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Impact of Canadian tobacco packaging policy on quitline reach and reach equity



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ABSTRACT

Objective. To examine the impact of the new Canadian tobacco package warning labels with a quitline toll-free phone number for seven provincial quitlines, focusing on treatment reach and reach equity in selected vulnerable groups.

Methods. A quasi-experimental design assessed changes in new incoming caller characteristics, treatment reach for selected vulnerable sub-populations and the extent to which this reach is equitable, before and after the introduction of the labels in June, 2012. Administrative call data on smokers were collected at intake. Pre- and post-label treatment reach and reach equity differences were analysed by comparing the natural logarithms of the reach and reach equity statistics.

Results. During the six months following the introduction of the new warning labels, 86.4% of incoming new callers indicated seeing the quitline number on the labels. Treatment reach for the six-month period significantly improved compared to the same six-month period the year before from .042% to .114% ($p < .0001$) and reach equity significantly improved for young males ($p < .0001$) and those with high school education or less ($p = .004$).

Conclusions. The introduction of the new tobacco warning labels with a quitline toll-free number in Canada was associated with an increase in treatment reach. The toll-free number on tobacco warning labels aided in reducing tobacco related inequalities, such as improved reach equity for young males and those with high school or less education.

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Introduction

Tobacco is a leading cause of preventable illness and death in Canada and throughout the world (World Health Organization, 2009, 2012). In Canada, it is estimated that approximately 100 Canadians die each day from a smoking-related illness (Health Canada, 2011). The economic impact of tobacco related illness in Canada is also significant, with the annual burden of tobacco smoking estimated to be \$21.3 billion (Krueger et al., 2014). In Ontario—Canada's largest province—smoking is the biggest factor for hospital bed-utilisation accounting for 22% of men's and 12% of women's hospital bed-days and almost \$1 billion in hospital costs for 2011 (Manuel, et al., 2014). Approximately 15% of Canadians aged 15+ are smokers (Reid, et al., 2015); however, there

are large disparities in tobacco use, with some groups experiencing a disproportionate share of the tobacco health burden (David, et al., 2010; Blas and Sivasankara Kurup, 2010). These groups are vulnerable sub-populations who are more likely to be exposed to conditions that place them at a greater risk of exposures resulting in poor health (Frohlich, et al., 2006; Frohlich and Potvin, 2008). Populations in Canada with high smoking prevalence include young males 18 to 29 years of age (27%), those living in rural areas (19%), and those with high school or less education (21%) as a proxy for low socio-economic status (Schwartz, et al., July, 2010; Statistics Canada, 2012; Health Canada, 2015). Although smoking prevalence has declined over time in Canada, the disparity in smoking rates between high and low socio-economic status and for other sub-populations has remained (Reid, et al., 2014). More needs to be done to reduce these disparities.

Canada introduced pictorial health warning labels on cigarette packs in the year 2000. A new set of pictorial health warning labels (HWLs) were introduced by Health Canada in 2012 (see Fig. 1) and included,

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* additional examples can be found at <http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/legislation/label-etiquette/cigarette-eng.php>

Fig. 1. Example* Cigarette Package Health Warning Label – March 2012 to present. *Additional examples can be found at <http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/legislation/label-etiquette/cigarette-eng.php>.

for the first time, a quitline toll-free number (Government of Canada, 2014). Manufacturers were prohibited from producing cigarette packages and retailers were prohibited from selling cigarettes without the new HWLs as of March 21 and June 18, 2012 respectively. Including a quitline telephone number in tobacco warnings on cigarette packages has been found to increase call volume (Bot, et al., 2007; Miller, et al., 2009) and the associated number of new callers registering with the service (Li and Grigg, 2009; Willemsen, et al., 2002), resulting in an increased reach for quitlines. Following the introduction of labels with quitline numbers in the Netherlands, the callers were from a broader group of smokers and there was an increase in callers from lower socioeconomic groups (Willemsen, et al., 2002). However, little is known about the impact of the introduction of these labels on reach equity, that is whether the percentage of quitline callers from vulnerable groups is representative of the smoking population (Campbell, et al., 2014).

Quitlines are population-based cessation support interventions that have been shown to be effective in a variety of contexts (Stead, et al., 2013; Lichtenstein, et al., 1996), however the evidence regarding their impact on tobacco-related health disparities is scarce, and what is published reports mixed findings (Hill, et al., 2013; Brown, et al., 2014; Varghese, et al., 2014; North American Quitline Consortium, 2011). Canadian provincial quitlines can be easily accessed free of charge, have no eligibility restrictions, and provide evidence-based information, advice and motivational counselling. The impact of a population-based intervention is measured as the product of the intervention's reach and its effectiveness (Glasgow, et al., 2006). Canadian quitlines, relative to other jurisdictions, have had lower reach and consequently lower relative impact due to limited funding for mass media promotions and nicotine replacement therapy (NRT) services, both of which have been shown to increase reach (Saul, et al., 2014). During the 2010 fiscal year, Canadian quitlines reached and provided treatment to 0.30% of the adult smoking population overall and the treatment reach for individual provincial quitlines ranged from 0.17% to 1.79% (North American Quitline Consortium, 2012). Therefore, it is important to monitor the impact of population-based strategies such as the new tobacco package HWLs with a quitline toll-free number on overall reach and reach into vulnerable population groups (McLaren, et al., 2010) to establish health equity.

This paper examines the impact of the new health warning labels with the quitline toll-free number for seven Canadian provincial quitlines, focusing on the changes in the characteristics of quitline

callers, treatment reach into selected vulnerable groups in the population, and the impact on the reach equity for these groups.

Methods

Study design

This study is a quasi-experimental pre-test post-test design based on the natural experiment created by the introduction of new HWLs with a toll-free quitline number (Victoria, et al., 2004; Petticrew, et al., 2005). Comparisons are made of new incoming caller characteristics, the proportion of selected vulnerable smoking sub-populations who receive treatment from the quitline (treatment reach) and the extent to which this reach is equitable, before and after the introduction of the labels. The post-label period is the six months from July 1, 2012 to December 31, 2012, after the new tobacco regulations came into full force and retailers could no longer sell cigarettes or little cigars without the new labels (Government of Canada, 2014), while the pre-label period was for the comparable months in the preceding year (July 1, 2011 to December 31, 2011). These time periods were chosen to remove months where other quitline promotions such as Quit and Win contests had been run in the pre-label period.

Participants

The study focuses on quitline new callers who were age 18 and over, smoked daily or occasionally at intake or had recently quit (within the past 30 days), were seeking smoking cessation help, and who had no contact with the quitline in the past 12 months (North American Quitline Consortium, 2009).

Three vulnerable groups were selected for the analysis on the basis of the quitline and population data available. The first is young males whose self-reported age is 18 to 29 years. The second group is smokers with high school or less education, which is used as a measure for low socioeconomic status. The third group is smokers living in rural areas.

Data sources

Data on quitline callers were obtained from participating quitline providers' intake and service data for seven provinces in Canada (Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, and Saskatchewan). Quitline providers from Quebec, Alberta and British Columbia declined participation.

To calculate reach and reach equity, population data for these provinces were obtained from the Canadian Tobacco Use Monitoring Survey (CTUMS) public use data files for the years of 2011 and 2012 (Statistics Canada, 2012, 2013).

The Statistics Canada Postal Code Conversion File May, 2011 was used to convert postal codes for quitline callers into residential location categories comparable to the CTUMS data (Statistics Canada, 2011) to calculate reach and reach equity for those living in rural areas.

Measures

Age, gender, education, residential location as determined by postal code, ethnicity and smoking status (daily or occasional) were collected at intake from incoming callers. Incoming callers were asked a multiple response question “How did you hear about the service?” and could name more than one source. The graphic warning on the cigarette pack was added as a source and response option after the introduction of the labels. Callers would be considered to have heard from at least one media source if they mentioned newspapers, radio, television, website, or other media such as magazines. Referral sources included informal referral from health professionals, family or friends, quit contests, or other referrals such as the workplace. Other advertising included brochures, posters or flyers, or other advertising such as telephone directory.

Treatment reach is the number of new incoming callers over the six month period, 18 years of age and over, who were smoking at intake or recently quit (within last 30 days), were calling for themselves for help to quit or stay quit, and received quit counselling within 30 days of intake, divided by the estimated number of smokers age 18 and over in the population (North American Quitline Consortium, 2009).

Reach equity for the vulnerable groups is measured using reach ratios which are calculated as the proportion of new callers receiving treatment in a specific sub-population divided by the proportion of the smoking population who are in the sub-population (Campbell, et al., 2014). A value below 1.0 indicates that the vulnerable group is under-represented among the quitline callers, while a value above 1.0 indicates that the group is over-represented.

Analysis

Caller characteristics during the pre- and post-label periods were compared for the combined and individual provinces using the mean ± SD for continuous variables and frequency percentages for categorical variables. Statistical tests were based on the t-test for independent groups or the Fisher's exact test respectively to test for significant differences between the pre- and post-test periods.

For the reach and reach ratio calculations, the population estimates in relevant sub-groups for each year were obtained using the boot-strap weights provided by Statistics Canada (2012, 2013). Confidence intervals (95%) were calculated for the natural logarithm of the reach and reach ratios using the delta method to obtain an approximate variance of the logarithm of the appropriate ratio (Fagerland, et al., 2014). These were then transformed to confidence intervals for the ratios themselves. The hypotheses that the pre- and post-test reach and reach ratios were equal were tested by comparing the natural logarithms of the relevant statistics. For example, the test statistic to compare the pre- and post-test reach statistics is:

$$Z = (\log(\text{Reach}_{\text{pre}}) - \log(\text{Reach}_{\text{post}})) / (\text{Variance}(\log(\text{Reach}_{\text{pre}})) + \text{Variance}(\log(\text{Reach}_{\text{post}})))^{1/2}$$

where the variances are obtained as described above (Fagerland, et al., 2014). Comparison of the observed value of the test statistic to the tables of the standard normal distribution gives an approximate significance

level for the hypothesis. Analyses for this project were conducted using SAS (versions 9.3 and 9.4).

Results

During the six months following the introduction of the new warning labels (July – Dec 2012), 86.4% of incoming new callers reported seeing the quitline number on the health warning labels (see Table 1). Other sources of information about the quitline service had lower percentages than in the comparable pre-label period (July–Dec 2011), and the numbers declined for referral and advertising sources.

New caller volume and characteristics

After the introduction of the new HWLs, the volume of new incoming callers more than tripled for the combined provinces – increasing from 1182 pre-label period to 3671 post-label period (see Table 2).

The characteristics of new callers to the quitlines also changed after the introduction of the new HWL. For example, the proportions of males, young males (18–29), and callers with high school education or less each increased significantly. Post-label, the average age of callers decreased significantly and there was a significant increase in the proportion of callers that were daily smokers compared to non-daily. In addition, the percentage of callers from Asian and Latin American ethnic origins increased significantly (see Table 2).

There is some variation in these patterns by province. Although the average age of new callers decreased in Ontario after the introduction of the labels (from 47.1 to 43.5 years, p < .0001), the remaining provinces did not have a significant change. The percentage of callers who were daily smokers increased in Manitoba (from 81.2% to 91.6%, p = .02) and Ontario (from 79.4% to 89.4%, p < .0001). The percentage of callers who were male increased significantly in New Brunswick (25.6% to 46.0%, p = .02), Nova Scotia (33.7% to 46.3%, p = .05), Ontario (40.1% to 52.3%, p < .0001) and Saskatchewan (31.6% to 51.5%, p = .01). In Ontario, the percentage who were young males increased from 6.4% to 15.9% (p < .0001), and the other provinces showed a similar but not statistically significant trend. A higher percentage of callers had high school education or less post-label in Manitoba (increased from 45.8% to 66.7%, p = .01) and in Ontario (from 45.3% to 53.1%, p = .001), and although not statistically significant, this pattern could be also be seen for the other provinces.

Treatment reach and reach equity

After the introduction of the labels, the six-month period treatment reach for the combined provinces contributed by new incoming callers increased significantly from .042% pre-label to .114% post-label (p < .0001), and the numbers receiving cessation treatment almost tripled from 1063 to 2777. Each of the provinces also had significant increases

Table 1
How new incoming callers heard about the quitline during pre- and post-label periods for combined provinces.

Information source	Pre-label ^a (N = 1128) ^c			Post-label ^b (N = 3511) ^c			p value ^d
	N	Percent of responses	Percent of callers ^e	N	Percent of responses	Percent of callers ^e	
Graphic warnings on cigarette pack ^f	10	0.87%	0.9%	3033	80.4%	86.4%	<0.0001
At least one media source	229	19.9%	20.3%	236	6.3%	6.7%	<0.0001
At least one referral source	595	51.8%	52.8%	372	9.9%	10.6%	<0.0001
At least one other advertising source	314	27.4%	27.8%	132	3.5%	3.8%	<0.0001
Total ^g	1148	100%	102%	3773	100%	108%	

^a Missing data: pre-label = 54.

^b Missing data: post-label = 160.

^c Column head N refers to number of individuals.

^d Fisher's exact test for percent of callers.

^e Sums to more than 100% since callers can provide more than one response.

^f Pre-label responses may be due to incoming callers reporting existing HWL without toll-free number.

^g Column figures refer to number of responses.

Table 2
Characteristics of new incoming callers at intake during pre- and post-label periods for combined provinces.

Characteristics ^a	Pre-label Number (%)	Post-label Number (%)	p value ^b
Total	1182	3671	
Mean age, years (SD)	47.0 (14.2)	44.2 (15.6)	<0.0001
Gender			<0.0001
Male	448 (37.9)	1856 (50.8)	
Female	734 (62.1)	1798 (49.2)	
Age and gender group			0.0001
Young male (18–29)	68 (6.5)	492 (14.5)	
Other	979 (93.5)	2895 (85.5)	
Education			<0.0001
High school or less	412 (47.5)	1504 (56.4)	
More than high school	456 (52.5)	1164 (43.6)	
Residential location			1.0000
Rural	130 (13.7)	370 (13.7)	
Urban, urban fringe	822 (86.3)	2331 (86.3)	
Ethnic origin ^c			
Aboriginal	65 (7.6)	190 (7.0)	0.5422
Asian	16 (1.9)	124 (4.6)	0.0002
Black	25 (2.9)	115 (4.2)	0.1051
Latin American	4 (0.5)	49 (1.8)	0.0031
Middle Eastern	28 (3.3)	105 (3.9)	0.4697
White	751 (87.8)	2196 (80.6)	<0.0001
Smoking status at intake			<0.0001
Daily	954 (80.7)	3278 (89.3)	
Occasionally or recent quitter	228 (19.3)	393 (10.7)	

^a Missing: age = 413; gender = 17; age and gender group = 419; education = 1317; residential location = 1200; ethnic origin = 1273; and smoking status at intake = 0.

^b Fisher's exact Test or Student's t-test.

^c Sums to more than 100% since callers can have more than one response.

in the percentage and numbers of smokers reached, with the exception of Prince Edward Island where there was a significant decrease (.186% to .091%, $p = .02$) and the numbers reached declined from 43 to 17.

Young males

Treatment reach of new incoming callers into the young male (age 18–29) smoking population increased significantly for the total combined provinces from .015% to .092% ($p < .0001$), and in the provinces of Manitoba ($p = .001$), Nova Scotia ($p = .04$), Ontario ($p < .0001$) and Saskatchewan ($p = .005$). Treatment reach into this sub-

population of smokers did not significantly change in New Brunswick ($p = .1$) or Newfoundland and Labrador ($p = .7$), (see Fig. 2).

The treatment reach ratio for incoming new callers who were young male smokers significantly changed for the combined provinces (.37 pre-label to .86 post-label, $p < .0001$), largely reflecting the pattern in Ontario (.35 to .93, $p < .0001$) where the proportion of new incoming callers who are young males is approaching the proportion of young male smokers in the population (see Fig. 3). Although the reach into the young male smokers in the population may be low, it has become more equitable and this subgroup is better represented in quitline callers receiving treatment. The treatment reach ratios in the other provinces did not significantly change, although the trends in Manitoba (.23 to .82, $p = .09$) and Saskatchewan (.58 to 1.10, $p = .2$) resemble Ontario's.

Low education

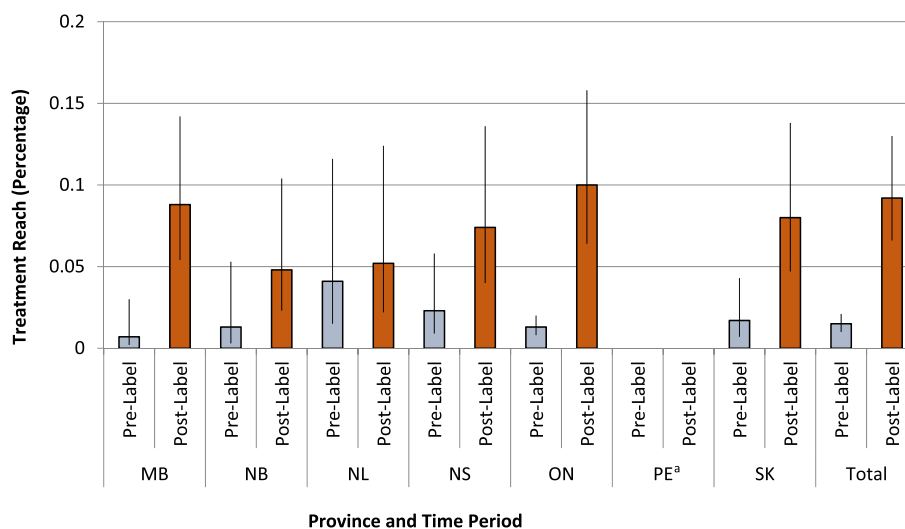
Treatment reach for those with an education of high school or less significantly increased for the combined provinces (from .026% to .088%, $p < .0001$) and for each of the provinces (see Fig. 4), with the exception of Newfoundland and Labrador where the increase was not significantly different (.056% to .079%, $p = .2$) and Prince Edward Island where it decreased from .153% to .064% ($p = .04$).

The treatment reach ratio for incoming new callers with high school or less education significantly changed for the combined provinces from .77 pre-label to .99 post-label ($p = .004$), largely reflecting the pattern in Ontario (.74 to 1.02, $p = .009$). After the introduction of the labels the proportion of new incoming callers with high school or less matches the proportion of smokers with high school or less in the population – education equity. Although not statistically significant, the other provinces show a similar trend (see Fig. 5).

Rural residence

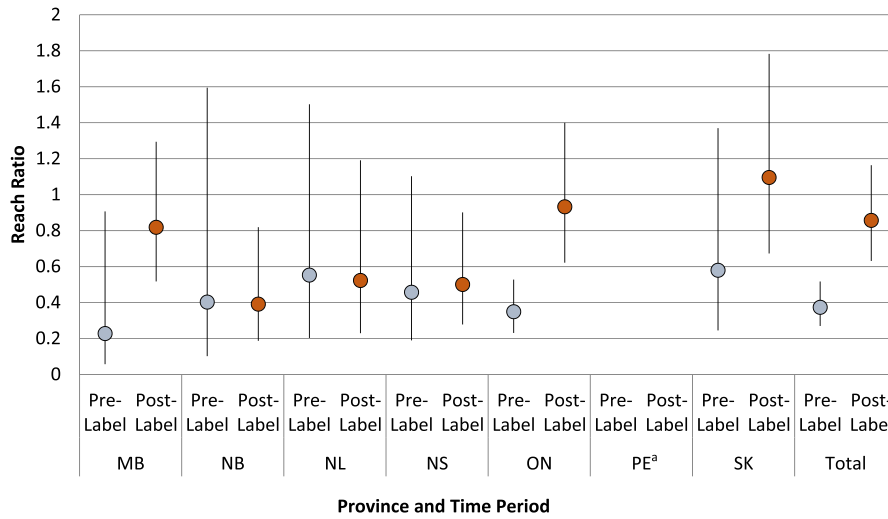
As can be seen in Fig. 6, the treatment reach of incoming new callers for the subpopulation of smokers who reside in rural areas significantly increased from .024% ($n = 122$) pre-label to .032% ($n = 293$) post-label for the combined provinces ($p < .0001$), and for Manitoba ($p = .05$), New Brunswick ($p = .009$), Nova Scotia ($p = .003$), and Ontario ($p = .0006$), but did not significantly change in Prince Edward Island ($p = .55$) or Newfoundland and Labrador ($p = .61$).

Overall, there was not a significant difference in the pre- and post-label treatment reach ratio for incoming new callers who had rural



^a not reported due to small caller numbers

Fig. 2. Treatment reach and 95% confidence intervals for young males by province and pre- and post-label time period.



^a not reported due to small caller numbers

Fig. 3. Treatment reach ratios and 95% confidence intervals for young males by province and pre- and post-label time period. ^aNot reported due to small caller numbers.

residences for the combined provinces ($p = .89$). With the exception of Prince Edward Island where the reach ratio increased from .31 to .44 ($p = .05$), the individual provinces do not show a significant change (see Fig. 7).

Discussion

This paper examined the impact of the new HWLs in the first six months after introduction, for seven Canadian provincial quitlines using quitline intake data. Results show that the new HWLs were an effective quitline promotion associated with significant changes in the awareness of quitlines, characteristics of quitline callers, treatment reach and reach equity for some vulnerable groups. The impact on smokers of graphic health warnings on cigarette packages have been well evaluated over the past decade, both within and between countries, and it is well established that graphic health warnings are more effective than plain text-based warnings (Hammond, et al., 2007, 2013; Fathelrahman, et al., 2013; Malouff, et al., 2012). There is no doubt that graphic health warnings on cigarette packets provide information

to smokers, engage smokers, and influence smokers' cognitions, feelings and behavioural intentions (Volchan, et al., 2013). Furthermore, as shown by this study with 86% of callers reporting seeing the toll-free quitline number on the new HWLs, it has been demonstrated that smokers cite graphic health warning labels as a source of information about quitlines and self-reported use of quitlines (Thrasher, et al., 2014).

This study adds to the evidence on the inclusion of a toll-free quitline number on tobacco packages (Willemsen, et al., 2002; Miller, et al., 2009; Bot, et al., 2007; Young, et al., 2014; Li and Grigg, 2009). It has demonstrated increased population level awareness of the quitline toll-free number as well as use of quitline services in terms of both overall population level reach and the reach equity into sub-populations of smokers that bear an undue burden from tobacco. Experience from other countries shows calls increase substantially with the introduction of numbers on tobacco packaging, leading to 100% increase in call volumes in some countries (Bot, et al., 2007; Young, et al., 2014). When Australia introduced new plain packaging and health warnings with the quitline number prominently displayed, the number of calls to their quitline increased 78% (Young, et al., 2014). However, the

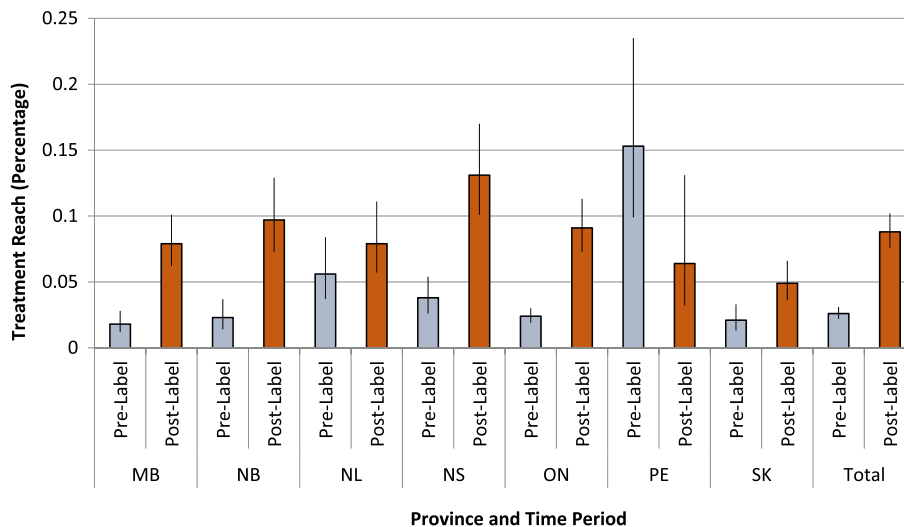


Fig. 4. Treatment reach and 95% confidence intervals for high school or less by province and pre- and post-label time period.

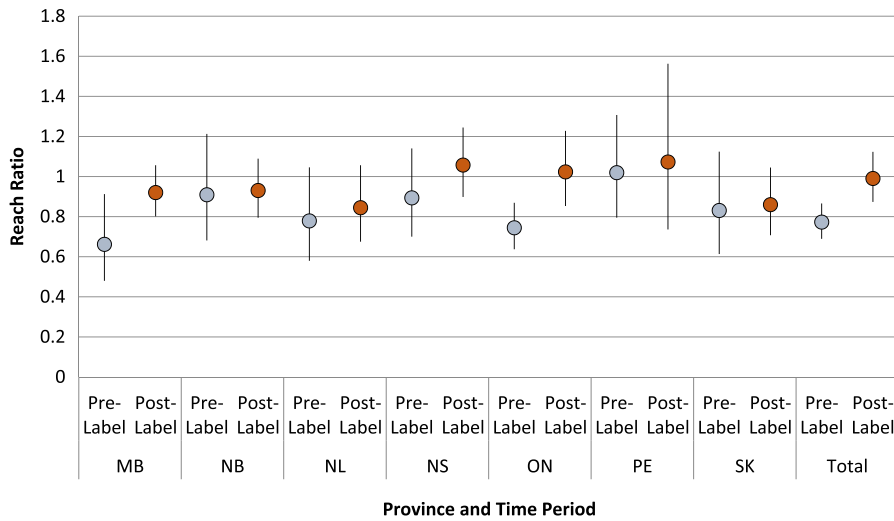


Fig. 5. Treatment reach ratios and 95% confidence intervals for new incoming callers with high school or less by province and pre- and post-label time period.

added call volume to the quitlines may represent, in part, a novelty effect of the HWLs, and it will be important to monitor whether these higher numbers are maintained as smokers habituate to the new HWLs.

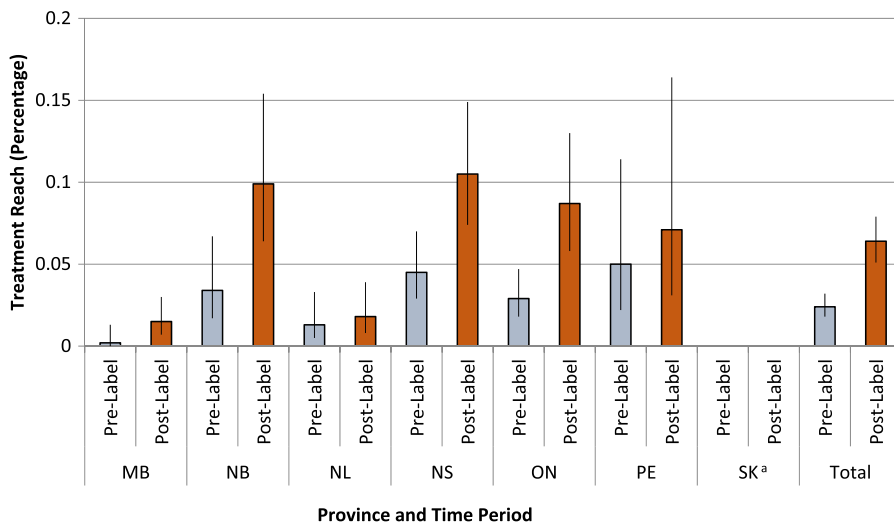
Similar to this study, the Netherlands, introduced their quitline numbers on their new HWLs in 2002 and found the demographics of callers to the quitline changed; before the implementation callers were mainly from the middle socioeconomic groups and after the callers represented a broader group of smokers with many more calls from smokers of lower socioeconomic groups (Willemssen, et al., 2002). Further, New Zealand introduced package warnings in 2008 with the quitline number prominently displayed on cigarette packages (Li and Grigg, 2009). The New Zealand study found prior to the new warnings 36.8% of New Zealanders knew the quitline number and after the new warnings 60.9% knew the number (Wilson, et al., 2010). The level of recognition was similar across all socioeconomic groups suggesting this means of promotion benefits all socioeconomic groups, including reaching underserved aboriginal populations.

One of the limiting factors on quitline success has been low reach. The North American Quitline Consortium determined that the 2011 level of twelve-month treatment reach for all Canadian quitlines is 0.30%. (North American Quitline Consortium, 2012) The low reach is

attributed to lack of awareness among target audiences that quitlines exist and lack of awareness of what quitlines do (Rutten, et al., March, 2011; The World Bank, 2001). Saul et al.(2014) found that mass media promotions for the mainstream population was a significant factor associated with increased treatment reach. Promotion of quitlines is an important element in reducing smoking rates, reducing the per person costs of operating quitlines, and increasing cost effectiveness. Since the overall impact of a population health intervention is the product of reach and effectiveness, quitlines that increase reach will have a greater population benefit (higher number of quitters in the population) (Glasgow, et al., 2006). The six-month reach attained from the new HWLs with a toll-free number for 6 months after the introduction of the policy was 0.114% and although this represents a significant improvement from before the introduction of the labels, there is still need for additional promotion campaigns, NRT services and enhanced referrals from health professionals.

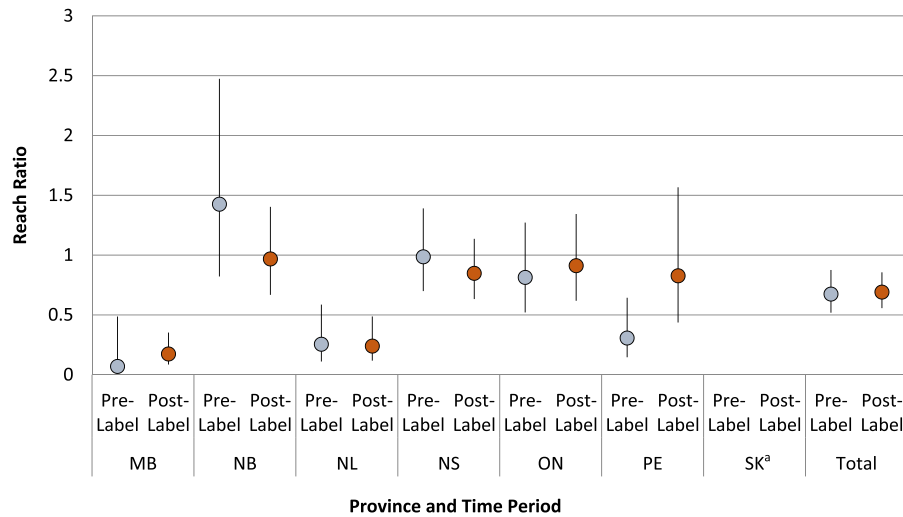
Study limitations

This study has several limitations typical of those that use administrative data, notably the self-reported nature of the data and missing



^a not reported due to small caller numbers

Fig. 6. Treatment Reach for Rural Residence by Province and Pre- and Post-Label Time Period. ^aNot reported due to small caller numbers.



^a not reported due to small caller numbers

Fig. 7. Treatment reach ratios for new incoming callers with rural residences by province and pre- and post-label time period. ^aNot reported due to small caller numbers.

information (Statistics Canada, 2014). For example, educational status (27%), rural residency (26%) and ethnic origin (28%) had high percentages of missing information. Campbell and colleagues (2014) have analysed Canadian quitline intake data and confirmed that missing caller characteristics did not influence treatment reach ratios. The quitline data were cleaned, coded and checked for consistency to ensure quality; however, some errors in reporting may exist. While the pre-test post-test study design is appropriate for studying policy interventions that are not under the control of the investigator (Petticrew, et al., 2005), this design cannot prove causation and other factors can affect validity of the study results. In this context, other promotional campaigns, changes in the price of tobacco, free nicotine replacement therapy (NRT) from the quitline, or celebrity focus on quitting are the most likely factors that would affect reach or reach equity. To our knowledge no other new promotional initiatives, celebrity focus or NRT services were introduced during the time of this study. We were unable to control for province specific confounders such as changes in price of tobacco in the provinces. Despite these design limitations, the data represent all caller activity from each of the participating provinces. We believe our findings represent the reach and reach equity impact of the new HWLs with a toll-free quitline number on tobacco packaging and that we have shown a positive association between a policy intervention and quitline reach and reach equity.

Conclusion

The introduction of the new HWLs with a quitline toll-free number in Canada changed the profile of incoming callers to the provincial quitlines and was associated with increased treatment reach for most provinces in the study. To our knowledge, this is the only study that has considered reach equity to assess the impact of the inclusion of a HWL toll-free quitline number on special population groups. The new HWLs with a toll-free number aided in reducing tobacco related inequalities, with improved treatment reach equity for young males and those with high school or less education.

Authors' contributions

HSC and NBB led the conceptualization and design of the study and LH, DH, RDK and KSB contributed to the design of the study. NBB and LH drafted the manuscript. NBB, LH, DH, RDK, KSB and HSC critically revised the manuscript for important intellectual content. NBB and HSC are co-principal investigators and DH, RDK and KSB are co-investigators

on the research funding application. LH provided administrative, technical, and material support. NBB supervised the study. NBB is the guarantor.

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Conflict of interest

The authors declare there is no conflict of interest.

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