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Cigarette package inserts can promote efficacy beliefs and sustained smoking cessation attempts: A longitudinal assessment of an innovative policy in Canada

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ABSTRACT

Background. In June 2012, Canada implemented new pictorial warnings on cigarette packages, along with package inserts with messages to promote response efficacy (i.e., perceived quitting benefits) and self-efficacy (i.e., confidence to quit). This study assessed smokers' attention toward warnings and inserts and its relationship with efficacy beliefs, risk perceptions and cessation at follow-up.

Methods. Data were analyzed in 2015 from a prospective online consumer panel of adult Canadian smokers surveyed every four months between September 2012 and September 2014. Generalized Estimating Equation models were estimated to assess associations between reading inserts, reading warnings and efficacy beliefs (self-efficacy, response efficacy), risk perceptions, quit attempts of any length, and sustained quit attempts (i.e., 30 days or more) at follow-up. Models adjusted for socio-demographics, smoking-related variables, and time-in-sample effects.

Results. Over the study period, reading warnings significantly decreased ($p < 0.0001$) while reading inserts increased ($p = 0.004$). More frequent reading of warnings was associated independently with stronger response efficacy ($B_{\text{often/very often vs never}} = 0.28$, 95% CI: 0.11–0.46) and risk perceptions at follow-up ($B_{\text{often/very often vs never}} = 0.31$, 95% CI: 0.06–0.56). More frequent reading of inserts was associated independently with stronger self-efficacy to quit at follow-up ($B_{\text{twice or more vs none}} = 0.30$, 95% CI: 0.14–0.47), quit attempts ($OR_{\text{twice or more vs none}} = 1.68$, 95% CI: 1.28–2.19), and sustained quit attempts ($OR_{\text{twice or more vs none}} = 1.48$, 95% CI: 1.01–2.17).

Conclusions. More frequent reading of inserts was associated with self-efficacy to quit, quit attempts, and sustained quitting at follow-up, suggesting that inserts complement pictorial HWLs.

1. Introduction

Prominent pictorial health warning labels (HWLs) on tobacco packaging were first implemented in Canada in 2000, with more than 70 countries adopting them since then (Canadian Cancer Society, 2014). Countries print HWLs on package exteriors; however, package inserts (i.e., small leaflets inside of packs) remain underutilized for health messaging, even though tobacco companies have long used them for promotions (Brandt, 2007). Canada is the only country to use inserts to supplement HWLs (Thrasher et al., 2015a), providing an important case study for understanding whether inserts can help enhance pictorial HWL effects.

2. Background

Experimental and observational studies indicate that pictorial HWLs are more effective than text-only HWLs in increasing consumer understanding of smoking-related risks and promoting cessation-related behaviors (Thrasher et al., 2012a; Huang et al., 2014; Hammond et al., 2012; Hammond, 2011; Noar et al., 2015; Hammond and Reid, 2012; Yong et al., 2014). Pictorial HWLs appear to work, at least partly, because they are threatening (Peters et al., 2013). Reviews of threat appeals in general (Witte, 1994; Witte and Allen, 2000), as well as of smoking cessation campaigns (Durkin et al., 2012) and cigarette

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package HWLs (Hammond, 2011; Noar et al., 2015), indicate that strong, threatening communications promote desired risk perceptions and behaviors to avoid risks. Nevertheless, threatening pictorial HWLs have been critiqued for not increasing response efficacy beliefs (e.g., benefits of quitting) or self-efficacy beliefs (e.g., perceived ability to quit) (Peters et al., 2013; Ruiter and Kok, 2005).

The extended parallel process model (EPPM) predicts that threatening messages will be most effective when both perceived threat is high and efficacy beliefs are strong (Witte, 1994; Witte and Allen, 2000). Some experimental evidence suggests that fear arousing pictorial HWLs with loss-framed messages generate stronger quit intentions amongst smokers with relatively high compared to low self-efficacy to quit (Mays et al., 2015; Romer et al., 2013), consistent with other framing research on smoking cessation (Van't Riet et al., 2009). Research on gain-framed messages that promote response efficacy beliefs is more mixed (Mays et al., 2015; Goodall and Appiah, 2008; Nan et al., 2015; Toll et al., 2014; Zhao et al., 2014). While studies have compared framing alternatives, research has not assessed HWLs with *both* efficacy and threat messages. According to EPPM, this message combination should be the most effective.

Whether fear arousing pictorial HWLs can be optimized by promoting efficacy beliefs generally remains unexplored. Interventions often promote quitting by increasing self-efficacy (Andrews et al., 2007; Brandon et al., 1990; Cinciripini et al., 2003; O'Hea et al., 2004). Although HWLs with cessation resource information increase awareness and utilization of cessation resources (Thrasher et al., 2015a, 2012b; Cavalcante, 2003; Miller et al., 2009; Wilson et al., 2010), self-efficacy's role in this process is not clear. No study of which we are aware has examined longitudinal changes in efficacy beliefs as a function of HWL policy.

2.1. Study context

In June 2012, Canada implemented 16 new pictorial HWLs on different smoking-related risks, along with eight new package inserts with colored graphics (see Appendix) to replace text-only inserts used since 2000. Inserts were enhanced to emphasize benefits of quitting (i.e., response efficacy) and to provide behavioral recommendations and coping information that may promote self-efficacy to quit. This goes beyond providing a telephone number (i.e., quitline) and/or cessation resource website, which many countries include on HWLs. A brief research report indicates that Canadian smokers who read inserts were more likely to try to quit (Thrasher et al., 2015a). However, this study did not assess the psychological mechanisms by which reading inserts influenced quitting nor did it assess sustained cessation attempts.

The current study aims to determine trends in smokers' attention toward package inserts and pictorial HWLs, while also determining their effects on efficacy beliefs, risk perceptions, and cessation behavior at follow-up. We hypothesize that reading inserts will be associated with stronger self-efficacy to quit at follow-up, while reading inserts and HWLs will be associated with stronger response efficacy at follow-up. Reading HWLs, but not inserts, should be associated with stronger risk perceptions. We also hypothesize that reading both inserts and HWLs will be associated with cessation behavior at follow-up, with efficacy beliefs and risk perceptions mediating these associations. Finally, we assess whether associations between reading HWLs, reading inserts and cessation behavior are moderated by efficacy beliefs, risk perceptions or quit intentions, and whether reading HWLs and inserts interact.

3. Methods

3.1. Sample

Data were analyzed in 2015 from an online consumer panel of Canadian residents purposively recruited by diverse methods for Internet-based market research on key consumer segments (www.gmi-mr.com). Recruitment involved sending invitation emails to panelists of eligible age (18–64 years old) who were either known smokers or whose smoking status was unknown. Eligible panelists had smoked at least once in the prior month and more than 100 cigarettes in their lifetime. Participant follow-up also involved email invitations. To address attrition and maintain sample sizes of approximately 1000 participants at each wave, samples were replenished with eligible, new participants. From September 2012 to September 2014, seven waves of data were collected at four month intervals. Across waves, the survey response rate for panelists to whom study invitations were sent was 15% (range = 8%-22%) with 57% follow-up (range = 53%-62%). The current study used all data from the first six waves, as well as a longitudinal subsample of participants with two or more surveys (n = 1432 individuals, 4,734 observations).

3.2. Measures

All questions were asked at every wave, with "don't know" recoded to missing unless otherwise specified.

3.2.1. Reading HWLs and inserts

Participants were asked: "*In the last month, how often, if at all, have you read or looked closely at the warning labels on cigarette packages*?" Response options (i.e., "never", "rarely", "sometimes", "often", "very often") were recoded, combining "often" and "very often" for adequate sample size in analyses. Participants were also asked: "*In the last month, how often have you read the health warnings on the inside of cigarette packs*?" Responses (i.e., "not at all", "once", "a few times", "often", "very often") were recoded, combining the three highest categories for adequate sample size in analyses.

3.2.2. Efficacy beliefs

Self-efficacy to quit was measured by asking: "*If you decided to give up smoking completely in the next 6 months, how sure are you that you would succeed*?" (IARC, 2008) with responses on a 1- to 9-point scale, using verbal anchors for every other option (i.e., "not at all", "a little", "moderately", "very much", "extremely"). Response efficacy was measured by asking: "*How much do you think you would benefit from health and other gains if you were to quit smoking permanently in the next 6 months*?" (IARC, 2008) with the same response options.

3.2.3. Risk perceptions

Questions were combined on awareness of smoking-related diseases and perceived personal risk for these diseases. Awareness was assessed by asking participants to indicate which illnesses, if any, are caused by smoking, followed by a list of diseases shown in random order, including three (i.e., heart attacks, bladder cancer, and blindness) described on Canadian HWLs (responses = yes; no; don't know). Personal risk was assessed by asking: "*Let's say that you continue to smoke the amount that you do now. How would you compare your own chance of getting* [*heart attacks/bladder cancer/blindness*] *in the future to the chance of a non-smoker*?" with responses options from 1 ("Just as likely") to 4 ("Much more likely"), with a "Don't know" option (Costello et al., 2012). For the three diseases on HWLs, participants were classified into three levels: 0 = "no" or "don't know" response to awareness of the smoking-related disease; 1 = "yes" to awareness, but either "don't know" or "no" for increased personal risk for the disease; 2 = "yes" to awareness and increased personal disease risk. These indicators were summed (range = 0 to 6).

3.2.4. Quit attempts

Participants were classified as making a quit attempt if they no longer smoked at follow-up (and smoked at the prior wave) or if they reported attempting to quit in the prior four months (Miller et al., 2009; Thrasher et al., 2012b). These participants were asked about the longest time quit during this period, and 30 days or more was classified as a

sustained quit attempt, because longer abstinence predicts better cessation success (Dale et al., 1997; Ferguson et al., 2003; Garvey et al., 1992).

3.2.5. Covariates

Socio-demographic variables included sex, age, race (white vs. non-white), educational attainment (high school or less; some college or university; completed university or higher), and annual household income ($29,999 or less; $30,000 to $59,999; $60,000 or more). Smoking-related variables included intention to quit within six months (yes, no); daily or non-daily cigarette smoking; the Heaviness of Smoking Index (HSI) (range = 0–6) (Heatherton et al., 1989); and use of cessation resources in the prior four months through quitlines (yes, no) or websites (yes, no). To adjust for prior survey participation, a variable was created for the number of prior surveys to which the participant had responded (range = 0–5).

3.3. Statistical analysis

Analyses were conducted using Stata, version 13. Chi-square tests assessed differences between subsamples with and without follow-up. Data from the first six surveys were analyzed using generalized estimating equation (GEE) models, treating data from each wave as a separate observation and using an exchangeable correlation matrix to adjust for repeated observations. Using all data from the first six waves, linear trends were assessed by regressing any reading of inserts and, separately, any reading of HWLs on survey wave. Additional analyses included only the followed-up subsample. Separate bivariate and adjusted linear GEE models were estimated for follow-up (i.e., t + 1) reports of response efficacy, self-efficacy, and smoking risk perceptions, with these outcomes regressed on prior wave assessments (i.e., t) for reading HWLs, reading inserts, and covariates, including the dependent variable. Similarly, bivariate and adjusted logistic GEE models were estimated for having made an attempt to quit and, separately, making a sustained quit attempt over the follow-up period (i.e., t + 1), regressing these outcomes on prior wave efficacy beliefs, risk perceptions, reading HWLs, reading inserts, and control variables. In the models regressing quit attempts on study variables, we conducted mediation analyses using the –khb command to test whether association between cessation behaviors at follow-up and reading inserts or HWLs was mediated by efficacy beliefs or risk perceptions (Kohler and Karlson, 2011). Multiplicative interactions between the dummy coded reading variables as well as between these variables and response efficacy, self-efficacy, risk perceptions (treated as continuous variables) and quit intentions were assessed separately in fully adjusted models. An overall F-test for differences across levels of the interaction term was assessed, and, if statistically significant, stratified analyses were conducted.

3.3.1. Sensitivity analyses

Because of the skewed distribution for response efficacy, all models were re-run after dichotomizing response efficacy ("extremely" vs lower; "very much" or higher vs lower). Self-efficacy responses were multimodal, so all models were re-run using a five-level variable that combined response options with verbal anchors and adjacent response options. Finally, because participants were from an undefined sampling frame, analyses were re-run, using weights based on the age, gender and educational profile of smokers in Canada (Canadian Research Data Centre Network. Canadian Community Health Survey, 2012); these weighted analyses admit inference in terms of the general population of Canadian smokers. To assess potential biases from differential attrition, propensity score analyses (Dorsett, 2010) adjusted for the likelihood of survey completion at the person-wave level. The predicted probability from the propensity score model represents a measure of confounding against which the coefficients of interest are adjusted. This adjustment removes biases from imbalance in the propensity score model covariates (i.e., employment, marital status, number of online surveys and online smoking surveys in the prior four months, health status, reasons for quitting smoking) amongst participant groups (attrition participants versus non-attrition participants). The pattern of results from sensitivity analyses was consistent in direction, magnitude, and statistical significance of effects, although a few results from the weighted models became marginally non-significant.

4. Results

4.1. Sample characteristics

In addition to some socio-demographic and smoking-related differences between the follow-up sample (n = 1432 smokers, 4,734 observations) and smokers who participated in only one survey wave (n = 1,748 smokers), smokers in the follow-up sample were more likely to report lower self-efficacy to quit, lower response efficacy, greater risk perceptions, and less frequent reading of HWLs and inserts (see Table 1). At each wave, 72% to 82% of the entire sample read HWLs in the prior month, with 29% to 36% reading inserts (Fig. 1). In bivariate models with the entire sample, there was a significant linear trend indicating increased frequency of reading inserts over time (B = 0.04, 95% CI 0.01–0.07; p = 0.004), whereas reading HWLs decreased over time (B = −0.10; 95% CI -0.13– -0.07; p < 0.0001).

4.2. Efficacy beliefs and risk perceptions at follow-up

In adjusted GEE models regressing follow-up self-efficacy on study variables (Table 2), reading inserts, but not reading HWLs, was independently associated with stronger follow-up self-efficacy ($B_{\text{once vs none}}$ = 0.29, 95%CI 0.09–0.50; $B_{\text{twice or more vs none}}$ = 0.30, 95%CI 0.14–0.47). In adjusted GEE models that regressed follow-up response efficacy on study variables (Table 2), more frequent HWL reading was associated with stronger follow up response efficacy ($B_{\text{often/very often vs none}}$ = 0.28, 95%CI 0.11–0.46). In adjusted, but not bivariate models, reading inserts once in past month was associated with weaker response efficacy at follow-up ($B_{\text{once vs none}}$ = −0.18, 95%CI -0.36– -0.00). Adjusted GEE models that regressed follow-up risk perceptions on study variables (Table 2) indicated that reading HWLs, but not reading inserts, was independently associated with stronger follow-up risk perceptions ($B_{\text{rarely vs none}}$ = 0.19, 95%CI 0.01–0.36; $B_{\text{often/very often vs none}}$ = 0.31, 95%CI 0.06–0.56).

4.3. Quit attempts at follow-up

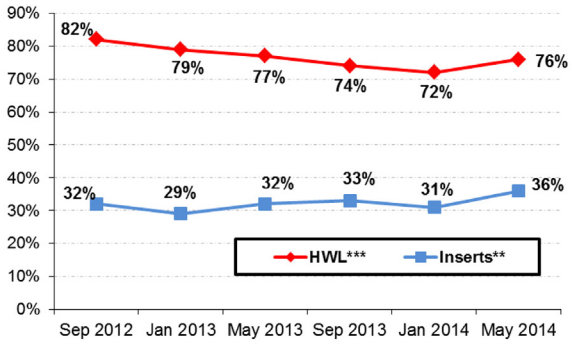
Independent, positive associations with any follow-up quit attempt were found for self-efficacy (AOR = 1.07, 95% CI 1.02–1.12), response efficacy (AOR = 1.08, 95% CI 1.02–1.14), and more frequent reading of inserts ($AOR_{\text{twice or more vs none}}$ = 1.68, 95% CI 1.28–2.19; See Table 3). Models for sustained quit attempts over the follow-up period found similar results for self-efficacy (AOR = 1.14, 95% CI 1.05–1.24) and more frequent reading of inserts ($AOR_{\text{twice or more vs none}}$ = 1.48, 95% CI 1.01–2.17). Quit intentions were positively associated with both making a quit attempt and making a sustained quit attempt.

Interactions between reading variables and efficacy beliefs, risk perceptions, and quit intentions were mostly not statistically significant (range p = 0.057–0.814). For models predicting either quit attempt outcome, a statistically significant interaction was found between reading inserts and response efficacy (p = 0.044 and p = 0.032, respectively). After stratifying smokers into high and low response efficacy (i.e., "very much" or more; less than "very much"), independent associations were found for reading inserts and quit attempts of any length only amongst smokers with high response efficacy ($AOR_{\text{twice or more vs none}}$ = 1.56; 95%CI = 1.16–2.09). However, in the stratified models regressing sustained quit attempts on study variables, no statistically significant independent associations were found with reading inserts at either response efficacy level. In the sustained quit attempt model, a statistically significant interaction was found between reading inserts and risk

Table 1
Sample characteristics for Canadian smokers with and without follow-up data,* September 2012-September 2014.

Variable of Interest	Follow-up sample	No follow-up sample	Total Sample
Age[c]			
18–24	7%	21%	12%
25–34	20%	28%	23%
35–44	22%	22%	22%
45–54	25%	16%	21%
55–64	26%	14%	22%
Sex[c]			
Female	51%	61%	55%
Education[c]			
High school or less	27%	39%	31%
some College or University	45%	44%	45%
University or more	28%	17%	24%
Income[c]			
$29,999 or less	24%	32%	26%
$30,000-$59,999	30%	34%	31%
$60,000 or more	46%	34%	42%
Race			
White	85%	84%	85%
Non-White	15%	16%	15%
Heaviness of Smoking Index			
Mean (SE)	2.4 (1.6)	2.3 (1.6)	2.3 (1.6)
Cigarette consumption[b]			
Nondaily	20%	22%	21%
Daily	80%	78%	79%
Quit attempt in prior 4 months[b]			
Yes	41%	44%	42%
Quit Intentions in next 6 months[c]			
Yes	42%	49%	45%
Self-efficacy[c]			
Mean (SD)	5.0 (2.1)	5.3 (2.2)	5.1 (2.2)
Response-efficacy[c]			
Mean (SD)	7.4 (1.8)	7.7 (1.7)	7.5 (1.8)
Frequency of reading inserts in past month[b]			
Not at all	72%	68%	71%
Once	10%	11%	10%
A few times	15%	17%	15%
Often	2%	3%	3%
Very often	1%	1%	1%
Frequency of reading HWLs in past month[c]			
Never	26%	19%	24%
Rarely	35%	32%	34%
Sometimes	26%	28%	26%
Often	8%	12%	9%
Very often	6%	9%	7%
Risk Perceptions[c]			
Mean (SD)	3.3 (2.0)	3.0 (1.8)	3.2 (1.9)
Called quitline in past four months[b]			
Yes	3%	5%	4%
Visited cessation website in past four months			
Yes	6%	7%	6%

Follow-up vs. no follow-up sample: a = p < 0.05; b = p < 0.01; c = p < 0.001.
HWLs: Health warning labels.
[a] Seven survey waves were conducted every 4 months for two years. The follow-up sample included all individuals with two or more waves of data ($n_{smokers}$ = 1432 providing for 4,734 observations); the no follow-up sample included smokers who participated in only one wave ($n_{smokers}$ = 1,748). 21% of smokers in the entire sample provided exactly two waves of data, and 29% of smokers more than two.



*** Significant linear trend at p<0.0001; ** Significant linear trend at p=0.004

Fig. 1. Reading HWLs and reading inserts in past month over the study period amongst all participants from wave-I to wave-VI.

perceptions (p = 0.016). After stratifying smokers into high and low risk perceptions (using median risk perception), an independent association was found for reading inserts and sustained quit attempts amongst only smokers with low risk perceptions ($AOR_{twice\ or\ more\ vs\ none}$ = 1.97; 95%CI = 1.14–3.40]. In mediation analysis, neither efficacy beliefs nor risk perceptions mediated the relationship between reading HWLs or inserts and follow-up cessation behaviors (range p = 0.194–0.695).

5. Discussion

This study suggests that reading cigarette package inserts with efficacy messages enhances follow-up self-efficacy to quit and promotes smoking cessation above and beyond reading pictorial HWLs on cigarette package exteriors. Reading inserts was associated not only with a greater likelihood of subsequent quit attempts, as in prior research (Thrasher et al., 2015a), but also with sustained quit attempts that are more indicative of successful cessation (Dale et al., 1997; Ferguson et al., 2003; Garvey et al., 1992). These associations were independent of reading HWLs, self-efficacy, response efficacy, and risk perceptions, with some indication that reading inserts was most effective for smokers with lower risk perceptions and higher response efficacy. Hence, inserts appear to complement threatening pictorial HWLs by influencing different smoker subpopulations and working along pathways that HWLs do not address. The relative importance of cessation messages on inserts was further suggested by higher rates of reading inserts (29%-36% across waves) than accessing cessation resources (4–6%) (Thrasher et al., 2015b). As expected, only reading inserts, not HWLs, was associated with self-efficacy at follow-up, providing evidence for the specificity of its effects.

Reading inserts was unassociated with response efficacy beliefs (i.e., benefits of quitting), contrary to hypotheses based on insert content. Compared to smokers who did not read inserts in the prior month, those who read them once had marginally lower response efficacy at follow up, although only in adjusted models. No association was found with more frequent insert reading, suggesting that over-adjustment for potential confounders may account for this contradictory finding. By contrast, reading threatening pictorial HWLs was associated with stronger downstream response efficacy. Alongside the lack of support for mediation by either type of efficacy belief, this finding suggests that the effects of reading inserts on cessation behavior may be through pathways that we did not assess. Future research should consider enriched measurement of efficacy constructs to better reflect specific insert content. Improved understanding of the pathways through which inserts work should help with designing more effective insert message content.

Reading HWLs was independently associated with stronger downstream response efficacy (i.e., beliefs about benefits of quitting) and risk perceptions, but not with cessation outcomes. Prior observational research with longer intervals between surveys (1–2 years) has also found that attention to HWLs, which includes reading HWLs, does not directly lead to downstream cessation (Borland et al., 2009a), although attention promotes psychological elaboration of HWL messages that is associated with cessation (Yong et al., 2014; Borland et al., 2009a). Similarly, prior research with our study sample found greater elaboration of HWL content appears to promote cessation attempts (Thrasher et al., 2015a). Indeed, prominent pictorial HWLs, which cover 75% of Canadian cigarette packages, may promote cessation-related affect, cognitions, and behaviors independent of purposeful processing captured by self-reported HWL reading.

Table 2
Predictors of efficacy beliefs and risk perceptions at follow-up, Canada, September 2012-September 2014.

Independent Variables	Self-efficacy at follow-up (t + 1)		Response-efficacy at follow-up (t + 1)		Risk Perceptions at follow-up (t + 1)	
	Bivariate Model	Adjusted Model[~1]	Bivariate Model	Adjusted Model[~2]	Bivariate Model	Adjusted Model[~3]
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)
Reading Insert						
Not at all	REF	REF	REF	REF	REF	REF
Once	**0.25**	**0.29**	−0.15	**−0.18**	0.06	0.05
	[0.05–0.46]	**[0.08–0.50]**	[−0.34–0.04]	**[−0.36 - -0.00]**	[−0.14–0.27]	[−0.17–0.28]
Two or more times	**0.37**	**0.30**	0.10	−0.09	**0.20**	0.05
	[0.19–0.55]	**[0.14–0.47]**	[−0.05–0.25]	[−0.24–0.05]	**[0.02–0.39]**	[−0.16–0.25]
Reading HWLs						
Never	REF	REF	REF	REF	REF	REF
Rarely	−0.11	−0.14	−0.01	0.07	**0.22**	**0.19**
	[−0.27–0.05]	[−0.30–0.02]	[−0.15–0.13]	[−0.06–0.20]	**[0.05–0.38]**	**[0.01–0.36]**
Sometimes	0.06	−0.16	0.08	0.13	**0.26**	0.09
	[−0.12–0.24]	[−0.33–0.02]	[−0.08–0.24]	[−0.01–0.27]	**[0.08–0.45]**	[−0.11–0.29]
Often/very often	0.07	−0.17	**0.29**	**0.28**	**0.48**	**0.31**
	[−0.16–0.31]	[−0.38–0.04]	**[0.11–0.48]**	**[0.11–0.46]**	**[0.26–0.69]**	**[0.06–0.56]**

~Models adjust for the independent variables listed in the table, as well as for age, gender, education, income, race, heaviness of smoking index, cigarette consumption, quit intention, quit attempts, use of cessation resources (i.e., quitline or website) in previous four-months, survey wave and time in sample.
1 Model adjusted for self-efficacy at time 't'; 2 Model adjusted for response-efficacy at time 't'; 3 Model adjusted for both efficacy believes and risk perceptions at time 't'.
HWLs: Health warning labels.

The salience of HWLs may explain the higher percentage of smokers who read HWLs (72%-82%) than inserts (29%-36%). The relatively low prevalence of reading inserts may also be due to message relevance, as only 42% of our sample intended to quit in the next six months, similar to other studies (Ferguson et al., 2003; Prochaska et al., 2013). Nevertheless, the percentage of smokers who read inserts increased over time, suggesting that their relevance can increase, even as attention to threatening pictorial HWLs declines. While other studies also have found evidence of "wear out" (Borland et al., 2009b; Hammond et al., 2007), this is the first to evince "wear in," signifying the importance of future research in this area. Future research should examine the impact of different design features (e.g., colors; rotating designs) and message content (e.g., economic incentives to quit) that could promote attention to inserts and enhance their effects (Strahan et al., 2002).

Study results did not support hypotheses that reading pack inserts with efficacy messages would be most effective in promoting quit attempts for smokers who intend to quit, who have greater self-efficacy to quit, or who read HWLs more often. Prior research has not examined

Table 3
Predictors of quit attempts and sustained quit attempts during follow-up period, Canada, September 2012-September 2014.

Independent Variables (time t)	Quit attempt during follow-up (time t + 1)			Sustained quit attempt during follow-up (time t + 1)		
	42%	Bivariate Model	Adjusted Model~	11%	Bivariate Model	Adjusted Model~
		Estimate (95% CI)	Estimate (95% CI)		Estimate (95% CI)	Estimate (95% CI)
Reading Insert						
Not at all	33%	REF	REF	7%	REF	REF
Once	51%	**1.39**	1.20	12%	**1.65**	1.30
		[1.14–1.71]	[0.89–1.62]		**[1.15–2.38]**	[0.83–2.03]
Two or more times	61%	**1.91**	**1.68**	16%	**2.07**	**1.48**
		[1.58–2.30]	**[1.28–2.19]**		**[1.55–2.77]**	**[1.01–2.17]**
Reading HWLs						
Never	36%	REF	REF	12%	REF	REF
Rarely	36%	0.87	0.95	9%	0.79	0.94
		[0.75–1.03]	[0.75–1.18]		[0.62–1.02]	[0.64–1.38]
Sometimes	47%	1.08	1.04	12%	0.90	0.95
		[0.90–1.3]	[0.79–1.36]		[0.67–1.22]	[0.61–1.46]
Often/very often	56%	**1.38**	1.25	15%	1.15	1.22
		[1.12–1.72]	[0.90–1.73]		[0.81–1.64]	[0.73–2.04]
Quit Intentions in next 6-months						
No	24%	REF	REF	5%	REF	REF
Yes	62%	**2.65**	**2.04**	14%	**2.44**	**1.67**
		[2.25–3.13]	**[1.66–2.51]**		**[1.90–3.14]**	**[1.20–2.33]**
Self-efficacy at time 't'						
		1.16	**1.07**		**1.27**	**1.14**
		[1.12–1.21]	**[1.02–1.12]**		**[1.20–1.36]**	**[1.05–1.24]**
Response-efficacy at time 't'						
		1.10	**1.08**		1.11	0.94
		[1.05–1.14]	**[1.02–1.14]**		[0.88–1.42]	[0.86–1.03]
Risk perceptions at time 't'						
		1.00	0.97		**0.95**	0.97
		[0.97–1.04]	[0.92–1.02]		**[0.90–1.00]**	[0.902–1.046]

~Models adjust for the independent variables listed in table, as well as for age, gender, education, income, race, heaviness of smoking index, cigarette consumption, quit intention, quit attempts, using cessation resources (i.e., quitline or website) in previous four-months, survey wave and time in sample.
HWLs: Health warning labels.

moderation of HWL message type by quit intention; however, experiments have found that loss-framing of pictorial HWLs appear more effective for influencing quit intentions amongst smokers with higher self-efficacy (Mays et al., 2015; Romer et al., 2013), whereas gain-frame text for pictorial HWLs is more effective for smokers with low self-efficacy. That we did not find evidence for moderation may be due to the more elaborated efficacy messaging on Canadian inserts, as well as the observational nature of our study. That efficacy and fear messages exhibit independent main effects, but not interactive effects, is consistent with prior research (Witte, 1994; Witte and Allen, 2000). Future research should examine how smokers with different levels of self-efficacy respond to diverse content and extent of efficacy message elaboration, whether through inserts or package HWLs.

5.1. Limitations

Self-reported reading of warnings and inserts may be biased, although correlations between these variables and related theory-based constructs in this and other studies support their validity. Furthermore, some smokers may have also considered inserts when responding to questions about HWLs. Nevertheless, discriminant validity is suggested by independent associations with theorized correlates (i.e., inserts with self-efficacy and HWLs with response efficacy and risk perceptions). Our single-item measure for efficacy beliefs may also be limited, although it has been recommended for policy evaluation research (IARC, 2008), may be more accurate than multi-item measures (Gwaltney et al., 2005), and shows evidence of predictive validity (Yan, 2007). Nevertheless, future research may benefit from richer measurement that more tightly links question content with insert message content. We did not examine quit success because too few smokers successfully quit over the study period. By examining sustained cessation behavior (30 days or more), we advanced prior research that only assessed cessation attempts (Thrasher et al., 2015a; Yong et al., 2014). Furthermore, our assessment of self-efficacy involved a key mediator of cessation success. Future research with larger sample sizes may be necessary to study quit success.

The study recruitment rate was low (12%). Although no data are available to directly assess selection biases, they may be similar to attrition biases. Loss to follow up was associated with greater self-efficacy to quit, higher response efficacy, lower risk perceptions and more frequent reading of HWLs and inserts. Hence, we may have underestimated effects if smokers with these characteristics are more responsive to HWLs and inserts. However, sensitivity analyses to adjust for potential biases from differential attrition produced very similar results. Finally, our sample came from an online consumer panel purposefully selected to represent key market segments, but without a defined sampling frame. Lack of Internet access may not have substantially biased results, as 82% of Canadians are Internet users (GMI, 2013). Still, smoking is disproportionately concentrated amongst low socioeconomic groups (Reid et al., 2010), which also have lower Internet access. Nevertheless, other research suggests that lower SES smokers are equally or more responsive to pictorial HWLs than higher SES smokers (Nagelhout et al., 2015; Thrasher et al., 2012c). Furthermore, analyses weighted to make our sample more similar to the general population of Canadian smokers produced similar results, suggesting that our conclusions would not substantially change with a more representative sample. Even if our study population meaningfully differed from the general population, our longitudinal design with relatively short intervals between surveys (i.e., four months) advances prior research by allowing closer examination of how warning responses are associated with follow-up perceptions and behaviors. Prior observational studies have longer intervals between surveys (typically one to two years), allowing intervening variables, such as other tobacco control policies, to provide alternative explanations for study findings.

6. Conclusions

This study suggests that cigarette package inserts influence key psychosocial variables and promote sustained quitting behavior. Inserts have long been used by the tobacco industry, and the elaborated messaging that inserts allow is commonly used in integrated marketing approaches to communicate with different consumer segments (Krugman et al., 2005) and should be considered by public health authorities.

Conflict of interest statement

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Transparency Document

The Transparency document associated with this article can be found, in the online version.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.ypmed.2016.03.006.

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