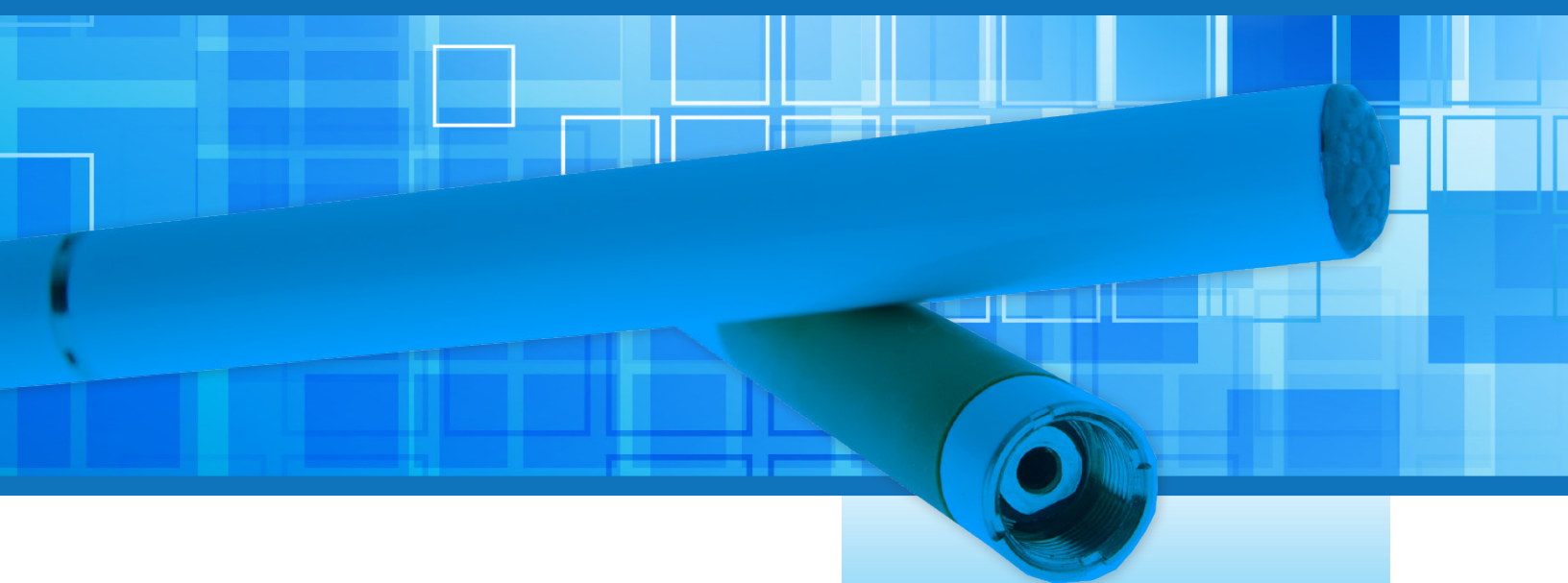


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E-Cigarette Prevalence in Eastern Ontario

Completed for TCAN-East
on behalf of six Local Public Health Agencies in Eastern Ontario.



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Abstract

Background: Electronic cigarettes (e-cigarettes) are for sale to the public from retail stores despite Health Canada’s March 27th 2009 notice advising Canadians not to “purchase or use electronic smoking products as these products may pose health risks and have not been fully evaluated for safety, quality and efficacy”[1]. The same notice advises that “persons importing, advertising or selling electronic cigarette products in Canada must stop doing so immediately”. This project report is an attempt to quantify the prevalence of retailers selling electronic smoking products within Ontario’s eastern region and will document the sale and advertisement of e-cigarettes by vendor location.

Methods: The project used a stratified random sample to select vendors in the East Tobacco Control Area Network (TCAN-East) from the Tobacco Information System (TIS) maintained by the Ontario Ministry of Health and Long-Term Care. Of the 1506 tobacco vendors in the East region involving six Local Public Health Agency areas, 196 (13%) were sampled in the project.

Results: Of the 196 vendors surveyed, 37 sold e-cigarette products. This number represents a mean of 19% e-cigarette prevalence of the vendors surveyed in the six Local Public Health Agency areas.

Discussion: The mean e-cigarette prevalence of 19% in the TCAN-East region demonstrates that the availability of this product is generally widespread within the region. The store type with the highest e-cigarette prevalence of 58% (7 of 12) was found in chain convenience stores. Prevalence rates of e-cigarettes at gas stations were also high at 44% (31 of 70).

Background

The proliferation of the sale of electronic smoking products in the TCAN-East region is undermining Health Canada's public advisory to Canadians to not "purchase or use electronic smoking products as these products may pose health risks and have not been fully evaluated for safety and efficacy by Health Canada"[1]. The continued sale of electronic cigarettes (e-cigarettes) despite Health Canada's public advisory is a growing concern for public health organizations. Tobacco Enforcement Officers (TEOs) from across the Tobacco Control Area Network of Eastern Ontario (TCAN-East) have been observing an increase in the prevalence of the product in retail locations. The six Local Public Health Agencies in the TCAN-East are also receiving an increase in public enquiries regarding the use of e-cigarettes, especially as an aid for cessation, and if this product was within compliance of the no smoking requirements of the *Smoke-Free Ontario Act*.



“Public Health officials fear that these displays act to normalize smoking and purposely promote the sale of tobacco products.”

Officials from Local Public Health Agencies across the TCAN region have concerns over the display and promotion of e-cigarettes within the retail environment. They are concerned with the open display of these products, which resembles tobacco displays prior to the enactment of *Smoke-Free Ontario Act, 2006* legislation. Public Health officials

fear that these displays act to normalize smoking and purposely promote the sale of tobacco products. Concerns relating to e-cigarette quality control and risk to the general health are also frequent areas of concern for public health officials.

While there is limited research on nicotine-free e-cigarettes, those containing nicotine have undergone more rigorous scientific research and testing. The United States Food and Drug Administration (SFDA) testing of electronic cigarette cartridge contents, sometimes referred to as e-juice or e-liquid, found five tobacco specific impurities and diethylene glycol, a known human toxicant and component of antifreeze[1]. Chemical analysis of e-cigarette cartridges said to contain zero nicotine have tested positive for nicotine [2]. Within the same study nicotine impurities were identified in various e-cigarettes, including drugs amino-tadalafil and rimonabant; a drug that was removed from the global market in 2009 due to adverse health effects. The study demonstrated the possibility of nicotine

addiction for an e-cigarette user who is unknowingly using a product containing nicotine [2]. Respiratory research following e-cigarette use has shown increases in exhaled nitric oxide of 2.14 parts per billion, an increase in total respiratory impedance of 0.033 kilopascals, and an increase in airway resistance of 0.042 kilopascals. Cartridge testing of the nicotine content found in e-cigarettes has also shown variation from manufacturers' statements of nicotine concentrations [4]. Researchers Cobb and Abrams state that because of the aerosol variability found within e-cigarettes, it is likely that smokers using the product in an attempt to quit, or reduce tobacco, will find the product ineffective due to inconsistent nicotine delivery [5]. The fear raised by Cobb and Abrams is that e-cigarettes will create dual use of e-cigarettes and tobacco cigarettes [5].

There are no dedicated studies examining health effects of flavoured, nicotine-free e-cigarettes, as they are viewed as a novelty product by Health Canada. Despite the classification as a novelty product, nicotine-free e-cigarettes can quickly and easily become nicotine e-cigarettes with the addition of e-juice, a liquid nicotine substance derived from tobacco, to the cartridges. Discussion on many e-cigarette internet online forums indicates that e-juice is readily available to purchase online from international retailers and is a popular modification to nicotine free e-cigarettes available in Canada. Cobb and Abrams state that although e-cigarettes are marketed as cigarettes they are more similar to regulated or illicit drug delivery devices such as vaporizers, pipes and nebulizers [5]. Although no firm research exists to support claims many e-cigarette companies are making, many make general health claims about benefits of using their products over tobacco and as a harm reduction product [6].

The objective of this project was to quantify the prevalence of e-cigarette products in the TCAN-East region for sale at the retail level.. The environmental scan documents the sale and advertisement of e-cigarettes by vendor location in the catchment areas of the Eastern Ontario Health Unit (EOHU), the Hastings Prince Edward Counties Health Unit (HPECHU), Kingston Frontenac and Lennox & Addington Public Health (KFL&A), the Leeds, Grenville and Lanark, District Health Unit (LGLDHU), Ottawa Public Health (OPH) and the Renfrew County and District Health Unit (RCDHU). The outcome of the environmental scan should assist to illustrate the magnitude of the prevalence of retailers selling e-cigarette products. One of the primary purposes of this project was to provide information to guide enforcement and policy action regarding e-cigarettes.

Methods

Survey Design and Sampling Methodology

To study access to e-cigarettes from retail vendors, the project used a stratified random sample to select vendors in TCAN-East. Of the 1506 tobacco vendors in the East region 200 (13.2%) were selected to be sampled in the project. Due to business closures, 196 vendors (13%) were used as the final sample size in the project. Time and resource constraints determined the sample size.

In order to maintain a representative sample within the study a sampling fraction was used to maintain a proportionate allocation. The 196 vendors were initially divided amongst the six Local Public Health Agency areas within Eastern Ontario based on population. The six areas include; the Eastern Ontario Health Unit (EOHU), the Hastings Prince Edward County Health Unit (HPECHU), Kingston Frontenac Lennox & Addington Public Health (KFL&A), the Leeds, Grenville and Lanark District Health Unit (LGLDHU), Ottawa Public Health (OPH) and the Renfrew County and District Health Unit (RCDHU). Population statistics for these areas are taken from 2011 census data collected by Statistics Canada.

Table 1. Illustrates the initial proportional division of the 196 sample vendors in the East region based on population proportions.

Region	Population	% of Total Region Population	Sampling Fraction (complete value)
RCDHU	101,752	6	12
HPECHU	162,803	9	18
KFL&A	197,473	11	22
LGLDHU	168,337	10	22
OPH	911,738	52	104 *100
EOHU	199,363	12	25
Totals	1,741,466	100	200 *196

*Actual sample value. Due to business closures 196 vendors (13%) were used as the final sample size in the project.

The “% of Total Region Population” (refer to Table 1 column 3) is calculated using the “Population” (refer to Table 1 column 2) of each region divided by the total population of the East region (1,741,466).

Sampling fractions from Table 1 are further proportioned by dividing the sampling fraction to account for urban and rural populations. Urban and rural population percentages were calculated based on Statistics Canada 2011 census data. The term “urban” as used in the document refers to, “any area with a population of at least 1,000 and with no fewer than 400 persons per square kilometre” (Human Resources and Skills Development Canada). Within each of the 6 regions, municipality (or sub-region) population datum was recorded. This data was used to label each municipality as urban or rural (based on population density). The term “rural” as used in the document refers to, “any area with a population density less than 400 persons per square kilometre” (Human Resources and Skills Development Canada). Population densities over 400 persons per square kilometre were marked as urban. Densities less than 400 persons per square kilometre were marked as rural. A total percentage of urban and rural population was then calculated by dividing municipality (sub-region) populations labelled as urban and rural by the total population for the region. Please refer to Table 2 column 2 for urban population percentages for each region, and Table 2 column 3 for rural population percentages.

The percentages of urban and rural populations for each of the larger 6 regions were then used to calculate sampling fractions (see Table 2).

The “Urban Sampling Fraction” (refer to Table 2 column 5) was calculated by dividing the “Sampling Fraction” (refer to Table 2 column 4) by “Urban Population %” (refer to Table 2 column 2). Values were rounded to the nearest whole number.

The “Rural Sampling Fraction” (refer to Table 2 column 6) was calculated in the same manner using “Rural Population %”. Values were rounded to the nearest whole number.

Table 2. Illustrates the final proportional division of the 200 sample vendors in the East region based on urban and rural habitation proportions.

Region	Urban Population %	Rural Population %	Sampling Fraction (from Table 1)	Urban Sampling Fraction (complete value)	Rural Sampling Fraction (complete value)
RCDHU	26	74	12	3	9
HPECHU	60	40	18	11	7
KFL&A	65	35	22	14	8
LGLDHU	34	66	20	7	13
OPH	100	0	104 *100	104 *100	0
EOHU	34	66	24	8	16
Totals			200	147 *143	53

*Actual sample value. Due to business closures 196 vendors (13%) were used as the final sample size in the project.

Using the urban and rural proportioned sampling fractions (Table 2 columns 5 and 6 respectively) to determine sample size, vendor locations were selected at random using Excel random generator from a complete list of tobacco retailers within each region. The complete list of vendors for each region was obtained from the Tobacco Information System (TIS).

Retailer visits were comprised of an anonymous inspection. If e-cigarette products were not clearly visible the clerk was asked if they sold e-cigarettes. After a retailer was visited the retailer was marked on a recording sheet according to the criteria: e-cigarettes not advertised or sold, e-cigarettes not advertised but available when asked, print ads in or outside of store, countertop display of e-cigarettes, and brand.

Tobacco Enforcement Officers (TEOs) from EOHU, HPECHU, KFL&A, LGLDHU, OPH, and RCDHU were interviewed prior to retailer visits in each region. TEO interviews aided in focusing the investigation by providing primary documents from e-cigarette manufacturers as well as providing field accounts of e-cigarette sales, advertising, and public complaints. TEO's helped to determine the actual retailer inspection criteria. This information was critical for the preparation of the discussion and results analysis.

Statistical Analyses

For graphs and interpretations the data was used as a prevalence percentage. Prevalence as used within the document refers to the found frequency of e-cigarettes. Prevalence was calculated by dividing the number of surveyed locations selling e-cigarettes (survey findings) by the sample total.

A confidence interval was used in the results section to analyze data. A 95% confidence level was used. To calculate the confidence interval the mean was found. The standard deviation of the mean value was then calculated. The critical value of t was looked up on a t -distribution table for the degree of freedom of the study. Standard error of the mean was then calculated by dividing the standard deviation by the square root of the degree of freedom.

Results

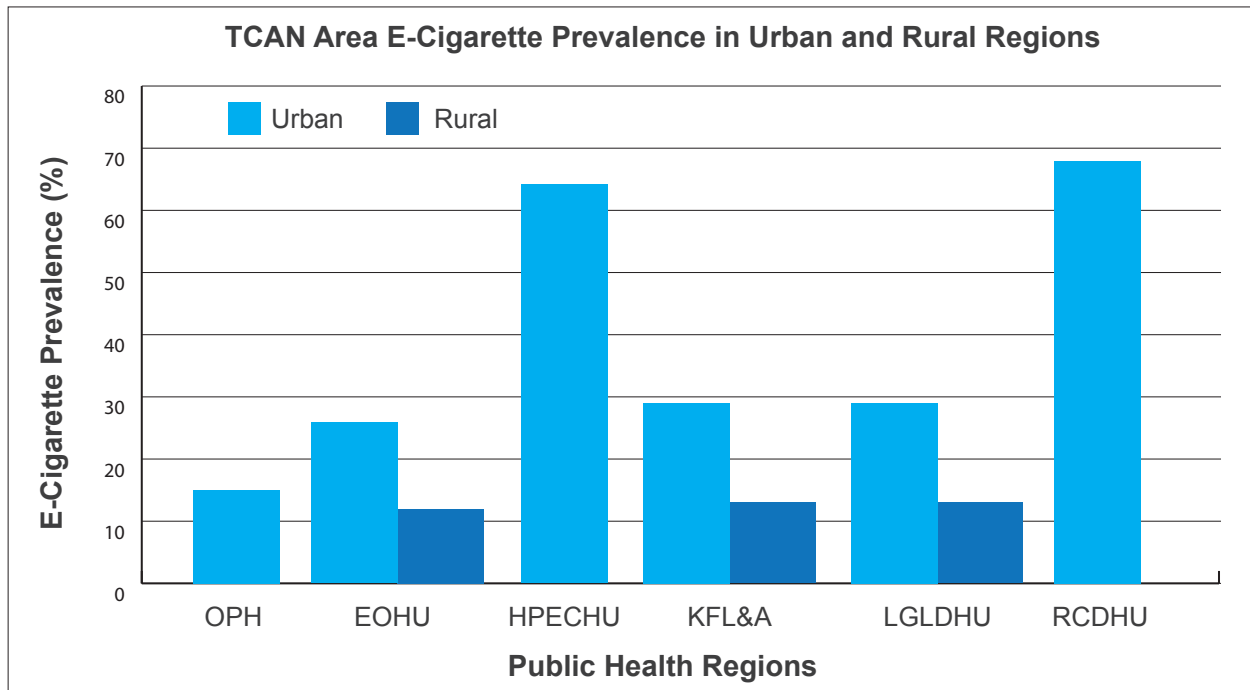
Of the 196 tobacco vendors sampled in the EOHU, HPECHU, KFL&A, LGLDHU, OPH, and RCDHU areas, 37 sold e-cigarette products. This number represents a mean of 19% e-cigarette prevalence of the vendors surveyed in the six PHU areas. The associated 95% confidence interval is 6%-32% e-cigarette prevalence.

EOHU prevalence rates were 4 of 25. HPECHU prevalence rates were 7 of 18. KFL&A prevalence rates were 7 of 18. LGLDHU prevalence rates were 4 of 22. OPH prevalence rates were 15 of 97. RCDHU prevalence rates were 2 of 12.

The store type with the highest e-cigarette prevalence of 58% (7/12) was found in chain or franchise convenience stores (see Graph 2). Prevalence rates of e-cigarettes at gas stations were also high at 44% (31/70) (see Graph 2).

Eighty-one percent of retailers found selling e-cigarettes had clearly visible countertop displays made of cardboard or acrylic boxes containing e-cigarettes. Nineteen percent of retailers selling e-cigarettes had the product either behind tobacco screens or hidden beside or below the cash register. Survey results found 4 different brands of electronic cigarettes (Smoke NV, Impulse, Evo, Vapur). Retailers belonging to specific chains of stores frequently sold the same brand of e-cigarettes as other retailers also part of that chain of stores.

Graph 1. E-cigarette total prevalence split by urban and rural frequency for entire TCAN region. Urban mean prevalence percentage was 38.2% with a standard deviation of ± 21.8 . Rural mean prevalence percentage was 7.6% with a standard deviation of ± 6.9 .



Graph 2. E-cigarette total prevalence split by store type for entire TCAN area.

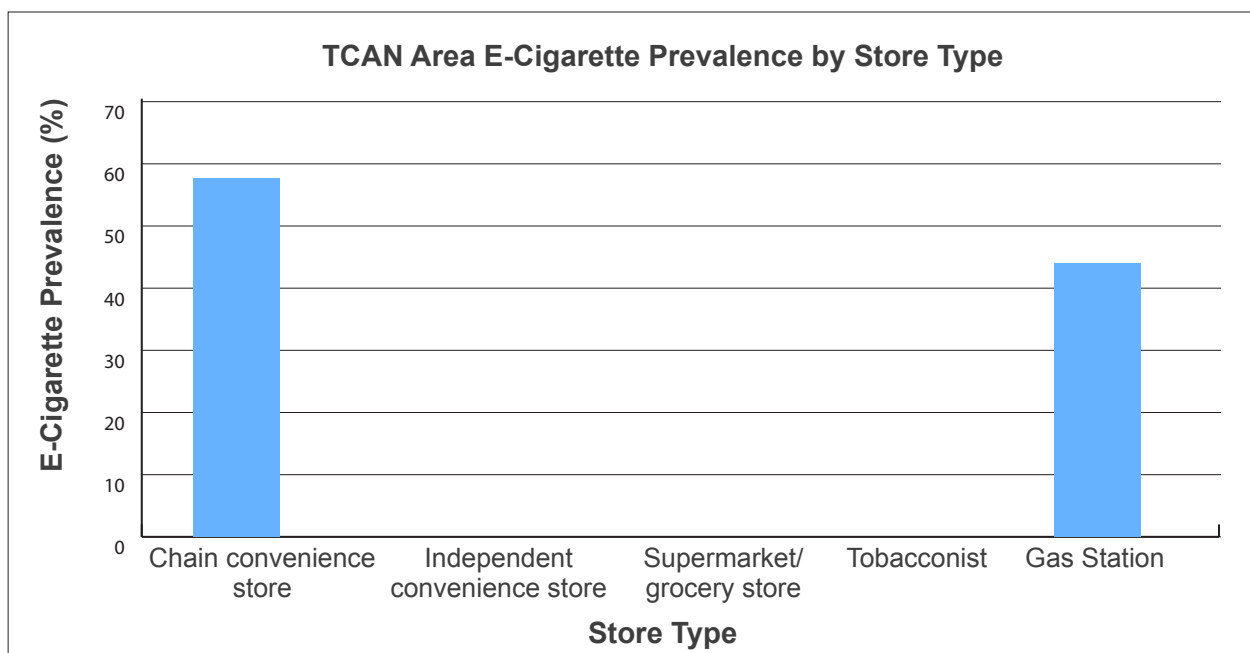


Table 3. E-cigarette prevalence by store type for each PHU area.

Region	Total Sample (s=196)				
	CCS	ICS	S/GS	T	GS
OPH	s=7	s=42	s=14	s=1	s=27
	n=3	n=0	n=0	n=0	n=12
RCDHU	s=1	s=7	s=N/A	s=N/A	s=4
	n=0	n=0	n=N/A	n=N/A	n=2
KFLA	s=1	s=11	s=N/A	s=1	s=9
	n=1	n=0	n=N/A	n=0	n=4
EOHU	s=1	s=12	s=4	s=N/A	s=8
	n=1	n=0	n=0	n=N/A	n=3
HPECHU	s=1	s=5	s=1	s=N/A	s=11
	n=1	n=0	n=0	n=N/A	n=7
LGLDHU	s=1	s=4	s=4	s=N/A	s=11
	n=1	n=0	n=0	n=N/A	n=3

s = total sample. n = number selling e-cigarette.

*CCS = chain convenience store. *ICS = independent convenience store. *S/GS = supermarket/ grocery store. *T = tobacconist. *GS = gas station.

Table 4. E-cigarette prevalence in urban and rural regions for each PHU area.

Region	Total Sample (s=196)	
	Urban	Rural
OPH	s=97	s=N/A
	n=15	n=N/A
RCDHU	s=3	s=9
	n=2	n=0
KFLA	s=14	s=8
	n=4	n=1
EOHU	s=8	s=17
	n=2	n=2
HPECHU	s=11	s=7
	n=7	n=0
LGLDHU	s=7	s=15
	n=2	n=2

s = total sample. n= number selling e-cigarettes.

Discussion

The mean e-cigarette prevalence of 19% in the TCAN region demonstrates a significant abundance of product in the region. HPECHU and KFL&A had the highest prevalence rates of 38.9% and 22.7%, respectively, and also had the highest proportion of chain convenience stores and gas stations, 66% and 55% respectively.

TEO questioning of a prominent gas station retailer found that e-cigarette product was chosen by corporate sales representatives and was not a local sales decision made by the managers at a particular retail outlet.. This evidence of standardized practice stemming from company policy likely explains the high rates of e-cigarette prevalence at chain convenience stores and gas stations. The case study of one prominent gas station chain illustrates this finding. Nine Ultramar gas station outlets were sampled across the six Local Public Health Agency areas. Seven of the nine Ultramar locations sold the same brand e-cigarettes, displayed in identical locations. This evidence would seem to suggest that corporate policy or buying practise dictates which product is sold and how and where it is to be displayed.

The 3 regions with the lowest prevalence rates had the highest proportion of independent retailers and/or large rural samples. The lowest e-cigarette prevalence rates were found in the catchment areas of Ottawa Public Health (15.5%), Eastern Ontario Health Unit (16%), and Renfrew County District Health Unit (16.7%). Urban prevalence of e-cigarettes was also significantly higher than that of rural regions (see Graph 1). This finding relates to the trend of higher prevalence of e-cigarettes in chain stores and gas stations which are often found in urban settings. The isolation of e-cigarette prevalence in chain convenience stores and gas stations in urban areas may provide an easier avenue for enforcement of the product.

Retail clerks in rural and small urban locations frequently stated that they had never heard of e-cigarettes. As mentioned above the main differentiating feature of rural and small urban retailers is the fact that the majority of these locations are independent. While low prevalence rates at independent locations seem promising for enforcement; the possibility exists that these locations will see a rise in e-cigarette prevalence. Independent retailers may simply be behind chain stores in the uptake of a niche product.

The survey findings demonstrate an ideal time for amendments to e-cigarette policy and enforcement. With prevalence rates of 19%, e-cigarettes appear to be currently isolated in chain locations. As time passes the prevalence of e-cigarettes in independent retailers may increase, potentially magnifying public health issues by increasing access to these products. This prevalence rate also suggests that the current 2009 Health Canada advisory should be re-examined, and up-dated.

Limitations of Study

The survey sample size, n=196, of the 1506 total tobacco vendors in TCAN-East represents a 13% sample size. The small sample size represents a limitation of the study. The associated 95% confidence interval of the prevalence rate is large (6%-32%), and demonstrates a wide variance in survey findings. The potential exists for the survey findings to over-estimate prevalence due to small samples in each region. Results must, therefore, be interpreted with caution as survey findings may not be representative of the true prevalence rates.

Only registered tobacco vendors were used to choose the sample for this survey. Interviews with TEOs across TCAN-East stated that because e-cigarettes are not a tobacco product they have witnessed pharmacies and other business operations (ie head shops, furniture stores, and mall kiosks), selling e-cigarettes, not just registered tobacco retailers. Reports of e-cigarettes being given away at trade shows was also documented during interviews. The survey focused on prevalence of e-cigarettes in registered tobacco vendors; therefore the survey sample did not include any other sales or distribution locations. In order to gain a more complete prospective of e-cigarette prevalence further studies should incorporate other locations and methods of sales such as online, pharmacies, door to door sales etc.

The study could be improved by increasing the sample size. A larger sample size would likely narrow confidence intervals and increase reliability in the data by reducing skew. The study could also be expanded to include other locations and types of sales, to gain a complete picture of e-cigarette prevalence.

Further studies could explore the demographic of e-cigarette buyers. A survey looking at demographics would illustrate what proportion of the population is currently using e-cigarettes. A demographic survey could also shed light on potential issues regarding the use of e-cigarettes with youth. No such research to date currently exists in Canada. This product is still not approved for sale in Canada.

It is important to note that caution must be used when examining prevalence numbers due to the small sample size (this issue is explained in the opening paragraph of 'limitations of study' section above). For example the 58% e-cigarette prevalence rate found in chain convenience stores is a frequency for a very small sample (12) and, therefore, values are easily skewed by changes to the numerator (survey findings). The statistics do, however, illustrate general trends.

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