quebec between 2017 and 2019, and in Ontario between 2017 and 2018. In both provinces, increases in vaping were driven by youth, and this is consistent with trends observed in other national surveys.[1-3]

Consistent with previous research, cigarette smoking was the most robust predictor of past-30-day vaping, with the strongest association observed among those who reported current smoking followed by those who reported former smoking.[13,16] The current analysis brings to light a significant association between vaping and experimental smoking, meaning even a brief smoking history is associated with increased odds of vaping. At the population level, this association was observed in the context of increases in the prevalence of vaping and a declining trend in the prevalence of current and experimental smoking in Quebec and Ontario (data not shown). The temporal nature of this association may be further examined at the individual level using longitudinal cohort data to understand the potential for vaping to lead to, or away from, cigarette smoking.

Although vaping is significantly more likely among those who reported current or former smoking, the use of vaping products among non-smokers is considerable. Respondents classified as non-smokers at the time of the survey (including those who reported lifetime abstinence and experimental smoking) comprised 14% and 20% of respondents who reported vaping in the past 30 days in Ontario in 2015 and 2018, respectively; and 18% and 27% of respondents who reported vaping in the past 30 days in Quebec in 2017 and 2019, respectively. While this trend over time did not reach statistical significance (data not shown), the smoking status of Canadians who vape should be studied closely, particularly as the vaping market continues to evolve.

Consistent with previous research, the current study showed that the use of vaping products was associated with young age.[13] The magnitude of observed associations in the current analysis shows a more pronounced age gradient in relation to vaping among respondents in Quebec and Ontario. For instance, compared with adults aged 45 and older residing in Quebec in 2019, youth aged 15 to 19 were approximately 29 times more likely to report vaping, while young adults aged 20 to 24 were approximately 6 times more likely to report vaping and adults aged 25 to 44 were approximately 3 times more likely to report vaping. Together with national trends in vaping prevalence,[1-3] these findings suggest that the use of vaping products has become increasingly concentrated among young Canadians.

Our analysis showed no association between vaping and sex, consistent with a previous analysis of vaping correlates at the national level among Canadians aged 15 years and older.[13] However, analyses examining vaping among youth have shown significantly greater use among males;[16] thus, researchers working in the domains of youth health and substance use behaviours may wish to further explore sex- and gender-based analysis in future work.

To date, research examining substance use among Canadians has not delved into the relationship between the use of vaping products and the use of cannabis.[13,17,18] The current analysis showed an association between cannabis use in the past 12 months and vaping in the past 30 days among residents of Quebec in 2019. While not as strong as the association between vaping and cigarette smoking, significant associations were observed for occasional and regular consumption of cannabis in the past year. Continued monitoring and further research examining this relationship are warranted, with particular attention to age. While trends in vaping have shown an increase in use among youth and young adults in recent years,[1-3] cannabis use is most prevalent among young adults, with no observed changes in consumption among youth following legalization in 2018.[18, 19,20] The current analysis did not explicitly aim to compare vaping between Ontario and Quebec as the regulatory environments in these provinces did not substantially differ in the periods examined; however, recent regulatory changes for vaping products in several provinces,[21] in addition to federal legalization of cannabis, may prompt such quasi-experimental research to examine the impacts on markets and the use of these substances. An additional focus of surveillance efforts may include polysubstance use given that approximately three-quarters of Canadians who reported consuming cannabis in the past 12 months reported using cannabis with alcohol, while approximately one-third reported doing so with tobacco.[19] Given recent reports of cannabis use via vaporizers (including e-cigarettes) among adolescents in Ontario, consideration should also be given to the method of cannabis consumption.[22] A deeper understanding of polysubstance use may therefore require more detailed measures in national surveys and other research methods and tools.

Strengths and limitations

Using newly available data from a robust surveillance tool, findings from the current study further our understanding of vaping behaviour in Canada. Although the data used for the analysis were representative, they were limited to select provinces. In addition, statistical power was limited because of limited available data; as a result, we were unable to examine factors associated with vaping among specific subgroups (e.g., youth, adults) using statistical stratification or two-way interactions. The primary outcome measure was limited in several ways. First, the question did not include a preamble to indicate the inclusion or exclusion of specific substances. While the question was part of the "Tobacco products alternatives" module, and thus aimed at assessing the use of vaping products with or without nicotine, collected data may include respondents who use cannabis or other substances in e-cigarettes. Second, the measure did not assess the frequency of

vaping; thus, we could not take this into account in our analysis. The inclusion of vaping as national content in the CCHS as of 2021 will provide opportunities to examine vaping at the national level and greater power to conduct analyses among subpopulations of interest.[23] Detailed analyses examining vaping behaviour by age and smoking status (e.g., Spears et al., 2019)[24] may yield results more suitable to informing Canada's Tobacco Strategy. Lastly, results are based on self-reported data that are subject to recall bias, and the cross-sectional nature of the study does not allow for the inference of causal relationships between vaping and associated factors.

Conclusion

Study findings show increases in vaping among youth in recent years in both Ontario and Quebec, and this is similar to trends observed nationally. Despite being more common among those who reported current or former smoking, vaping among non-smokers is considerable. A robust association between past-30-day vaping and cannabis use in the past 12 months was also observed in Quebec in 2019. Findings from the current study further our understanding of vaping behaviour and highlight the utility of the CCHS as an additional tool for the surveillance of vaping product use among Canadians.

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Conflicts of interest

The authors have no conflicts of interest to disclose.

Author contributions

All authors contributed to the conceptualization and design of the study. CC analyzed and interpreted the data and drafted the paper. GL analyzed and interpreted the data and contributed to paper revisions. TM interpreted the data and contributed to paper revisions. All authors approved the final manuscript for submission.

Appendix Table A.1

Prevalence of past-30-day vaping among respondents aged 15 years and older in Ontario (2015 to 2018) and Quebec (2017 to 2019)

	2015				2016				2017			
	Weighted prevalence (%)	95% Confidence interval		Population estimate	Weighted prevalence (%)	95% Confidence interval		Population estimate	Weighted prevalence (%)	95% Confidence interval		Population estimate
Characteristic		Lower	Upper			Lower	Upper			Lower	Upper	
Ontario												
Overall	3.1	2.6	3.7	357,000	2.7	2.3	3.1	311,000	2.7	2.3	3.0	309,000
Age (years)												
15 to 19	6.1 E	3.7	8.6	52,000	3.4 E	2.2	4.7	26,000	5.7 E	3.7	7.7	47,000
20 to 24	6.4 E	3.5	9.4	60,000	7.1 E	3.8	10.3	65,000	6.1 E	3.6	8.6	55,000
25 to 44	4.1	3.0	5.2	147,000	3.3	2.4	4.1	117,000	3.5	2.7	4.2	130,000
45 and older	1.6	1.2	2.0	97,000	1.7	1.3	2.0	103,000	1.3	0.9	1.6	78,000
Sex												
Male	3.9	3.1	4.8	217,000	3.9	3.1	4.7	215,000	3.2	2.6	3.9	184,000
Female	2.4	1.9	2.9	140,000	1.6	1.3	2.0	96,000	2.1	1.6	2.6	126,000
Quebec												
Overall	…	…	…	…	…	…	…	…	3.4	2.9	3.8	233,000
Age (years)												
15 to 19	…	…	…	…	…	…	…	…	10.6	7.8	13.4	40,000
20 to 24	…	…	…	…	…	…	…	…	6.9 E	4.2	9.6	34,000
25 to 44	…	…	…	…	…	…	…	…	3.5	2.7	4.2	78,000
45 and older	…	…	…	…	…	…	…	…	2.1	1.7	2.6	81,000
Sex												
Male	…	…	…	…	…	…	…	…	4.1	3.5	4.8	141,000
Female	…	…	…	…	…	…	…	…	2.6	2.1	3.2	92,000

… not applicable

E use with caution

Notes: CI=Confidence Interval. Analyses conducted using weighted data. Respondents with missing data are not included in weighted estimates.

Source: Canadian Community Health Survey 2015 to 2019.

Appendix Table A.1

Prevalence of past-30-day vaping among respondents aged 15 years and older in Ontario (2015 to 2018) and Quebec (2017 to 2019) (continue)

	2018				2019			
	Weighted prevalence (%)	95% Confidence interval		Population estimate	Weighted prevalence (%)	95% Confidence interval		Population estimate
Characteristic		Lower	Upper			Lower	Upper	
Ontario								
Overall	3.4	2.9	3.9	404,000	…	…	…	…
Age (years)								
15 to 19	9.7	6.6	12.7	79,000	…	…	…	…
20 to 24	6.0 E	3.5	8.4	55,000	…	…	…	…
25 to 44	3.9	2.8	5.0	146,000	…	…	…	…
45 and older	2.0	1.4	2.5	124,000	…	…	…	…
Sex								
Male	4.5	3.7	5.3	260,000	…	…	…	…
Female	2.4	1.7	3.0	144,000	…	…	…	…
Quebec								
Overall	4.2	3.7	4.8	296,000	4.7	4.1	5.4	333,000
Age (years)								
15 to 19	10.5 E	7.0	14.0	43,000	18.9	14.1	23.7	77,000
20 to 24	10.2 E	5.9	14.4	48,000	9.6 E	5.6	13.6	40,000
25 to 44	4.8	3.7	5.9	108,000	5.6	4.4	6.8	128,000
45 and older	2.6	2.0	3.1	97,000	2.2	1.7	2.8	87,000
Sex								
Male	5.0	4.1	6.0	174,000	5.9	4.9	6.9	206,000
Female	3.5	2.8	4.2	122,000	3.6	2.8	4.3	127,000

… not applicable

E use with caution

Notes: CI=Confidence Interval. Analyses conducted using weighted data. Respondents with missing data are not included in weighted estimates.

Source: Canadian Community Health Survey 2015 to 2019.

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