

ORIGINAL INVESTIGATION

Changes in Effectiveness of Cigarette Health Warnings Over Time in Canada and The United States, 2002–2011

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ABSTRACT

Introduction: Article 11 of the World Health Organization's Framework Convention on Tobacco Control (FCTC) requires countries to implement health warnings on tobacco products. The Article 11 Guidelines advise countries to periodically rotate warnings to prevent "wearout" of the health warnings. This study investigates potential wearout of cigarette health warnings over a period of 9 years in 2 countries: Canada, where larger pictorial warnings were implemented approximately 1 year prior to the study, and in the United States, where small text-only warnings were in place for 17 years at the beginning of the study.

Methods: Data were drawn from national samples of smokers from the International Tobacco Control (ITC) Surveys in Canada ($N = 5,309$), and the United States ($N = 6,412$) recruited originally by telephone using random digit dialing. Changes in 4 measures of health warning effectiveness and in a composite Labels Impact Index were examined over 8 waves of survey data (2002–2011). Analyses were conducted in 2012.

Results: The health warning effectiveness measures and the Labels Impact Index indicated that the effectiveness of both the Canadian, and the U.S. warnings declined significantly over time. The Canadian warnings showed greater declines in effectiveness than the U.S. warnings, likely due to the initial novelty of the Canadian warnings. Despite the greater decline in Canada, the Canadian pictorial warnings were significantly more effective than the U.S. text-only warnings throughout the study.

Conclusions: Health warnings decline in effectiveness over time. Health warnings on tobacco products should be changed periodically to maintain effectiveness.

INTRODUCTION

Tobacco use is the leading cause of preventable disease in high-income countries (World Health Organization, 2009). Approximately half of all long-term smokers will die of a smoking-related disease, and it is estimated that smoking could kill 1 billion people this century (Mathers & Loncar, 2006; Peto et al., 1996). To address the harms caused by tobacco, the World Health Assembly adopted the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC) in 2003 (World Health Organization, 2005).

Article 11 of the FCTC covers the use of health warning labels to communicate information about the harms of tobacco. The Article 11 Guidelines, adopted in November 2008 (World Health Organization, 2008), recommend the implementation of pictorial health warnings that cover at least 50% of the top of the front and back of the package. The Article 11 Guidelines

are consistent with research showing that larger pictorial warnings are more effective than smaller text warnings for informing people about the health risks of smoking and encouraging smokers to quit (Hammond, 2011).

The Article 11 Guidelines imply that the same health warnings will not remain effective over long periods of time, in other words, their effectiveness will "wearout." The Guidelines state that warnings should be rotated to maintain warning saliency (Fiske & Morling, 1996) and enhance impact. This concern arises from communication research showing that although messages may become more persuasive as they approach a moderate level of exposure, they tend to become increasingly less persuasive as they approach a high level of exposure (Appel, 1971; Calder & Sternthal, 1980; Craig, Sternthal, & Leavitt, 1976; Gorn & Goldberg, 1980; Grass & Wallace, 1969; Schumann & Clemons, 1989; Winter, 1973). The Article 11 Guidelines specify that "rotation can be implemented by [1]

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Health Warning Label Effectiveness

Changes in health warning effectiveness were examined using: (a) a dichotomized version of four individual 4- to 5-point measures of health warning effectiveness, and (b) by combining continuous versions of the four individual measures into a composite Labels Impact Index (Hitchman et al., 2012).

Measures of Health Warning Effectiveness

Warning salience (Fiske & Morling, 1996) (SALIENCE) was measured by asking respondents: In the last month, how often, if at all, have you noticed the warning labels on cigarette packages (never, rarely, or sometimes, vs. often or very often). The extent to which the warnings led smokers to think about the harms of smoking (HARM) was measured by asking smokers: To what extent, if at all, do the warning labels make you think about the health risks of smoking (not at all, a little, or somewhat vs. a lot)? The extent to which the warnings led smokers to think about quitting (QUITTING) was measured by asking respondents: To what extent, if at all, do the warning labels on cigarette packs make you more likely to quit smoking (not at all, a little, or somewhat, vs. a lot)? The frequency in which the warnings led smokers to forgo a cigarette (FORGO) was measured by asking respondents: In the last month, have the warning labels stopped you from having a cigarette when you were about to smoke one (many times, a few times, or once vs. never)?

Warning Label Impact Index (LII)

The four individual measures of health warning effectiveness were combined into a single index, the Warning Label Impact Index (LII) (Hitchman et al., 2012). The LII was constructed for each respondent at each point in time by standardizing each of the four measures of effectiveness and then forming a weighted composite (the original 4- or 5-point scales of the measures were standardized—not the dichotomized versions). The measures were weighted according to each indicator's impact on quit attempts based on a previous study conducted by Borland, Yong, et al. (2009). In that longitudinal analysis of ITC data from Australia, Canada, the United States, and the United Kingdom (same dataset as the current study), Borland, Yong, et al. found that health warning salience was not a significant predictor of quit attempts (although there was a bivariate association, the relation was inconsistent or nonsignificant in multivariable models), that thoughts of harm and thoughts of quitting were significant predictors of quit attempts in the multivariable regression that included quit intentions, and that forgoing cigarettes seemed to be the strongest direct predictor. Thus, the LII was thus calculated as follows, $LII = (SALIENCE \times 1) + (HARM \times 2) + (QUITTING \times 2) + (FORGO \times 3)$, with higher scores on the LII signifying greater health warning impact. Note that the analyses using the LII only used Waves 2–8 because some measures were not asked in Wave 1.

Statistical Analysis

To test for health warning wearout using the individual binary measures of health warning effectiveness, separate logistic regression models were estimated using generalized estimating equations (GEE) (Horton & Lipsitz, 1999; Liang & Zeger, 1986) to test (a) whether there was a linear decline in effectiveness between Wave 1 and Wave 8, and (b) whether

there was a difference in effectiveness at Wave 8 versus Wave 1. Two of the four measures were not included in the Wave 1 survey and analyses, thus the HARM and QUITTING analyses could only include Wave 2 to Wave 8. A similar approach was used to test changes in the composite LII over time using linear GEE regression models with Wave 2 to Wave 8. To account for within-subject correlation that arises from subjects being asked the same questions over several waves, GEE models were estimated using an unstructured working correlation matrix in SAS Version 9.2. Analyses were conducted in 2012.

All regression models controlled for demographic variables assessed at each respondent's first interview (sex, age group, ethnicity, income, education), and smoking behaviors assessed at each wave (daily vs. nondaily smoking status, cigarettes/day, time to first cigarette after waking, and intentions to quit smoking). Demographic control variables were treated as time-invariant while smoking characteristics were time-varying. Time-in-sample (number of survey waves completed by each respondent) was controlled in all models. The analysis incorporated sampling weights to ensure that the results were representative of smokers in the two countries.

To provide a visual depiction of changes in health warning effectiveness over time, SAS Version 9.2 was used to estimate the (a) proportion of smokers having positive responses to the health warning effectiveness measures (e.g., % of smokers who noticed the warnings often or very often), and (b) average scores on the LII over time. These percentages and scores are model-based adjusted estimates, controlling for all factors in the model.

To test if the health warnings were significantly more effective in Canada compared to the United States over time, the main effect of country on each of the four measures of health warning effectiveness and the LII was also examined.

RESULTS

Characteristics of the Sample

There were significant differences in the sample characteristics between the two countries for wave of recruitment, time-in-sample, age group, ethnicity, income, education, cigarettes per day, time to first cigarette, and intention to quit smoking (Table 1). Differences in wave of recruitment and time-in-sample reflect the lower attrition rate in Canada versus the United States.

Health Warning Effectiveness: Canada Versus United States (Wave 1 to Wave 8)

Analyses of the four measures of health warning effectiveness indicated that the Canadian warnings were significantly more effective than the U.S. warnings throughout the study period, SALIENCE (Log OR = 1.06, $\chi^2 = 975.86$, $p < .001$), HARM (Log OR = 0.64, $\chi^2 = 156.74$, $p < .001$), QUITTING (Log OR = 0.49, $\chi^2 = 48.01$, $p < .001$), FORGO (Log OR = 0.48, $\chi^2 = 99.31$, $p < .001$) (Supplementary Figure 1). The composite Labels Impact Index also indicated that the Canadian warnings were significantly more effective than the U.S. warnings throughout the study period ($B = 2.06$, $\chi^2 = 361.91$, $p < .001$) (Figure 1).

Effectiveness of cigarette health warnings

Table 1. Sample Characteristics (at Recruitment/First Wave Surveyed for Each Respondent)

	Canada		United States		Overall	
	(n = 5,309)		(n = 6,412)		(n = 11,721)	
	Frequency	%	Frequency	%	Total	%
Wave of recruitment***						
1	2,157	40.6	2,060	32.1	4,217	36.0
2	502	9.5	659	10.3	1,161	9.9
3	538	10.1	866	13.5	1,404	12.0
4	507	9.5	717	11.2	1,224	10.4
5	570	10.7	722	11.3	1,292	11.0
6	537	10.1	690	10.8	1,227	10.5
7	306	5.8	359	5.6	665	5.7
8	192	3.6	339	5.3	531	4.5
Time-in-sample***						
1	1,950	36.7	3,095	48.3	5,045	43.0
2	1,240	23.4	1,492	23.3	2,732	23.3
3	788	14.8	769	12.0	1,557	13.3
4	461	8.7	445	6.9	906	7.7
5	308	5.8	265	4.1	573	4.9
6	208	3.9	158	2.5	366	3.1
7	155	2.9	99	1.5	254	2.2
8	199	3.7	89	1.4	288	2.5
Sex						
Female	2,846	53.6	3,505	54.7	6,351	54.2
Male	2,463	46.4	2,907	45.3	5,370	45.8
Age***						
18–24	654	12.3	709	11.1	1,363	11.6
25–39	1,597	30.1	1,642	25.6	3,239	27.6
40–54	1,959	36.9	2,363	36.9	4,322	36.9
55–max	1,099	20.7	1,698	26.5	2,797	23.9
Ethnicity***						
White	4,729	89.1	5,093	79.4	9,822	83.8
Non-White	580	10.9	1,319	20.6	1,899	16.2
Income***						
Low	1,500	28.3	2,369	36.9	3,869	33.0
Moderate	1,817	34.2	2,117	33.0	3,934	33.6
High	1,561	29.4	1,500	23.4	3,061	26.1
No answer	431	8.1	426	6.6	857	7.3
Education**						
Low	2,572	48.4	2,916	45.5	5,488	46.8
Moderate	1,951	36.7	2,463	38.4	4,414	37.7
High	786	14.8	1,033	16.1	1,819	15.5
Smoking status						
Daily smoker	4,930	92.9	5,976	93.2	10,906	93.0
Nondaily smoker	379	7.1	436	6.8	815	7.0
Cigarettes smoked per day***						
<10	1,665	31.4	2,005	31.3	3,670	31.3
11–20	2,270	42.8	2,966	46.3	5,236	44.7
21–30	1,133	21.3	845	13.2	1,978	16.9
≥31	241	4.5	596	9.3	837	7.1
Time to first cigarette (min)***						
>60	870	16.4	963	15.0	1,833	15.6
31–60	887	16.7	1,093	17.0	1,980	16.9
6–30	2,404	45.3	2,767	43.2	5,171	44.1
≤5	1,148	21.6	1,589	24.8	2,737	23.4
Intention to quit smoking***						
Within next 6 months	2,277	42.9	2,297	35.8	4,574	39.0
In the future/no intention to quit	3,032	57.1	4,115	64.2	7,147	61.0

** Pearson χ^2 test, $p < .01$.

*** Pearson χ^2 test, $p < .001$.

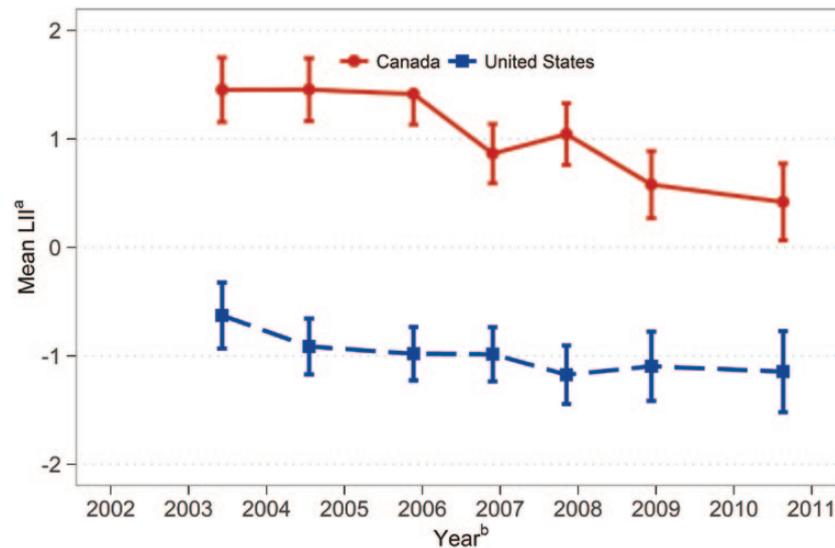


Figure 1. Label Impact Index in Canada and the United States, Wave 2 (2003) to Wave 8 (2011), model-based adjusted estimates, controlling for all factors in the model. ^aHigher scores indicate greater warning label effectiveness. ^bThe tick marks on the x-axis represent January 1st of each year; the plotted estimates represent the median survey date for each survey wave. See Figure 1 in supplementary files for the individual measures of health warning effectiveness.

Warning Salience (SALIENCE)

There was a significant linear decline in smokers' reports of noticing the warnings in Canada while there was a small increase in noticing the warnings in the United States from Wave 1 to Wave 8 (Table 2 and Supplementary Figure 1i). As an example to aid interpretation, the log odds of noticing warning labels decreased among Canadian smokers (log OR = -0.05). In other words, for each additional wave, Canadian smokers had 5% lower odds of noticing the warning labels (odds ratio [OR] = 0.95). Canadian smokers were less likely to report noticing the labels at Wave 8 versus Wave 1 whereas there was no difference among U.S. smokers.

Thoughts of Harm (HARM)

There were significant linear declines in smokers' reports of thinking about the health risks of smoking because of the health warnings in Canada and the United States; the decline was similar in both countries (Table 2 and Supplementary Figure 1ii). Canadian smokers were less likely to report thinking about the health risks because of the health warnings at Wave 8 versus Wave 2. However, for smokers in the United States, there was no difference at Wave 8 versus Wave 2. The difference between Wave 8 versus Wave 2 was not significantly greater in Canada than the United States.

Thoughts of Quitting (QUITTING)

There was a significant decrease in smokers' reports of thinking about quitting because of the health warnings in Canada (Table 2 and Supplementary Figure 1iii). However, there was only a marginally significant decline in the United States, and there was no difference in the trend between the two countries. Canadian and U.S. smokers were similarly less likely to think about quitting because of the health warnings at Wave 8 versus Wave 2.

Forgoing of Cigarettes (FORGO)

There was a significant decline in smokers' reports of forgoing a cigarette at least once because of the health warnings in Canada (Table 2 and Supplementary Figure 1iv). However, there was no significant decline in the United States nor was there any difference in the trend between the two countries. There were no significant differences in reports of forgoing a cigarette at least once between Wave 8 versus Wave 1 in either country.

Labels Impact Index (LII)

For the linear trend, there was a significant decline in scores on the LII in Canada and United States between Wave 2 and Wave 8 (Table 2 and Figure 1). The decline in scores on the LII was significantly greater in Canada. Comparisons of LII scores at Wave 2 versus Wave 8 showed that the LII was significantly lower in Canada and United States at Wave 8 compared to Wave 2, and that the difference in the scores on the LII at Wave 8 compared to Wave 2 was no different in Canada compared to the United States.

DISCUSSION

This is the first study to systematically examine wearout of cigarette health warnings. Overall, this study found evidence of significant warning wearout in Canada, and the United States over the 9-year study period. The significant decline in the United States was unexpected because the warnings were in place for 17 years at the beginning of the study, and because their effectiveness was low to begin with. These findings suggest that the U.S. warnings became even less effective during the study period.

The findings also showed that the decline in effectiveness on the Labels Impact Index was greater in Canada than in the United States, possibly because of (a) the hypothesized floor effect for the U.S. warnings, and (b) the novelty effect of the Canadian warnings at introduction just prior to the

