Original Investigation

The Effect of Cigarette Packaging and Illness Sensitivity on Attention to Graphic Health Warnings: A Controlled Study

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Abstract

Introduction: The social and health care costs of smoking are immense. To reduce these costs, several tobacco control policies have been introduced (eg, graphic health warnings [GHWs] on cigarette packs). Previous research has found plain packaging (a homogenized form of packaging), in comparison to branded packaging, effectively increases attention to GHWs using UK packaging prototypes. Past studies have also found that illness sensitivity (IS) protects against health-impairing behaviors. Building on this evidence, the goal of the current study was to assess the effect of packaging type (plain vs. branded), IS level, and their interaction on attention to GHWs on cigarette packages using proposed Canadian prototypes.

Aims and Methods: We assessed the dwell time and fixations on the GHW component of 40 cigarette pack stimuli (20 branded; 20 plain). Stimuli were presented in random order to 50 smokers (60.8% male; mean age = 33.1; 92.2% daily smokers) using the EyeLink 1000 system. Participants were divided into low IS ($n = 25$) and high IS ($n = 25$) groups based on scores on the Illness Sensitivity Index.

Results: Overall, plain packaging relative to branded packaging increased fixations (but not dwell time) on GHWs. Moreover, low IS (but not high IS) smokers showed more fixations to GHWs on plain versus branded packages.

Conclusions: These findings demonstrate that plain packaging is a promising intervention for daily smokers, particularly those low in IS, and contribute evidence in support of impending implementation of plain packaging in Canada.

Implications: Our findings have three important implications. First, our study provides controlled experimental evidence that plain packaging is a promising intervention for daily smokers. Second, the findings of this study contribute supportive evidence for the impending plain packaging policy in Canada, and can therefore aid in defense against anticipated challenges from the tobacco industry upon its implementation. Third, given its effects in increasing attention to GHWs, plain packaging is an intervention likely to provide smokers enhanced incentive for smoking cessation, particularly among those low in IS who may otherwise be less interested in seeking treatment for tobacco dependence.

Introduction

Approximately one in five (5.8 million) Canadians are smokers.¹ Consequently, the cost of cigarette smoking to the Canadian public

is \$17 billion/year.² These numbers are substantial considering that cigarette smoking is the leading cause of preventable disease and death in the world,³ and is causally related to serious negative health consequences, including cancers.⁴

When advertising products in competitive markets such as tobacco, suppliers use a variety of means to increase their brand's prominence. Due to the restrictions currently placed on the promotion of cigarettes (eg, limited space for branding due to large health warnings), cigarette packaging is a key element in marketing tobacco brands.⁵ The tobacco industry uses distinctive colors and appealing fonts to promote their products within the available package space.⁶ The use of descriptors is also common to suggest that certain products carry lower harms (eg, "light").⁷ These elements are examples of brand imagery that attract consumers.⁸ To counter brand imagery effects, governments have placed graphic health warnings (GHWs) on cigarette packages.

With respect to warnings on cigarette packs, a 2011 review concluded that their effect is dependent on their size and design.⁶ Larger warnings were slightly more effective than smaller ones in increasing knowledge of risk associated with smoking and promoting smoking cessation. Moreover, GHWs were more effective than text-only warnings. The evidence is based on a limited number of studies, however, and when significant, the magnitudes of the effects were found to be low.⁹ For example, a study assessing the effectiveness of tobacco health warnings found that larger warnings increased thoughts of smoking cessation, however only among low-income smokers under certain conditions. Nevertheless, according to these studies, GHWs can be a vital source of often novel consumer health education which, in turn, can deter smoking initiation. To this end, eye tracking outcomes are important to look at as other studies have found that increased visual attention to GHWs over branding increases likelihood of positive outcomes, such as recall of warning content,¹⁰ as well as negative affect in adults and adolescents and decreases susceptibility to future smoking for adolescents.¹¹

A plethora of evidence supports plain packaging (a homogenized form of cigarette packaging that removes brand imagery, leaving only the GHW and the brand name in standardized font) as an additional beneficial public health policy. Studies have shown that, relative to branded packages, plain packaging reduces positive perceptions of the cigarette pack¹² and increases the likelihood of smoking cessation and the number of quitline calls.¹³ A systematic review published in 2013 found that plain packages increased the salience and effectiveness of GHWs relative to branded packages.¹⁴ The majority of the reviewed studies showed that plain packaging, relative to its branded counterpart, improved attention to and memory for GHWs, as well as the believability and seriousness of these warnings.

Over the last decade, the use of eye tracking equipment for assessing the effect of plain packaging on attention has become popular. Studying young adults, one study showed that plain packaging increased attention to GHWs relative to those appearing on branded packages.¹⁵ They also found that nonsmokers and weekly smokers, but not daily smokers, showed increased eye movements toward health warning information, and thereby away from brand information, on plain (vs. branded) packages. Similarly, a 2013 study that examined the same research questions with adolescent weekly smokers and experimenters also showed that plain packaging increased attention to health warnings over brand imagery of the cigarette package.¹⁶ Both aforementioned studies were conducted in the UK with plain packages that were proposed for legislation there. Later, another study used similar guidelines for plain packaging with a sample of young adult never-smokers and found that they spent more time attending to the warnings on plain versus branded packages.¹⁷

Considering these studies, one of the current gaps in the literature is that findings supporting plain packaging implementation

have not been tested in Canada. Filling this gap is imperative, as Canadians differ from British and Australian populations in terms of their smoking profile (ie, Canadians smoke less than Brits and more than Australians).¹⁸ Also, past studies have used packages with GHWs located on the bottom of the package and the brand information on the top of the package,¹⁶ while in Canada, the plain packages planned for policy implementation will contain the GHWs on the top of the package (comprising 75% of the face of the package, the largest surface area allotted to GHWs in the world)¹⁹ and the branding on the bottom (25%),²⁰ as Canadian cigarette packages are currently structured this way. Thus, a packaging format that maintains the surface area of the GHW, along with Quitline information, leaving only a varying bottom part of the package (plain or branded) remains to be tested in terms of effects on attention to GHWs. Based on past findings on the effect of packaging on attention,¹⁵⁻¹⁷ *we expected Canadian-format plain packages to lead to greater attention to GHWs in comparison to branded ones.*

Another gap in the literature is that past studies have only assessed individual differences based on smoking status (eg, nonsmokers vs. occasional smokers¹⁶). One relevant individual difference variable is illness sensitivity (IS; fear of contracting an illness²¹). IS is an important individual-level factor to study in the smoking context as smoking is related to a large number of illnesses. It is thus likely that IS may impact whether a smoker will focus on GHWs, which convey smoking-related illness information. Therefore, this study examined IS as an individual difference that may influence smokers' attention to GHWs, both overall and differentially depending on package type (ie, plain or branded). *We expected that high IS smokers would exhibit high attention to GHWs, regardless of package type, as they tend to opt for health protective behaviors (ie, looking for health information).* This hypothesis is grounded on research that found IS to be a good predictor of health protecting behavior in general, and specifically against addictive behavior (eg, binge drinking²²). IS has also been shown to be related to more early learning experiences around aches and pains²³; thus, high IS smokers are likely to focus on GHW, relative to their low IS counterparts, because of their learning experiences which have sensitized them to illness-related information. Smokers with low and high IS may demonstrate different levels of attention toward GHW depending on its noticeability on the cigarette package. High IS smokers are likely to focus on GHW regardless of whether the warning is presented on plain format (more noticeable) in comparison to a branded format because of their heightened sensitivity to illness-related information. However, those with low IS could have greater attention to the warnings if they are presented on a plain format relative to a branded format because the plain format may serve as a stronger signal for these consumers regarding fear of illness. Therefore, application of this moderator to the smoking context will provide insight into whether plain packages that convey information about smoking-related illnesses resonate at different levels with people of varying levels of IS. *Thus, we also predicted that low IS (but not high IS) smokers would exhibit greater attention to GHWs on plain compared to branded packages.* This difference was expected as low IS smokers should be less likely to attend to GHWs on branded packages due to the presence of distracting brand imagery plus the comparatively low personal relevance of the GHWs. Contrarily, the plain package should increase the relative salience of the GHW and thus attention to the GHW, for low IS smokers.

Materials and Methods

Participants

We recruited adult smokers (smoked at least once a month over the past year; 19 years of age and older). Based on G*Power analysis, 50 participants (a convenience sample of 25 participants low in IS and 25 high in IS) were recruited in order to be adequately powered to detect a small effect size (Cohen $f = .10$) using a mixed measures design with a power of .95, $\alpha = 0.05$, and 40 repetitions (package stimuli).

A self-report of abstinence (3-h smoking, 2-h caffeine, as well as a 12-h alcohol, cannabis, and other drug abstinence) was required before participating in the study to ensure that the participant could complete the attention task without active substance effects. Further, participants could not be planning to quit smoking within a month of participating to minimize the possibility that the present cue exposure study might interfere with a cessation attempt. Also, participants could not currently be using any nicotine replacement therapies. Participants received \$10 for participation. All testing was performed in the Department of Psychology and Neuroscience at Dalhousie University, after approval from the university research ethics board (file #2018-4443). All participants gave full informed consent before participating.

Procedure

Recruitment and Telephone Screening

Adult smokers were recruited through multiple newspaper and on-line advertisements, as well as posters in various locations in the Halifax Regional Municipality. When individuals contacted the lab, they underwent a 10-min screening and, if applicable, scheduling of the testing session. During screening, respondents were asked for contact information, as well as questions about their age and smoking habits to assess eligibility. Participants then completed the Fagerström Test for Cigarette Dependence (FTCD)²⁴ during the screening to describe dependence levels in the sample. Questions regarding exclusionary criteria were also asked during the screening. If eligibility was confirmed, the respondent was scheduled for the session.

Eye Tracking

After being seated in front of the computer, participants were calibrated on the eye tracker using a 9-point grid procedure. The eye tracked (left or right) varied between participants, based on which pupil the tracker captured and calibrated most reliably. After successful calibration, participants completed 40 trials in which they viewed all images once in a random order. If participants repeatedly failed to perform a successful drift check at any point, they were recalibrated on the eye tracker by a research assistant before proceeding.

Measures

Self-report demographics and smoking history measures²⁵ were administered after completion of the eye tracking task, along with the IS measure. IS levels were assessed using the Illness/Injury Sensitivity Index (eg, “The thought of physical illness scares me”²¹). In an evaluation of this index, it was found to be a reliable and valid index of IS, demonstrating good internal consistency and discriminant validity.²⁶ A sample median split was then used to divide participants into low ($n = 25$) or high ($n = 25$) IS groups. Although, to our knowledge, this is the first application of this index to the smoking context, it has

previously been related to other health behaviors, such as avoidance of health-impairing behavior (eg, binge drinking).²² In the current study, we only used the five-item illness sensitivity subscale, which showed good internal consistency in the present sample ($\alpha = .86$).

Apparatus

The eye tracking paradigm was programmed in the Python language using the klibs framework,²⁷ and run on Apple iMac computers. During each session, participants’ eye movements were recorded using a desk-mounted SR Research EyeLink 1000 eye tracker and a headrest.²⁸ This study operationalized visual attention in two ways: dwell time (how long a participant’s gaze lingered on a particular point) and fixations (unique points upon which a participant’s gaze fell). For detailed information on the apparatus and its settings please refer to the Supplemental File. For an illustration of the eye movement recordings, please refer to Figure 1.

Design

The participants looked at the front-face of 40 cigarette packages as part of a 2×2 mixed within- (packaging type: plain or branded) and between-subjects (sensitivity: low or high IS) design. The 40 cigarette package stimuli were derived from 4 brands $\times$ 5 health warnings $\times$ 2 packaging types (branded/plain).

Stimuli

The brands used (Belvedere, Viceroy, LD Standard, and Matinée Mellow) were the only brands available in the slide-and-shell format and this format was selected to increase ecological validity of the study, given that this format will be the one used for plain packaging policy.²⁰ For GHWs, two human image-based (eg, “Your kids are sick of your smoking”) and three diseased organ-based warnings (eg, “Cigarettes are a major cause of heart disease”) were used.²⁰

Statistical Analysis

In terms of attentional assessment, two 2-way mixed model Analyses of Variance (ANOVAs) were used to assess dwell time and fixations on the GHW, respectively, as a function of IS group and packaging type. Significant interactions were probed using a set of paired-samples t tests in terms of plain versus branded packaging within each IS group.

Results

Participant Characteristics

Participants were 33.1 years old on average (Standard deviation [SD] = 5.56), 62% identified as male, 54% were employed at the time of participation, and 52% were currently enrolled in a postsecondary institution. Seventy-four percent of participants had completed all or some of a college/university degree, 22% had some high school education or had obtained a high school diploma, and 4% had obtained some other form of education. Sixty-six percent of participants were single, 16% were common-law or married, and 18% were either separated or divorced. In terms of smoking history variables, on average, participants smoked 11.1 cigarettes/day (SD = 6.94), and 74% of participants had made a previous serious quit attempt with an average of four attempts. Additionally, participants started smoking at a mean age of 14.7 years (SD = 5.60), and 92% were daily smokers. As assessed by the Fagerström Test

for Cigarette Dependence, the sample had a mean score of 4.12 ($SD = 2.66$). Thus, on average, participants were nicotine-dependent (cutoff = 4).²⁴

Low and high IS groups differed significantly in terms of age $t(37.3) = 2.07, p = .045$ (ie, high IS younger than low IS) [equal variances not assumed], but not cigarettes per day, age they started smoking, number of quit attempts, or Fagerström Test for Cigarette Dependence score ($p > .05$). Also, the two groups did not differ on sex, daily smoking, whether they had a serious quit attempt, employment status, highest level of education, or enrollment in a postsecondary institution. Given the IS group differences in age, we initially ran two 2-way mixed model Analyses of Covariance (ANCOVAs) to assess dwell time and fixations on the GHW, respectively, as a function of IS group and packaging type, with age as a covariate. Age had no effect on either outcome and we therefore used a model that excluded age for parsimony.

Eye Tracking Data

There was a significant main effect of packaging type on fixations (see Table 1), with more fixations on the GHWs in the case of the plain packages ($M = 12.6, SD = 3.70$) versus branded packages ($M = 12.03, SD = 3.52$). Although the main effect of IS group on fixations was not significant, as hypothesized, there was a significant interaction between package type and IS group on fixations.

The differential effect of package type on fixations by IS level was in the expected direction. Specifically, smokers in the high IS group demonstrated the same high number of fixations on the GHWs when presented in the context of a plain package compared to a branded package, $t(24) = .573, p = .571$ (see Figure 2). In contrast, smokers in the low IS group demonstrated higher fixations on the GHWs when

presented in the context of a plain package compared to a branded package, $t(24) = 4.02, p = .001$ (see Figure 2).

There was a marginally significant main effect of packaging on dwell time $F(1,48) = 2.94, p = .093, \eta^2 = .058$, with a trend toward greater dwell times on GHWs in the plain versus branded pack condition (see Table 1 and Figure 3). Contrary to our expectations, there was neither a significant main effect of IS group, nor a significant interaction between package type and IS group, for dwell time (see Figure 3).

Discussion

The current study examined whether the plain cigarette packaging proposed for implementation in Canada²⁰ increases attention to GHWs in comparison to branded packages, and whether IS plays a role in attention to GHWs, either as a main effect and/or in moderating the effects of plain packaging. Two main findings were obtained. First, and as expected, we found that plain packaging significantly increased smokers' fixations on GHWs in comparison to branded packaging. This finding is consistent with past studies that used prototypes for plain packaging on which the GHW size is smaller and placed below branding elements.^{15–17} These studies found that plain packaging, in comparison to branded packaging, increased visual attention toward GHWs and away from branding information. Taken together, these current and past findings suggest that plain packaging increases attention to warnings regardless of size and placement of the health warning, at least within parameters examined thus far. Importantly, these findings also suggest that plain packaging increases attention to the GHW, even when larger GHWs are used.

Figure 1. Example cigarette package stimuli as generated by the EyeLink viewer, showing the scan paths of both plain (left) and branded (right) packages. The scan path (arrows), fixations (circles), and durations (circle size) from a participant are indicated.

Table 1. Main and Interactive Effects of 2-Way ANOVA (Plain Packaging $\times$ Illness Sensitivity) for Each Attentional Outcome (Fixations and Dwell Time)

Variable	Fixations				Dwell time		
	<i>df</i>	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2
Packaging	48	8.08	.007	.144	2.94	.093	.058
Illness sensitivity	48	1.00	.321	.020	2.18	.146	.043
Packaging $\times$ illness sensitivity	48	4.98	.030	.094	.385	.538	.008

Figure 2. Number of fixations (#) on the GHW in the context of plain versus branded packaging for participants with low versus high illness sensitivity (IS). Bars represent plain (black) or branded (white) packaging. Standard error bars are denoted by the vertical lines on each bar.

Figure 3. Total dwell time (seconds) on the GHW in the context of plain versus branded packaging for participants with low versus high illness sensitivity (IS). Bars represent plain (black) or branded (white) packaging. Standard error bars are denoted by the vertical lines on each bar.

Second, we found that those with low IS fixate on GHWs on plain packages more than branded packages, whereas those with high IS do not exhibit differential attention by package type. This difference between IS groups with respect to plain packaging is likely due to the tendency of those with high IS to have increased attention to GHWs regardless of cues received due to their heightened fear of illnesses²¹—they already display high attention to GHWs on branded packages, and thus we found no added benefit from the increased salience of the GHWs on plain packages. Past studies have looked at the effect of smoking status on attention to warnings on cigarette packages, and found that nondaily smokers and nonsmokers (vs. daily smokers) are more likely to increase attention to the health warnings on plain packaging.¹⁶ Our study suggests that IS is another important individual difference with respect to its moderation of the effect of plain packaging on attention to warnings. The construct of IS is a particularly relevant individual difference factor with respect to cigarette packaging given its theoretical links to sensitivity to GHWs portraying smoking-related illnesses. This finding therefore sheds light on a demographic group affected by the presence of plain packaging and may be important in emphasizing policy relevance to vulnerable groups (eg, those with low IS).

Three results went against our expectations. First, those with high IS did not fixate or dwell on the warnings more than those with low IS overall. Past studies have found that high IS increases health promotive intention and behavior.^{22,23} This suggests that IS differences may be more likely to surface when behavior, rather than attention, is the outcome. However, the differences in attention between low and high IS groups became evident when the groups were exposed to different types of packaging. Thus, differences in attention between the two groups may only emerge in the presence of an external trigger (eg, plain vs. branded packaging).

The second unexpected result was the presence of a marginal (rather than significant) effect ($p < .10$, $\eta^2 = .058$) of packaging type on dwell time. This marginal effect could suggest that the study may have been underpowered to detect this smaller effect.¹⁷

The last unexpected finding was that the interaction between packaging type and IS group with respect to dwell time was not significant. This finding suggests that IS level only moderates the effect of packaging on attention capture (fixations), but not attentional maintenance (dwell time).

Our study has some important implications. First, since 92% of our sample smoked daily, our findings demonstrate that plain packaging is a promising intervention even for daily smokers. Contrarily, past studies have shown that both nonsmokers and nondaily smokers (eg, experimenters, weekly smokers), but not daily smokers, demonstrate increased attention to health warnings on plain packages.¹⁵ These differences among studies are likely due to the different package templates used. Unlike templates in previous studies, the current study had packages with larger GHW area (75% of the package), and placed the GHW at the top of the package and the brand information at the bottom. These differences in packaging could therefore be crucial, as on previous packages, the GHW is not the first thing one sees when examining the package from top to bottom, or potentially due to fact that the GHW (vs. brand imagery) is situated farther away from where the smoker (receiver) draws the cigarettes. Importantly, the large GHW dictated by Canadian guidelines proposed for plain packaging may increase GHW visibility in such a way that even those exposed to these warnings daily, who, as a result, may experience habituation to the stimulus due to repeated exposure, are forced to pay more attention to that area of the package.

A second important implication of the study is the increased ecological validity for its population, as the experiment was carried out using a Canadian sample and templates planned for plain packaging policy in Canada.²⁰ Also, the findings of this study contribute supportive evidence for the impending plain packaging policy in Canada.²⁹ Plain packaging policy is set to be implemented in Canada at the manufacturer level on November 9, 2019, and at the retail level on February 7, 2020.¹⁹ In conjunction with other evidence, these findings can therefore aid in defense against anticipated challenges from the tobacco industry in the stages of policy implementation and application, given Australia's experience with the implementation of this policy.³⁰ Furthermore, in terms of treatment implications, plain packaging is an intervention likely to provide enhanced incentive for smoking cessation, particularly for those low in IS who may be interested in seeking treatment for tobacco dependence. This group is not as concerned with contracting smoking-related illnesses relative to their high IS counterparts, and perhaps, by extension, are not as motivated to quit smoking due to lack of fear of these potential illnesses. Plain packaging could therefore play an important role in increasing

awareness of smoking-related health concerns via GHWs, thereby increasing motivation to change and improving smoking cessation rates among smokers low in IS. However, future work is needed to confirm plain packaging effects on smokers low in IS.

The findings of this study should be interpreted in the context of a few potential limitations. For the eye tracking task, participants were not divided into groups based on their smoking status or dependence level. Past literature has demonstrated that these factors can influence attention to GHWs with UK templates.¹⁵ However, since the sample obtained in the current study was almost entirely daily smokers that were, on average, dependent on nicotine, and since our sample overall showed an effect of plain packaging on attention, this may not hold in the case of large warnings such as those proposed for Canadian plain packaging implementation. To verify this, future studies should assess the impact of dependence level and/or daily smoking on attention to GHWs on Canadian plain packages. The sample obtained was also largely male, which, along with it being comprised of almost entirely daily smokers, may limit the generalizability of the findings. However, given that 9.4% of Canadians are daily smokers (vs. 3.7% nondaily smokers), our study is applicable to over 70% of Canadian smokers.³¹ Furthermore, the long-term behavioral impact of these increased attention findings is unclear. Individuals may become desensitized to GHWs on plain packaging in the long run. Further work is required to understand the consequences of increased attention to GHWs on actual smoking behavior and the endurance of these effects.

In conclusion, the results of this study are the first to demonstrate the efficacy of plain packaging in a Canadian context in terms of increasing attention to GHWs. This study is also the first to assess attention to GHWs in the context of IS, with results suggesting the possibility that plain packaging could improve motivation to quit among low IS individuals by increasing their attention to GHWs. Overall, the present results could be, as part of a library of other evidence, beneficial in support of implementing plain packaging policy in Canada, as they demonstrate that this type of packaging increases attention to GHWs, possibly leading to increased awareness of the contents of those warnings and, in turn, a decrease in smoking rates in the population over the long term.

Supplementary Material

Supplementary data are available at *Nicotine and Tobacco Research* online.

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Declaration of Interests

The authors declare that Dr. Al-Hamdani has been employed in the past and is currently employed by the Lung Association of Nova Scotia.

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