Depressive symptoms and responses to cigarette pack warning labels among Mexican smokers

Amira Osman, MPH, PhD,

Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina

James F. Thrasher, PhD,

Associate Professor, Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina. National Institute of Public Health, Department of Tobacco Research, Population Health Research Center, Cuernavaca, Mexico

Ebru Cayir,

Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina

James W. Hardin, PhD,

Associate Professor, Department of Epidemiology & Biostatistics, Arnold School of Public Health, University of South Carolina

Rosaura Perez-Hernandez, MCs, and

National Institute of Public Health, Department of Tobacco Research, Population Health Research Center, Cuernavaca, Mexico

Brett Froeliger, PhD

Assistant Professor, Department of Neuroscience, Hollings Cancer Center, Medical University of South Carolina

Abstract

Objective—we examine whether having depressive symptoms (DS) is associated with different responses to cigarette package health warning labels (HWLs) before and after the implementation of pictorial HWLs in Mexico.

Methods—we analyze data from adult smokers from Wave 4 and Wave 5 (n=1340) of the International Tobacco Control Policy Evaluation Project in Mexico. Seven CES-D items assessed DS, with scores   7 indicating elevated DS. Outcomes included: attention to HWLs; cognitive responses to HWLs; tobacco constituents awareness; putting off smoking due to HWLs; avoidance of HWLs; and awareness of telephone support for cessation (i.e., quitlines). Mixed effects models were used to assess main and interactive effects of DS and time (i.e., survey wave) on each outcome.

Results—all HWL responses increased over time, except putting off smoking. Statistically significant interactions were found between DS and time for models of tobacco constituents

Correspondence to: Amira Osman.

awareness (b=−0.36, SE= 0.15, p=.022); putting off smoking (OR=0.41, 95% CI 0.25, 0.66); avoidance of HWLs (OR=1.84, 95% 1.03, 3.29); and quitline awareness (OR=0.35, 95% CI 0.21, 0.56). Compared to smokers with low DS, smokers with elevated DS reported stronger HWL responses at baseline; however, HWL responses increased over time among smokers with low DS, whereas HWL responses showed little or no change among smokers with elevated DS.

Discussion—population-level increases in HWL responses after pictorial HWLs were introduced in Mexico appeared mostly limited to smokers with low DS. In general, however, smokers with elevated DS reported equivalent or stronger HWL responses than smokers with low DS.

Keywords

depressive symptoms; smoking; cigarette packages; pictorial health warning labels; Mexico

Introduction

The adoption of pictorial health warning labels (HWLs) on cigarette packaging follows recommendations by the World Health Organization's Framework Convention on Tobacco Control (FCTC), the world's first global health treaty (World Health Organization [WHO], 2003). As of 2013, more than 70 countries had implemented pictorial HWLs on cigarette packs (Canadian Cancer Society, 2014). HWLs aim to enhance smokers' knowledge of the range and magnitude of smoking harms, decrease the allure of smoking, and provide smokers with cues and linkage to resources for quitting. Empirical evidence shows that HWLs serve as a prominent source of health information for consumers, can increase health knowledge and perceptions of risk, and promote smoking cessation among smokers (Hammond, 2011; Swayampakala et al., 2014). In 2004, Mexico implemented HWLs that included only text (no pictures) and covered 50% of the back of cigarette packs (Thrasher, Pérez-Hernández, Arillo-Santillán, & Barrientos-Gutierrez, 2012). In 2010, new pictorial HWLs were mandated that included imagery on 30% of the front of the pack, with 100% of the back covered by only text warning (see examples in Table 1). In both experimental research and quasi-experimental cross-country studies, pictorial HWLs appear better able than HWLs with only text to promote knowledge and cessation-related affect, cognitions, and behavior (Cantrell et al., 2013; Mutti, Hammond, Reid, & Thrasher, 2013; Thrasher et al., 2010; Thrasher et al, 2012). However, the impact of this policy on critical subpopulations of smokers, such as smokers with depressive disorders, has not been studied.

Depressive disorders and smoking in Mexico

In Mexico, the second most populous country in Latin America, the estimated prevalence of lifetime Major Depressive Episode (MDE) is between 8% to 12% (Andrade et al., 2003; World Mental Health Survey Consortium, 2004; Slone et al., 2006). Risk factors for depressive disorders in the Mexican population are consistent with risk factors observed in other western populations. Mexican women and those residing in poor regions of Mexico present the highest rates of depressive disorders compared to men and people residing in prosperous regions (Burke, Fernald, Gertler, & Adler, 2005; Slone, et al., 2006). For example, the prevalence of lifetime Major Depressive Disorder (MDD) is twice as high for

women (16%) as it is for men (9%) (Slone et al., 2006). Another study in urban Mexico found high depressive symptoms in 60% of poor women (Burke et al., 2005). Lower education and having experienced childhood trauma are also associated with higher risk for depressive disorders among Mexicans (Slone et al., 2006). Similar to other traditional Latin American populations, Mexicans, tend to use somatic more than affective expressions of depressed mood (Kleinman & Good, 1985). As in other traditional cultures, mental illness is highly stigmatized in Mexico, which may help explain somatization of depressed mood (Guarnaccia, Angel, & Worobey, 1989; Golding, Aneshensel, & Hough, 1991; Kolody, Vega, Meinhardt, & Bensussen, 1986; Myers et al., 2002; Slone et al., 2006).

Previous research has shown a link between depressive symptoms and smoking behavior among Mexicans (Benjet, Wagner, Borges, & Medina-Mora, 2004; Escobedo, Kirch, & Anda, 1996; Lee & Markdes, 1991). Escobedo et al., (1996) found that depressive states (i.e., depressed mood, major depression or both) were positively associated with ever smoking in the Latino population in the U.S, especially among Mexican Americans. In a study in Mexico, Benjet et al., (2004) found among women, current smokers had twice the odds of elevated depressive symptoms than never smokers. Among men, those smoking a pack or more a day had greater odds of depressive symptoms. Hence, smoking and depression appear linked among Mexicans, as has been found for other countries and/or ethnic groups (Breslau, Kilbey, & Andreski, 1991; Pratt & Brody, 2010; Urdapilleta-Herrera et al., 2010).

Depressive disorders and smokers' responses to health warning labels on tobacco products

To decrease smoking prevalence, countries around the world are increasingly implementing a wide range of tobacco control policies such as health warning labels (HWLs) on cigarette packages; however, the impact of this policy on subpopulations such as persons with depressive disorders has not yet been studied. In high-income countries that are implementing tobacco control policies and programs, smoking prevalence is decreasing in the general population but becoming more concentrated among sub-populations, such as persons with mental health disorders and those of low socioeconomic status (Docherty & McNeill, 2012). Similar disparities in smoking prevalence can develop in low- and middle-income countries that are increasingly implementing tobacco control policies that the WHO recommends. Thus, it is particularly important to assess the differential impact of policies like pictorial HWLs among subpopulations that are at risk for tobacco related disparities.

The influence of pictorial HWLs, that include prominent graphic imagery, on cessation-related beliefs and behaviors involves both affective and cognitive pathways (Emery, Romer, Sheerin, Jamieson, & Peters, 2013; Thrasher et al., 2013; Newman-Norlund et al., 2014). Prior research on the effectiveness of pictorial HWLs on cigarette packages has shown that cognitive and behavioral responses to HWLs predict cessation behavior (Borland et al., 2009; Fathelrahman et al., 2009; Yong et al., 2014). Depressive symptoms severity may lead to greater negative emotional interference on cognition (Froeliger, Modlin, Kozink, Wang, & McClernon, 2012), thus may influence the cognitive processing of negative emotional

information that is displayed on cigarette pack HWLs. In addition, factors such as negativity bias that accompany depressive states (Moore & Fresco, 2012) may lead smokers with elevated DS to engage in more frequent or intensive processing of negative health related messages on HWLs.

In this study we examine changes in smokers' responses to HWLs on cigarette packages from before to after the implementation of pictorial HWLs in Mexico. We hypothesize that, overall, Mexican smokers will have stronger responses to HWLs following the implementation of more prominent, pictorial HWLs compared to the previous, less prominent text-only warnings. Further, in exploratory analyses, we examine whether smokers with elevated DS exhibit weaker, stronger, or similar responses to pictorial HWLs compared to those with low DS, as empirical and theoretical evidence support divergent hypotheses. Lastly, we assess whether having an elevated level of DS was associated with subsequent quit-related behaviors. We hypothesize that persons with elevated DS will be less likely to quit smoking, based on prior literature indicating the increasing concentration of smoking amongst populations with depressive symptoms in high income countries with longer histories of tobacco control policies and programs than in Mexico.

Methods

Sample

We use data from Wave 4 (year 2010) and Wave 5 (year 2011) of the International Tobacco Control Policy Evaluation Project in Mexico (ITC Mexico). The two waves coincide with the period before and after implementation of pictorial HWLs in Mexico. ITC Mexico used a stratified, multi-stage sampling design that involved face-to-face interviews with randomly selected adult smokers from seven cities in Mexico (i.e., Mexico City, Tijuana, Puebla, Monterrey, Guadalajara, Mérida, León). Data collection procedures were approved by the institutional review board of the National Institute of Public Health in Mexico. Participants were smokers aged 18 years or older who, at initial enrollment, smoked more than 100 cigarettes in their lifetime and smoked at least once in the previous week. Wave 4 of the ITC Mexico data included 1853 smokers of whom 1340 were re-interviewed at Wave 5 and hence constitute the analytic sample for this study (n=1340 individuals, n=2680 observations).

A total of 513 respondents were lost to follow-up. Supplemental analysis indicated that those lost to follow-up were similar to participants who were re-interviewed in terms of age, gender, education, income, and reports of past quit attempts. Those lost to follow up, however, were more likely to be non-daily smokers and less likely to have elevated depressive symptoms.

Measures

Dependent variables

Attention to health warning labels (HWLs): Participants were asked the following questions: 1) In the last month, how often, if at all, have you noticed health warnings on cigarette packages 2) In the last month, how often, if at all, have you read or looked closely

at the health warnings on cigarette packages. Responses were measured on a four point scale (i.e., *Never, once in a while, often, and very often*) with higher numbers indicating higher frequency. The Pearson correlation coefficient between the two items was .66 (P<.001). For each participant, we calculated a score that is the average of both items, as in other research (Borland et al., 2009).

Cognitive responses to HWLs: Smokers' cognitive responses to HWLs were assessed using three questions: 1) "To what extent, if at all, do the health warnings make you think about the health risks of smoking?" 2) "To what extent, if at all, do health warnings on cigarette packs make you think about quitting?" 3) "In the past six months, were you led to think about quitting by warning labels on cigarette packages?" Response options for the first two questions (i.e., "not at all", "a little", "somewhat", "a lot") were slightly different from those used for the third question (i.e., "not at all", "somewhat", "a lot"), as the third question was included in a different part of the survey, where an array of potential influences on quitting were queried. Reliability for these items was good (Cronbach's alpha .74). Responses were scaled from 1 to 4 to ensure equal weighting across the three items, and we calculated their average, with higher scores indicating stronger cognitive responses to HWLs, as in prior research (Borland et al., 2009).

Awareness of toxic tobacco constituents contained on HWLs: Respondents were asked whether cigarette smoke contains each of the following constituents: cyanide, ammonia, and cadmium. Each of these constituents was highlighted in a different HWL that was implemented in the first round of pictorial HWLs. Response options were "yes", "no", and "don't know", with the later two options coded as "0". These items were summed to create an index (range 0–3) with higher scores indicating a higher level of awareness of toxic tobacco constituents.

Behavioral responses to HWLs: Putting off having a cigarette because of HWLs was assessed using the question "In the last month, have the health warnings stopped you from having a cigarette when you were about to smoke?" was coded to 0 for responses of "never" and 1 for responses of "once or more frequently". Avoidance of HWLs was assessed with the question "In the last month, have you avoided looking at the warning labels on cigarette packs?" for which responses were coded as 0 for "no" and 1 for "yes".

Awareness of quitline number contained on HWLs: Pictorial HWLs in Mexico presented for the first time information on a telephone number for smokers to call for cessation assistance (i.e., ("quitline"). Smokers' awareness of the quit line number was assessed using the question *"*Have you heard of a free 01 800 telephone number where you can get smoking cessation advice?" Affirmative responses were coded as 1 while negative or don't know responses were coded as 0.

Quit-related outcomes: Smoking status in the ITC survey was self-reported, a measure that is consistent with the measures recommended by the International Agency for Research on Cancer (International Agency for Research on Cancer [IARC], 2008) and have been shown to be valid in the Mexican population in past research (Campuzano et al., 2004). At both Wave 4 and Wave 5, making a quit attempt was assessed through the question "Have you

tried to quit smoking in the last 12 months", which was coded as yes (1) versus no (0). Quit success was defined as being quit for at least 30 days at Wave 5. Finally, change in cigarette consumption was estimated by deriving the difference in the number of cigarettes smoked per day between the two waves and was used as a continuous variable in the analysis. Nondaily smokers were asked to report the number of cigarettes they smoked each week, and their average cigarettes per day was determined using their response.

Independent variables

Survey wave: We used data from Wave 4 and Wave 5 of the ITC Mexico survey. The survey wave of data collection was dummy coded as a time indicator, with Wave 4 survey as the reference category.

Depressive symptoms: Depressive symptoms were assessed using seven-items from the Center for Epidemiological Studies Depression Scale (CES-D), an abbreviated form of the 20-item CES-D scale. The Spanish CES-D 7 item scale was based on the Spanish translation of the full 20-item CES-D scale that was used in the Hispanic Health and Nutrition Examination Survey (HHANES) and has been widely used to examine depressive symptoms among Hispanic ethnic groups in the U.S., including Mexican immigrants and American born Mexicans (Cho et al., 1993; Moscicki, Locke, Rae, & Boyd, 1989). Respondents were asked, "How many days during the past week have you " (1) "had no appetite" (2) "felt hopeful about the future" (item was reversed coded) (3) "felt sad" (4) "felt that people disliked you" (5) "felt depressed" (6) "felt you could not shake off the blues" (7) "felt that everything was an effort". Response options ranged from 0–3 corresponding to the following answers "Rarely or none of the time", "Some or a little of the time", "Occasionally or a moderate amount of the time", "Most or all of the time". The internal consistency reliability (Cronbach's alpha) of the seven-item CES-D scale in our study was .80 at Wave 4 and .73 at Wave 5. In a nationally representative sample of Mexicans, the seven CES-D items we used had the same pattern of expected correlations with smoking and socio-demographic characteristics as the 20 item CES-D scale (data available in an online appendix). Following prior research in Mexico (Benjet et al., 2004), we classify participants as having elevated depressive symptoms if their score equaled or was greater than the mean plus one standard deviation (i.e., cut off   7 was used at each Wave).

Control Variables: The following socio-demographic data were assessed: age (i.e., categorized into "18–24", "25–39", "40–54", "55 or older"), sex, and educational attainment (i.e., "primary school or less", "middle school", "vocational school", "high school or incomplete university", "university or higher"). Monthly household income measured in Mexican pesos was categorized into "0–3000 pesos", "3001–5000 pesos", "5001–8000 pesos", "8001 pesos or more", and "don't know" (3000 Mexican pesos = approximately 240 U.S. dollars; in 2008, the Median national poverty line in urban Mexico was 1286.38 pesos per capita per month (USAID, 2011), although we did not collect household data to calculate per capita income). Mexican smokers are more likely to be non-daily smokers and to consume a lower number of cigarettes per day compared to smokers from majority ethnic groups in western countries (PAHO-INSP, 2010). For this reason participants were classified into one of four levels of cigarette consumption (i.e., non-daily cigarette consumption, daily

consumption of 1 to 4 cigarettes per day, daily consumption of 5 to 9 cigarettes per day, and daily consumption of 10 or more cigarettes a day). In addition, smokers were asked about their intention to quit smoking, which was coded 1 for those intended to quit within the next 6 months and 0 if otherwise. Participants in the ITC Mexico survey were recruited to the study at different waves. Time in sample variable indicates wave of recruitment (range 1–5) with higher numbers indicating recruitment at earlier waves. This variable was included as a continuous variable in all analyses to adjust for potential time in sample effects.

Statistical Analysis

We began with descriptive statistics to understand the data distribution. Then, using mixed effects logistic regression models, we examined socio-demographic and smoking related correlates of elevated depressive symptoms (DS). Next, we examined the association between survey wave as the main independent variable and HWLs related responses and whether depressive symptoms modified smokers' responses to HWLs over time. We estimated mixed effects linear regression models when predicting continuous dependent variables (i.e., attention to HWLs, cognitive responses to HWLs, and awareness of tobacco toxic constituents) and mixed effects logistic regression models when predicting binary dependent variables (i.e., putting off smoking a cigarette, avoidance of HWLs, and awareness of quit line number). For this analysis, our model building approach went as follows: first we estimated a bivariate model (Model 1) of the association between survey wave and each of the dependent variables and between DS and each of the dependent variables. Then we estimated the main effect of survey wave and DS (Model 2) on each of the dependent variables adjusting for age, sex, educational attainment, monthly household income measured in Mexican pesos, cigarettes per day, quit intention, quit attempt, and time in sample. Lastly, in Model 3, we included an interaction term between survey wave and DS adjusting for all aforementioned confounders. We plot statistically significant interactions using estimates produced by the *margins command* in Stata 13. The estimated predictions are marginalized over the covariates from the fully adjusted interaction models. We plot predicted means for models with continuous dependent variables and predicted probabilities for models with binary dependent variables. Lastly, to investigate whether DS at Wave 4 were associated with quit-related behaviors at Wave 5, logistic regression models estimated the relationship between baseline DS (i.e., Wave 4) and quit attempt and quit success at Wave 5. In addition, a linear regression model estimated the association between baseline DS (i.e., Wave 4) and change in cigarette consumption by Wave 5 as a continuous outcome. These analyses adjusted for age, sex, educational attainment, monthly household income measured in Mexican pesos, cigarettes per day, quit intention, and quit attempt, all measured at Wave 4. All bivariate and multivariate analyses adjusted for the sampling design and sampling weights, which accounted for the sampling strata and likelihood of participant selection. All analyses were conducted using Stata version 13.

Results

Sample characteristics

Table 2 presents baseline (Wave 4) socio-demographic and smoking related characteristics of the analytic sample (n=1340 individuals, n=2680 observations). Respondent's mean age

was 40 (SD=14.8, range 18–98). Participants were primarily males (62%) and had less than a high school education (66%). About half the sample (54%) reported a monthly income less than 5000 pesos. Though 82% of smokers expressed no intention to quit smoking and about 66% didn't try to quit smoking in the past year, about half of the sample (51%) were light smokers who smoke non-daily or daily between 1–5 cigarettes. Nineteen percent of the sample had elevated depressive symptoms.

Correlates of depressive symptoms (DS)

Results from bivariate and multivariate mixed effects logistic regression models (Table 3) indicate that survey wave, gender, education, income, and number of cigarettes per day, were all significantly associated with DS. Males, OR=0.42, 95% CI [0.31, 0.56], those with university level education or more, OR=0.39, 95% CI [0.21, 0.73], and those with higher income, OR=0.52, 95% CI [0.35, 0.77] for those earning 5001–8000 Mexican pesos; OR=0.46, 95% CI [0.29, 0.72] for those earning 8001 Mexican pesos or more, were less likely to exhibit elevated DS compared to females, persons with primary school education or less, and compared to those who reported a monthly income of less than 3000 Mexican pesos. Compared to non-daily smokers, smokers with the highest cigarette consumption per day (i.e., daily, 10 or more cigarettes) were more likely to have elevated DS, OR=1.92, 95% CI [1.35, 2.73]. Age, quit intention, and quit attempt were unassociated with DS.

Depressive symptoms and responses to health warning labels (HWLs)

Attention to HWLs—Bivariate and multivariate main effect models show that attention to HWLs increased over time (b=0.16, SE=0.03, p<.001) (Table 4). In addition, smokers with elevated DS reported greater attention to HWLs compared to persons with low DS (b=0.15, SE=0.04, p<.01). DS was not a statistically significant modifier in the relationship between survey wave and attention to HWLs.

Cognitive responses to HWLs—Table 4 presents results for cognitive responses to HWLs. Main effect models show that cognitive responses to HWLs increased over time (b=0.23, SE=0.03, p<.001) and it was higher amongst smokers who had elevated DS compared to low DS (b=0.22, SE=0.04, p<.001). There was no statistically significant interaction between survey wave and DS when predicting cognitive responses to HWLs.

Awareness of toxic tobacco constituents contained on HWLs—In the main effect model, awareness of tobacco constituents increased over time (b=0.50, SE=0.05, p<.001) and elevated DS was positively associated with greater awareness (b=0.17, SE=0.07, p<0.05) (Table 4). The interaction between survey wave and DS was statistically significant when examining this outcome (b=−0.36, SE=0.15, p<.01). Though smokers with elevated DS had higher awareness of toxic constituents at baseline (Wave 4), the increase in awareness of tobacco constituents over time appears greater among persons with low DS than among persons with elevated DS. At Wave 5, both groups had nearly equivalent awareness of tobacco constituents (Figure 1a).

Behavioral responses to HWLs

Putting off smoking because of HWLs—Main effect models for putting off smoking a cigarette because of HWLs (Table 5) indicated that smokers with elevated DS were more likely to report that the HWLs had stopped them from having a cigarette when they were about to smoke, OR=2.22, 95% CI [1.73, 2.84]. Results from interaction model, however, show that over time persons with low DS were more likely to report that the warnings had stopped them from having a cigarette while persons with elevated DS were less likely to do so, OR=0.41, 95% CI [0.25, 0.66] (Figure 1b).

Avoidance of HWLs—Survey wave and DS were significantly positively associated with avoiding looking at the HWLs (Table 5). Participants at Wave 5 were more likely to report that they have attempted to avoid looking at the warnings compared to participants a Wave 4, OR=2.02, 95% CI [1.62, 2.51]. Those with elevated DS were also more likely to avoid the HWLs, OR=1.42, 95% CI [1.06, 1.90]. We found a statistically significant interaction between survey wave and DS when examining avoidance of HWLs as the outcome, OR=1.84, 95% CI [1.03, 3.29]. There appears to be a sharper increase in avoiding HWLs overtime among persons with elevated DS than among persons with low DS (Figure 1c).

Awareness of quit line number

We found an increase in awareness of quit line number over time in Mexico, OR=1.90, 95% CI [1.60, 2.24] (Table 5). Smokers with elevated DS were more likely to report that they are aware of the quit line number, OR=1.48, 95% CI [1.15, 1.89]. A significant interaction between survey wave and DS for this outcome, OR=0.35, 95% CI [0.21, 0.56], indicates that an increase in awareness of quit line number over time among persons with low DS while there was a decrease over time in awareness of quit line number among those with elevated DS (Figure 1d).

Sensitivity analyses

To rule out the possibility that our results were driven by an omitted-variable bias, we estimated all models using conditional fixed effects regression. Conditional fixed effects regression models allow to examine the effect of within-subject change in the depression status on responses to HWLs. The results from interaction models using this analytic approach were generally similar in direction, magnitude, and significance to those we observed when using mixed effects regression models, except for the interaction between DS and time did not reach statistical significance when predicting putting of smoking cigarettes as the outcome of interest.

Different cutoff points were suggested for classifying people with low versus elevated depressive symptoms using different versions of the CES-D 7 item scale (Levine, 2013; Salinas-Rodríguez et al., 2013). We conducted sensitivity analyses and re-estimated all mixed effects models using cutoff points of 8 and 9 at each wave to classify people with low versus elevated depressive symptoms (results not shown in tables and are available upon request). We also conducted sensitivity analysis specifying the CES-D 7 as a continuous exposure variable (range 0–21). Results from sensitivity analyses using the cutoff point 8 were similar to those obtained when using the cutoff point 7. The results were similar with

regard to strength, direction, and significance of associations in bivariate, main effect, and interaction models estimated for all outcomes. Results from sensitivity analysis using the cutoff point 9 yielded similar results to those observed when using the cutoff point 7 when examining attention to HWLs, putting off smoking a cigarette, avoidance of HWLs, and awareness of quit line number as outcomes. We found different results, however, for interaction model where awareness of toxic tobacco constituents was the outcome, for which the interaction between DS and time was not statistically significant, and for interaction model examining cognitive responses to HWLs as the outcome, for which the interaction between DS and time became statistically significant. Results from models using CESD 7 as a continuous exposure variable (range 0–21) yielded significant interactions between survey wave and DS when predicting all outcomes. The direction of those interactions was similar to those observed with CESD 7 as a dichotomous variable. Lastly, to rule out the possibility that ceiling effects may have accounted for the finding of little to no change in responses to HWLs among persons with elevated DS, we examined the distributions and means of each of the outcome variables by wave and depressive symptom severity (i.e., low vs. elevated). We found no evidence for ceiling effects.

Depressive symptoms and quit-related behavior

Adjusting for socio-demographics, cigarettes per day, quit intention, and quit attempt, baseline level of depressive symptoms measured at Wave 4 was not significantly associated with subsequent quit attempt or quit success at Wave 5 or with change in cigarette consumption between the two waves among Mexican smokers.

Discussion

This study suggests that smokers reported stronger responses to HWLs and enhanced perceptions of smoking-related risks following the implementation of pictorial HWLs in Mexico, which is consistent with other population-based studies (Borland et al., 2009; Fathelrahman et al., 2010; Hammond et al., 2007; Hammond, Fong, McNeill, Borland, & Cummings, 2006; Thrasher et al., 2012; Thrasher et al., 2013). Our results also suggest that this increase was found primarily among smokers with low depressive symptoms (DS). At baseline, however, when cigarette package HWLs included only text and covered 50% of the back of the package, smokers with elevated DS reported generally stronger HWL responses than smokers with low DS. After pictorial HWLs were implemented, there was little to no change in responses to HWLs among smokers with elevated DS, while HWL responses were similar to or still lower among smokers with low DS. These results suggest that HWLs influence reporting stronger responses from smokers with elevated DS, but that elaborating HWL content to include pictorial imagery and additional information on smoking-related risks and cessation support (i.e., quitlines) is mostly effective for reporting stronger responses from smokers with low DS, which is the majority of smokers.

DS severity may be associated with cognitive processing of negative emotional information. For example, nonsmokers with depressive symptoms have stronger neural responses to negative emotional information than those without DS (Felder et al., 2012). Among smokers, nicotine withdrawal promotes greater negative emotional interference on cognition

(Froeliger et al., 2012; Gilbert et al., 2007)—the effects of which become worse with increasing levels of baseline depressive symptom severity (Froeliger et al., 2012; Gilbert et al., 2008). Furthermore, research on "depressive realism" suggests that persons with elevated DS engage in relatively more processing of negative information (Keller, Lipkus, & Rimer, 2002; Moore & Fresco, 2012). This may help explain why Mexican smokers with elevated DS reported relatively stronger HWL responses than those with low DS even before the implementation of pictorial HWLs in Mexico. Nevertheless, future research should assess why pictorial HWLs with more prominent and stronger health risk information did not appear to influence smokers with elevated DS.

The correlations found between DS and participant characteristics in our study were consistent with results from other studies in Mexico (Benjet et al., 2004; Urdapilleta-Herrera et al., 2010), suggesting that our abbreviated DS assessment was reasonably valid. Nevertheless, DS is heterogeneous and involves an array of affective, somatic, and/or interpersonal disturbances (Hasler, Drevets, Manji, & Charney, 2004), each of which may have distinct etiologies and impacts on cessation (Leventhal et al., 2008). Future research could examine whether different dimensions of DS may influence reported health information processing, nicotine withdrawal, and smoking behavior. This may shed light on why tobacco control policies and programs, including communication interventions like HWLs, appear to have had differential effects, with weaker effects among subpopulations of smokers who do not want or are less able to stop smoking (Hughes, 2011), such as smokers with depressive disorders. Indeed, HWLs may be more effective in prompting a cessation attempt than sustaining cessation.

Whether HWLs can be used as a strategy to target subpopulations of smokers such as those with mood disorders is not clear. Multi-modal interventions may be needed to most effectively promote and sustain cessation among smokers with underlying mood disorders (Fu et al., 2007; Gierisch et al, 2011; Garland, Froeliger & Howard, 2013), and HWLs can promote awareness about cessation resources (e.g., websites, medications) or services (e.g., telephone support) (Thrasher et al, 2014) that could simultaneously address smoking and mood disorders. Nevertheless, we found that smokers with elevated DS were no more or less likely than those with low DS to change their consumption behavior or to try to quit after pictorial HWLs were implemented. Hence, to the extent that HWLs stimulate quitting, they appear unlikely to stimulate less quitting amongst smokers who are more depressed. The results from this study should be replicated in other populations, and future research should determine which HWL content is most effective to offset or prevent key tobacco-related disparities.

Limitations

Several limitations warrant consideration. We did not directly assess secular trends that could provide alternative explanations for changes associated with HWL policy implementation; however, HWL responses were declining in the period before the increases associated with the introduction of pictorial HWLs (Thrasher et al., 2013). Smoking status was self-reported without biochemical verification, and participants may have over-reported cessation behaviors. Our approach, however, is consistent with recommendations (IARC,

2008) and has been validated among Mexicans (Campuzano et al, 2004). Furthermore, our measurement of depressive symptoms may have been flawed, which may explain the relatively low average DS scores observed in our sample. These scores may also be explained by the fact that DS are more prevalent among Mexican women than men, and men comprised a larger proportion of our sample. Also, Mexican/Latino populations tend to express depression using somatic more than affective expressions (Slone et al, 2006). Our CES-D 7 item scale included only one somatic item (i.e., "had poor appetite") and therefore might have not picked up on the DS phenotype among Mexican smokers. Nevertheless, the 7-item scale we used appears as valid as the full, 20-item CES-D (data available in an online appendix).

Our sample of seven major cities in Mexico may not represent the broader urban Mexican population, even though our sample was population based; however, the socio-demographic characteristics of our sample are consistent with those from the Mexican National Household Income and Expenses Survey (CONAPO, 2007), supporting the external validity of the results. Our sample was primarily male smokers (63%), but this is also consistent with higher rates of smoking among men than women in nationally representative surveys (PAHO-INSP, 2010). Lastly, the generalizability of these findings might be limited by the fact that this study was conducted in urban areas of Mexico and did not include rural areas. However, 78% of Mexico's population lives in urban areas (Central Intelligence Agency, 2010). In addition, the majority of Mexican smokers consume relatively few cigarettes per day; hence, the results from our study may not generalize to other populations where cigarette consumption is higher. The level of cigarette consumption and, by extension, level of addiction are consistently associated with cessation behavior (Vangeli, Stapleton, Smit, Borland, &West, 2011); however, no research of which we are aware has shown that level or cigarette consumption moderates HWL responses. Nevertheless, future research should examine whether HWLs are more likely to have an effect among smokers who are less addicted, including smokers with different levels of DS.

Conclusions

It is unclear how smokers with depressed mood respond to national-level tobacco control policies in the absence of individual-level interventions that target depressive disorders. Our study suggests that smokers with elevated DS generally have responses to HWLs that are as strong as or stronger than smokers with low DS. Nevertheless, Mexico's introduction of pictorial HWLs with elaborated risk messages (e.g., toxic constituents, how cigarettes cause disease, quitline information) appears to have mostly influenced smokers with low DS. Given the higher smoking rates and lower quit prospects among smokers with depressive states, research attention should be directed to determine whether national-level tobacco control policies can more effectively target smokers with depressive disorders. Indeed, interventions that target both smoking behavior and DS may have a greater impact on this population. To further understand the impact of different HWLs on smokers with and without depressive disorders, future research should examine these issues in other data sets and populations, disentangle the effects of specific HWL characteristics (e.g., HWL size, image type, textual message), consider other types of HWL responses (e.g., emotional responses), and include better measurement of depression and depressive symptoms severity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

References

Andrade L, Caraveo-anduaga JJ, Berglund P, Bijl RV, Graaf RD, Vollebergh W, Dragomirecka E, Kohn R, Keller M, Kessler R, Kawakami N, Kilic C, Offord D, Ustun TB, Wittchen HU. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. International Journal of Methods in Psychiatric Research. 2003; 12(1):3–21. [PubMed: 12830306]

Benjet C, Wagner F, Borges G, Medina-Mora M. The relationship of tobacco smoking with depressive symptomatology in the Third Mexican National Addictions Survey. Psychological Medicine. 2004; 34:881–888. [PubMed: 15500308]

Borland R, Yong HH, Wilson N, Fong GT, Hammond D, Cummings KM, Warwick Hosking W, McNeill A. How reactions to cigarette packet health warnings influence quitting: findings from the ITC Four-Country survey. Addiction. 200910.1111/j.1360-0443.2009.02508.x

Breslau N, Kilbey MM, Andreski P. Nicotine dependence, major depression, and anxiety in young adults. Archives of General Psychiatry. 1991; 48:1069–1074. [PubMed: 1845224]

Burke HM, Fernald LC, Gertler PJ, Adler NE. Depressive symptoms are associated with blunted cortisol stress responses in very low-income women. Psychosomatic Medicine. 2005; 67(2):211–216. [PubMed: 15784785]

Campuzano JC, Hernandez-Avila M, Jaakkola MS, Ponce EL, Morales PK, Bautista P, Benowitz NL, Ceraso M, Blackford A, Samet JM. Determinants of salivary cotinine levels among current smokers in Mexico. Nicotine & tobacco research. 2004; 6(6):997–1008. [PubMed: 15801572]

Cantrell J, Vallone D, Thrasher J, Nagler R, Feirman S, Muenz L, He D, Viswanath K. Impact of tobacco-related health warning labels across socioeconomic, race and ethnic groups: Results from a randomized web-based experiment. PLoS One. 2013; 8:e52206. [PubMed: 23341895]

Canadian Cancer Society. Cigarette Package Health Warnings: International Status Report. 2014. Available at http://www.tobaccolabels.ca/healthwarningsinfo/statusreport/

Central Intelligence Agency. The World Factbook. Mexico: 2010. Available at https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html

Cho MJ, Mo cicki EK, Narrow WE, Rae DS, Locke BZ, Regier DA. Concordance between two measures of depression in the Hispanic Health and Nutrition Examination Survey. Social Psychiatry and Psychiatric Epidemiology. 1993; 28(4):156–163. [PubMed: 8235801]

CONAPO. Delimitación de las zonas metropolitanas de México 2005. Mexico City: México: Consejo Nacional de Población; 2007.

Docherty G, McNeill A. The hardening hypothesis: does it matter? Tobacco control. 2012; 21(2):267–268. [PubMed: 22345265]

Emery LF, Romer D, Sheerin KM, Jamieson KH, Peters E. Affective and Cognitive Mediators of the Impact of Cigarette Warning Labels. Nicotine & Tobacco Research. 201310.1093/ntr/ntt124

Escobedo LG, Kirch DG, Anda RF. Depression and smoking initiation among US Latinos. Addiction. 1996; 91(1):113–119. [PubMed: 8822019]

Fathelrahman AI, Omar M, Awang R, Borland R, Fong GT, Hammond D, Zain Z. Smokers' responses toward cigarette pack warning labels in predicting quit intention, stage of change, and self-efficacy. Nicotine & Tobacco Research. 2009; 11(3):248–253. [PubMed: 19246625]

Fathelrahman AI, Omar M, Awang R, Cummings KM, Borland R, Samin ASBM. Impact of the new Malaysian cigarette pack warnings on smokers' awareness of health risks and interest in quitting

smoking. International Journal of Environmental Research and Public Health. 2010; 7:4089–4099. [PubMed: 21139879]

Felder JN, Smoski MJ, Kozink RV, Froeliger B, McClernon FJ, Bizzell J, Petty C, Dichter G. Neural mechanisms of subclinical depressive symptoms in women: a pilot functional brain imaging study. BMC Psychiatry. 2012; 12:152. [PubMed: 22998631]

Froeliger B, Modlin LA, Kozink RV, Wang L, McClernon FJ. Smoking abstinence and depressive symptoms modulate the executive control system during emotional information processing. Addiction Biology. 2012; 17:668–679. [PubMed: 22081878]

Fu SS, McFall M, Saxon AJ, Beckham JC, Carmody TP, Baker DG, Joseph AM. Post-traumatic stress disorder and smoking: a systematic review. Nicotine & Tobacco Research. 2007; 9:1071–1084. [PubMed: 17978982]

Garland EL, Froeliger BE, Howard MO. Mindfulness training targets neurocognitive mechanisms of addiction at the attention-appraisal-emotion interface. Frontiers in Psychiatry. 2013; 4:173. [PubMed: 24454293]

Gierisch JM, Bastian LA, Calhoun PS, McDuffie JR, Williams JJW. Smoking cessation interventions for patients with depression: a systematic review and meta-analysis. Journal of General Internal Medicine. 2011; 27:351–360. [PubMed: 22038468]

Gilbert DG, Carlson JM, Riise H, Rabinovich NE, Sugai C, Froeliger B. Effects of nicotine and depressive traits on affective priming of lateralized emotional word identification. Experimental and Clinical Psychopharmacology. 2008; 16:293–300. [PubMed: 18729683]

Gilbert DG, Sugai C, Zuo Y, Rabinovich NE, McClernon FJ, Froeliger B. Brain indices of nicotine's effects on attentional bias to smoking and emotional pictures and to task-relevant targets. Nicotine & Tobacco Research. 2007; 9:351–363. [PubMed: 17365767]

Golding JM, Aneshensel CS, Hough RL. Responses to depression scale items among Mexican-Americans and non-Hispanic Whites. Journal of Clinical Psychology. 1991; 47(1):61–75. [PubMed: 2026780]

Guarnaccia PJ, Angel R, Worobey JL. The factor structure of the CES-D in the Hispanic Health and Nutrition Examination Survey: The influences of ethnicity, gender and language. Social Science & Medicine. 1989; 29(1):85–94. [PubMed: 2740931]

Hammond D. Health warning messages on tobacco products: a review. Tobacco Control. 2011; 20:327–337. [PubMed: 21606180]

Hammond D, Fong GT, Borland R, Cummings KM, McNeill A, Driezen P. Text and graphic warnings on cigarette packages: findings from the international tobacco control four country study. American Journal of Preventive Medicine. 2007; 32:202–209. [PubMed: 17296472]

Hammond D, Fong GT, Mcneill A, Borland R, Cummings KM. Effectiveness of cigarette warning labels in informing smokers about the risks of smoking: findings from the International Tobacco Control (ITC) Four Country Survey. Tobacco control. 2006; 15(suppl 3):iii19–iii25. [PubMed: 16754942]

Hasler G, Drevets WC, Manji HK, Charney DS. Discovering endophenotypes for major depression. Neuropsychopharmacology. 2004; 29:1765–1781. [PubMed: 15213704]

Hu F, Goldberg J, Hedeker D, Flay BR, Pentz MA. Comparison of population-averaged and subject-specific approaches for analyzing repeated binary outcomes. American Journal of Epidemiology. 1998; 147:694–701. [PubMed: 9554609]

Hughes JR. The hardening hypothesis: Is the ability to quit decreasing due to increasing nicotine dependence? A review and commentary. Drug and Alcohol Dependence. 2011; 117:111–117. [PubMed: 21411244]

International Agency for Research on Cancer [IARC]. IARC Handbooks of Cancer Prevention. Vol. 12. World Health Organization; 2008. Methods for Evaluating Tobacco Control Policies.

Keller PA, Lipkus IM, Rimer BK. Depressive realism and health risk accuracy: The negative consequences of positive mood. Journal of Consumer Research. 2002; 29(1):57–69.

Kleinman, A.; Good, B., editors. Culture and depression: Studies in the anthropology and cross-cultural psychiatry of affect and disorder. Vol. 16. University of California Press; 1985.

Kolody B, Vega W, Meinhardt K, Bensussen G. The correspondence of health complaints and depressive symptoms among Anglos and Mexican-Americans. The Journal of Nervous and Mental Disease. 1986; 174(4):221–228. [PubMed: 3958703]

Lee DJ, Markides KS. Health behaviors, risk factors, and health indicators associated with cigarette use in Mexican Americans: results from the Hispanic HANES. American Journal of Public Health. 1991; 81(7):859–864. [PubMed: 2053661]

Leventhal AM, Ramsey SE, Brown RA, LaChance HR, Kahler CW. Dimensions of depressive symptoms and smoking cessation. Nicotine & Tobacco Research. 2008; 10:507–517. [PubMed: 18324570]

Levine SZ. Evaluating the seven-item Center for Epidemiologic Studies Depression Scale short-form: a longitudinal US community study. Social psychiatry and psychiatric epidemiology. 2013; 48(9): 1519–1526. [PubMed: 23299927]

Moore MT, Fresco DM. Depressive realism: A meta-analytic review. Clinical Psychology Review. 2012; 32(6):496–509. [PubMed: 22717337]

Moscicki EK, Locke BZ, Rae DS, Boyd JH. Depressive symptoms among Mexican Americans: The Hispanic health and nutrition examination survey. American Journal of Epidemiology. 1989; 130(2):348–360. [PubMed: 2750730]

Mutti S, Hammond D, Reid J, Thrasher J. The efficacy of cigarette warning labels on health beliefs in the United States and Mexico. Journal of Health Communication. 2013; 18:1180–1192. [PubMed: 23905611]

Myers HF, Lesser I, Rodriguez N, Mira CB, Hwang WC, Camp C, Anderson D, Lucy E, Wohl M. Ethnic differences in clinical presentation of depression in adult women. Cultural Diversity and Ethnic Minority Psychology. 2002; 8:138. [PubMed: 11987591]

Newman-Norlund R, Thrasher J, Fridrikson J, Brixius W, Froeliger B, Hammond D, Cummings M. Neural biomarkers for assessing the effects of different types of imagery in pictorial health warning labels on cigarette packaging. BMJ Open. 201410.1136/bmjopen-2014-006411

PAHO-INSP. Encuesta Global de Tabaquismo en Adultos, Mexico 2009. Cuernvaca: Instituto Nacional de Salud Pública; 2010. Available at http://www.who.int/tobacco/surveillance/gats_rep_mexico.pdf

Pratt, L.; Brody, D. NCHS data brief. Hyattsville, MD: National Center for Health Statistics; 2010. Depression and smoking in the U.S. household population aged 20 and over, 2005–2008.

Salinas-Rodríguez A, Manrique-Espinoza B, Acosta-Castillo I, Téllez-Rojo MM, Franco-Núñez A, Gutiérrez-Robledo LM, Sosa-Ortiz AL. Validación de un punto de corte para la Escala de Depresión del Centro de Estudios Epidemiológicos, versión abreviada (CESD-7). salud pública de méxico. 2013; 55(3):267–274. [PubMed: 23912539]

Slone LB, Norris FH, Murphy AD, Baker CK, Perilla JL, Diaz D, Gutiérrez Rodriguez F, de Jesús Gutiérrez Rodriguez J. Epidemiology of major depression in four cities in Mexico. Depression and Anxiety. 2006; 23(3):158–167. [PubMed: 16453336]

Swayampakala K, Thrasher JF, Hammond D, Yong HH, Bansal-Travers M, Krugman D, Brown A, Borland R, Hardin J. Pictorial health warning label content and smokers' understanding of smoking-related risks–A cross-country comparison. Health Education Research. 201410.1093/her/cyu022

Thrasher JF, Villalobos V, Szklo A, Fong GT, Pérez C, Sebrié E, Sansone N, Figueiredo V, Boado M, Arillo-Santillán E, Bianco E. Assessing the impact of cigarette package health warning labels: a cross-country comparison in Brazil, Uruguay and Mexico. Revista de Salud Pública de México. 2010; 52:S206–S215.

Thrasher JF, Pérez-Hernández R, Arillo-Santillán E, Barrientos-Gutierrez I. Towards informed tobacco consumption in Mexico: Effects of pictorial warning labels among smokers. Revista de Salud Pública de México. 2012; 54:242–253.

Thrasher, JF.; Reynales-Shigematsu, L.; Lazcano-Ponce, E.; Hernández-Ávila, M., editors. Public health & tobacco: Warning labels en Latin America and the Caribbean. Vol. 2. Cuernavaca, México: Instituto Nacional de Salud Pública; 2013.

Thrasher JF, Osman A, Moodie C, Hammond D, Bansal-Travers M, Cummings KM, Borland R, Yong HH, Hardin J. Promoting cessation resources through cigarette package warning labels: a

longitudinal survey with adult smokers in Canada, Australia and Mexico. Tobacco Control. 2014 Published Online First July 22, 2014. 10.1136/tobaccocontrol-2014-051589

Urdapilleta-Herrera E, Sansores R, Ramírez-Venegas A, Méndez-Guerra M, Lara-Rivas A, Guzmán-Barragán S, Ayala-Guerrero F, Haro-Valencia R, Cansino S, Moreno-Coutiño A. Anxiety and depression in Mexican smokers, and their relationship with the severity of addiction. Salud Publica de Mexico. 2010; 52:S120–S128. [PubMed: 21243182]

USAID. Poverty Assessment Tool. USAID/IRIS Tool for Mexico. 2011. Available at http://www.povertytools.org/countries/Mexico/Mexico.html

Vangeli E, Stapleton J, Smit ES, Borland R, West R. Predictors of attempts to stop smoking and their success in adult general population samples: a systematic review. Addiction. 2011; 106(12):2110–21. [PubMed: 21752135]

World Health Organization [WHO]. Tobacco Free Initiative. Geneva, Switzerland: 2003. Framework Convention on Tobacco Control.

World Mental Health Survey Consortium. Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. JAMA: the journal of the American Medical Association. 2004; 291(21):2581–2590. [PubMed: 15173149]

Yong, HH.; Borland, R.; Thrasher, JF.; Thompson, ME.; Nagelhout, G.; Fong, GT.; Hammond, D.; Cummings, KM. Mediational pathways of the impact of cigarette warning labels on quit attempts: An application of the International Tobacco Control (ITC) Conceptual Model. Health Psychology. 2014. Advance online publication, http://dx.doi.org/10.1037/hea0000056
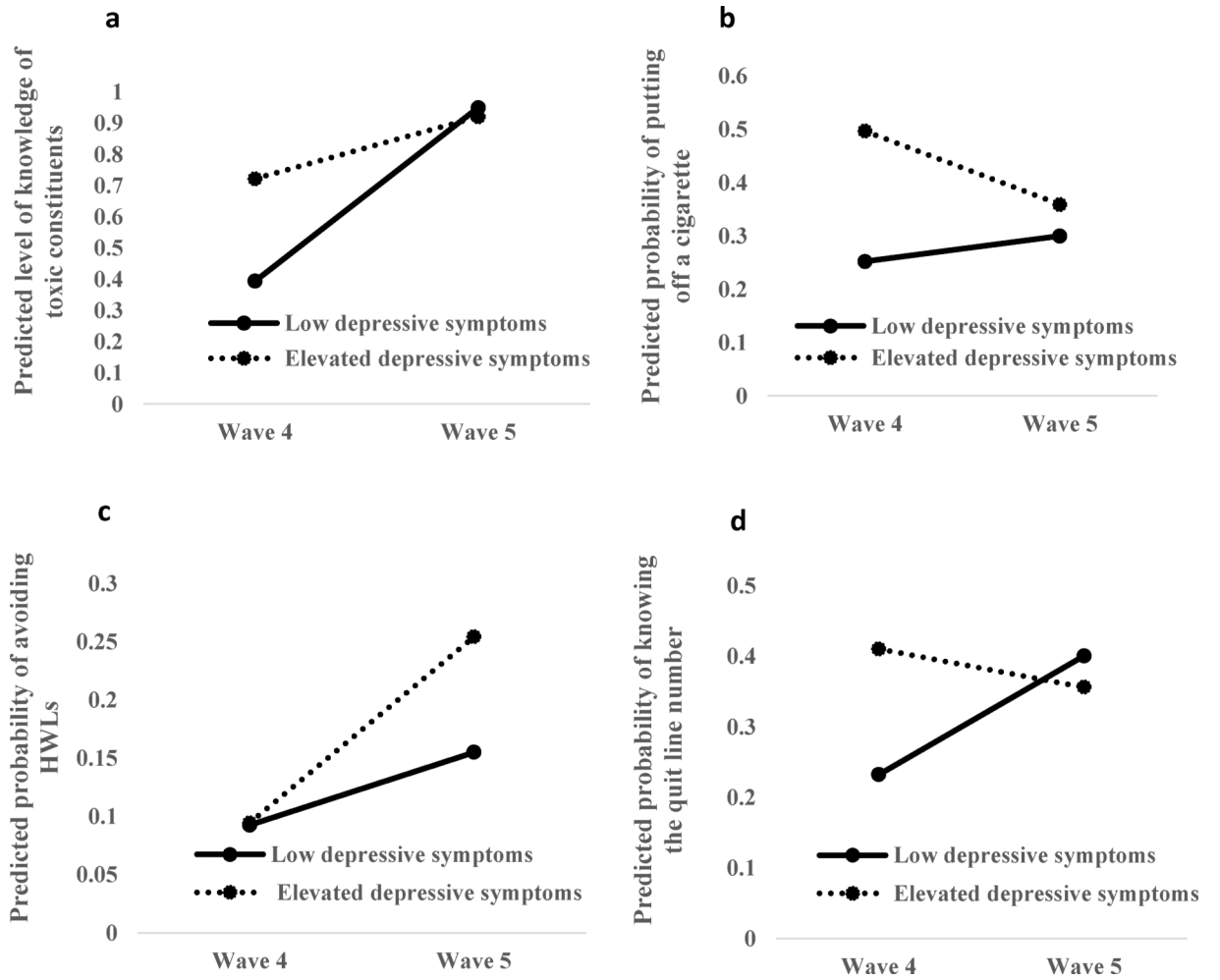
Figure 1.
Predicted means, by survey wave and depressive symptoms for: (a) Knowledge of toxic tobacco constituents included on HWLs (Table 4, Model 3). Predicted probabilities, by survey wave and depressive symptoms (Table 5, Model 3) for (b) Putting off smoking because of HWLs; (c) Avoidance of HWLs (d) Awareness of quit line number included on HWLs: Wave 4 (2010) and Wave 5 (2011), International Tobacco Control Policy Evaluation Survey in Mexico (ITC Mexico).

Table 1

Examples of pictorial health warning labels displayed on the front (image) and back (text warning) of cigarette packs, Mexico, 2010
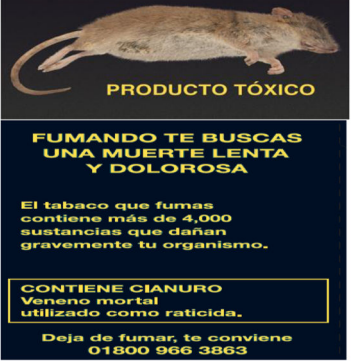
Pictorial warning	Translation to English
	Smoking kills you … and not only you SMOKE FROM YOUR TOBACCO ALSO HURTS YOUR CHILDREN. By smoking you make breathing difficult for children and cause them to have severe respiratory diseases. CONTAINS TAR Toxic particulate that causes cancer. You should quit smoking 01800 966 3863
	Stop smoking now, later will be too late. BY SMOKING, YOU INCREASE BY TWENTY TIMES YOUR CHANCE OF DYING FROM LUNG CANCER. 90% of lung cancer deaths are among people who smoked like you. CONTAINS AMMONIA A toxic substance that facilitates the absorption of nicotine, which increases your addiction. You should quit smoking 01800 966 3863
	Toxic product. BY SMOKING, YOU FIND A SLOW AND PAINFUL DEATH. The tobacco you smoke contains more than 4000 substances that seriously hurt your body. CONTAINS CYANIDE A lethal poison used to kill rats. You should quit smoking 01800 966 3863

Table 2

Sample characteristics of adult smokers, International Tobacco Control Policy Evaluation Survey, Mexico, Wave 4 (2010), raw estimates

	% or Mean (SD)
Age (mean, SD)	40 (14.8)
Age groups (years)	
18–24	16
25–39	37
40–54	30
55 or more	17
Sex	
Male	62
Female	38
Education	
Primary or less	36
Middle school	30
Vocational school	6
High school or incomplete university	19
University or more	9
Income [a]	
0–3000 pesos	28
3001–5000 pesos	26
5001–8000 pesos	21
8001 pesos or more	18
Don't know	7
Cigarettes per day	
Non-daily cigarette consumption	30
Daily consumption, 1–4 cigarettes per day	21
Daily consumption, 5–9 cigarettes per	23
Daily consumption, 10 cigarettes or more per day	26
Quit intention	
No	84
Yes	16
Quit attempt	
No	66
Yes	34
Time in sample	
Recruited in Wave 5	0
Recruited in Wave 4	43
Recruited in Wave 3	33
Recruited in Wave 2	4
Recruited in Wave 1	20

	% or Mean (SD)
Depressive symptoms (mean, SD) [b]	3.54 (4.0)
Low	81
Elevated	19

Note. n=1340 individuals, n=2680 observations;

[a]Exchange rate: $1USD=13 Mexican pesos; Income amount = pesos per month.

[b]The cut off point for low DS versus elevated DS was ≥ 7 at both waves using the CES-D7 scale.

Table 3

Odds Ratios (OR) from mixed effects logistic regression models examining correlates of elevated depressive symptoms among smokers, International Tobacco Control Policy Evaluation Survey, Mexico, 2010–2011, weighted estimates

Independent variables		Bivariate		Multivariate	
		OR	[95% CI]	OR	[95% CI]
Survey wave	4 (year 2010)	1.00	-	1.00	-
	5 (year 2011)	0.60 ***	[0.48, 0.76]	0.65 ***	[0.51, 0.81]
Age group	18–24	1.00	-	1.00	-
	25–39	0.87	[0.60, 1.27]	0.76	[0.52, 1.22]
	40–54	1.19	[0.81, 1.74]	0.94	[0.63, 1.40]
	55 or more	1.42	[0.93, 2.19]	1.01	[0.63, 1.60]
Sex	Female	1.00	-	1.00	-
	Male	0.55 ***	[0.42, 0.72]	0.42 ***	[0.31, 0.56]
Education	Primary or less	1.00	-	1.00	-
	Middle school	0.73 *	[0.54, 0.99]	0.84	[0.60, 1.17]
	Vocational school	0.49 *	[0.29, 0.84]	0.57	[0.32, 1.01]
	High school or incomplete	0.56 **	[0.39, 0.81]	0.72	[0.48, 1.07]
	University or more	0.27 ***	[0.16, 0.47]	0.39 **	[0.21, 0.73]
Income	0–3000 pesos	1.00	-	1.00	-
	3001–5000 pesos	0.71 *	[0.54, 0.96]	0.82	[0.60, 1.12]
	5001–8000 pesos	0.39 ***	[0.27, 0.57]	0.52 ***	[0.35, 0.77]
	8001 pesos or more	0.34 ***	[0.22, 0.51]	0.46 ***	[0.29, 0.72]
	Don't know	0.79	[0.46, 1.32]	0.94	[0.55, 1.60]
Cigarettes per day	Non-daily cigarette consumption	1.00	-	1.00	-
	Daily consumption, 1–4 cigarettes per day	0.84	[0.58, 1.20]	0.82	[0.60, 1.12]
	Daily consumption, 5–9 cigarettes per day	1.17	[0.84, 1.64]	1.27	[0.90, 1.81]
	Daily consumption, 10 cigarettes or more per day	1.76 **	[1.26, 2.46]	1.92 ***	[1.35, 2.73]
Quit intention	No	1.00	-	1.00	-
	Yes	1.21	[0.88, 1.66]	1.39	[0.99, 1.94]
Quit attempts	No	1.00	-	1.00	-

Independent variables	Bivariate		Multivariate	
	OR	[95% CI]	OR	[95% CI]
Yes	1.23	[0.95, 1.59]	1.19	[0.91, 1.56]
Time in sample	0.75 ***	[0.65, 0.85]	0.83 **	[0.62, 0.82]

Note. n=1340 individuals, n=2680 observations. The cut off point for low DS versus elevated DS was 7 at both waves using the CES-D7 item scale. Income amount = pesos per month. Multivariate analysis adjusts for all variables in the table.

*
p<.05;

**
p<.01;

***
p<.001

Table 4

Mixed effects linear regression models of the association between survey wave, depressive symptoms, and responses to health warning labels among smokers, International Tobacco Control Policy Evaluation Survey, Mexico, 2010–2011, weighted estimates

	Model 1 Bivariate		Model 2 Main Effect Model		Model 3 Interaction Model	
	b	(SE)	b	(SE)	b	(SE)
Attention to HWLs						
Survey wave						
4	-		-		-	
5	0.15***	(0.03)	0.16***	(0.03)	0.18***	(0.04)
Depressive symptoms						
Low	-		-		-	
Elevated	0.13**	(0.04)	0.15**	(0.04)	0.19**	(0.05)
Survey wave X depressive symptoms					-0.09	(0.08)
Cognitive response to HWLs						
Survey wave						
4	-		-		-	
5	0.21***	(0.03)	0.23***	(0.03)	0.25***	(0.04)
Depressive symptoms						
Low	-		-		-	
Elevated	0.21***	(0.05)	0.22***	(0.04)	0.27***	(0.06)
Survey wave X depressive symptoms					-0.12	(0.09)
Awareness of tobacco constituents contained on HWLs						
Survey wave						
4	-		-		-	
5	0.49***	(0.05)	0.50***	(0.05)	0.55***	(0.05)
Depressive symptoms						
Low	-		-		-	
Elevated	0.07	(0.07)	0.17*	(0.07)	0.33**	(0.09)
Survey wave X depressive symptoms					-0.36*	(0.15)

Note. n=1340 individuals, n=2680 observations. HWLs – Health warning labels. The cut off point for low DS versus elevated DS was ≤ 7 at both waves using the CES-D7 scale. All main effect and interaction models adjust for age, sex, educational attainment, monthly household income, cigarettes per day, quit intention, quit attempt, and time in sample.

*
  p<.05;

**
  p<.01;

***
  p<.001

Table 5

Mixed effects logistic regression models of the association between survey wave, depressive symptoms, and responses to health warning labels among smokers, International Tobacco Control Policy Evaluation Survey, Mexico, 2010–2011, weighted estimates

	Model 1 Bivariate		Model 2 Main Effect Model		Model 3 Interaction Model	
	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]
Putting off smoking because of HWLs						
Survey wave						
4	1.00		1.00		1.00	
5	1.09	[0.92, 1.29]	1.11	[0.94, 1.32]	1.29 **	[1.07, 1.56]
Depressive symptoms						
Low	1.00		1.00		1.00	
Elevated	2.44 ***	[1.90, 3.13]	2.22 ***	[1.73, 2.84]	3.25 ***	[2.35, 4.49]
Survey wave X depressive symptoms					0.41 ***	[0.25, 0.66]
Avoidance of HWLs						
Survey wave						
4	1.00		1.00		1.00	
5	1.95 ***	[1.57, 2.41]	2.02 ***	[1.62, 2.51]	1.81 **	[1.17, 1.90]
Depressive symptoms						
Low	1.00		1.00		1.00	
Elevated	1.37 *	[1.03, 1.82]	1.42 *	[1.06, 1.90]	1.02	[0.66, 1.58]
Survey wave X depressive symptoms					1.84 *	[1.03, 3.29]
Awareness of quit line number contained on HWLs						
Survey wave						
4	1.00		1.00		1.00	
5	1.87 ***	[1.58, 2.20]	1.90 ***	[1.60, 2.24]	2.24 ***	[1.86, 2.70]
Depressive symptoms						
Low	1.00		1.00		1.00	
Elevated	1.31 *	[1.03, 1.65]	1.48 **	[1.15, 1.89]	2.34 ***	[1.70, 3.22]
Survey wave X depressive symptoms					0.35 ***	[0.21, 0.56]

Note. n=1340 individuals, n=2680 observations. HWLs – Health warning labels. The cut off point for low DS versus Elevated DS was ≥7 at both waves using the CES-D7 scale. All main effect and interaction models adjust for age, sex, educational attainment, monthly household income, cigarettes per day, quit intention, quit attempt, and time in sample.

*
p<.05;

**
p<.01;

***
p<.001