Evaluating the perceived effectiveness of pregnancy-related cigarette package health warning labels among different gender/age groups

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Abstract

Introduction—The impact of pregnancy-related health warning labels (HWLs) appearing on cigarette packages on women of reproductive age and other socio-demographic groups is not well understood. The current study analyzes how different age/gender groups respond to pregnancy-related HWLs as compared to non-pregnancy HWLs.

Methods—Data were analyzed from four waves of an online longitudinal study with adult smokers aged 18-64 in Australia, Canada, Mexico, and the US. Participants were classified into four age\gender groups: women 40 and under; men 40 and under; women over 40; men over 40. Participants rated one pregnancy-related and several non-pregnancy related labels on worry, believability, and motivation to quit. Country-specific adjusted linear GEE were estimated regressing ratings for each of the three key outcomes for 1) pregnancy-related HWLs and 2) a rating difference score that subtracted the average ratings of the non-pregnancy warning from the rating of the pregnancy warning. All models adjusted for socio-demographics and smoking related variables.

Results—In Mexico and Australia, where graphic pregnancy-related HWL imagery is used (i.e., premature infant), women of reproductive age reported stronger believability, worry, and quit motivation than all other groups. Results were similar in the US, where text only HWLs are used. In contrast in Canada, where the pregnancy-related HWL imagery features a pregnant woman, ratings were unassociated with gender/age groups. Stronger effects among women of reproductive age were limited to pregnancy HWLs in each country, except Canada.

Conclusions—HWLs that depict graphic effects to illustrate smoking-related pregnancy risks appear to be perceived as particularly effective among women of reproductive age.

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Introduction

The possible effects on fetal health from smoking during pregnancy are well documented and range from low birth weight to stillbirth (WHO, 2013). Rates of self-reported smoking during pregnancy vary widely between countries with 5-8% in Mexico (Frank et al., 2004; Sánchez-Zamorano et al., 2004), 10% in the United States (US) (CDC 2015), 13% in Australia (Li et al., 2013), and 23% in Canada (Cui et al., 2014). Some women who smoke while pregnant, however, attempt to conceal this behavior due to social stigma and social desirability (Borland et al., 2013; Wigginton & Lee, 2013). Hence, reported smoking rates may be higher due to nondisclosure of smoking behavior, which has been documented among pregnant women (Dietz et al., 2010; Shipton et al, 2009). Cigarette package health warning labels (HWLs) that address the harmful effects of smoking during pregnancy and promote resources for smoking cessation could motivate women to quit during pregnancy or better still, before they become pregnant.

Prior studies have examined smokers' first-time responses to pictorial HWLs with pregnancy imagery (Cantrell et al., 2013; Hammond et al., 2012; O'Hegarty et al., 2006; Peters et al., 2007; Vardarvas et al., 2009), but these studies differ from naturalistic exposures, where smokers are repeatedly exposed to warnings on cigarette packs. Moreover, no studies of which we are aware have evaluated smoker's responses to text based cigarette package warning labels that address smoking during pregnancy. The current paper examines smoker's responses to pregnancy and non-pregnancy related warning labels, both in countries where warning labels include prominent pictures (Australia, Canada, Mexico) and where warnings are small and include only text (US) after the warnings have been included on cigarette packaging. As such, this study advances prior research by providing an assessment of the perceived efficacy of warning labels that smokers have been repeatedly exposed to under naturalistic conditions.

Pregnancy-related HWLs

Several experimental studies evaluating the perceived effectiveness of pictorial HWLs compared to text only HWLs have included pregnancy-themed content as one of several test labels (Cantrell et al., 2013; Hammond et al., 2012; O'Hegarty et al., 2006; Peters et al., 2007; Vardarvas et al., 2009). In all of these studies, pictorial HWLs were perceived as more effective than text only warnings. These images also seem to resonate with youth and adults regardless of cultural background. For example, in studies in the US (Peters et al., 2007), Brazil (Nascimento et al., 2008) and Greece (Vardarvas et al., 2009), adults and/or adolescents ranked pregnancy-related HWLs as more effective and/or aversive than other pictorial HWLs. None of these studies, however, exposed participants to the same HWL imagery that currently appeared on cigarette packages in the country in which participants resided. A limited number of qualitative studies in Australia have assessed the impact of the pregnancy-related HWLs appearing on cigarettes packages (Gould et al., 2013; Hauck et al.,

2013; Miller et al., 2011). Findings indicate that some pregnant women attribute their knowledge of the negative health effects of smoking during pregnancy to the pictorial HWLs (Gould et al., 2013; Hauck et al., 2013). These studies did not address, however, the impact of pregnancy-related HWLs on perceptions of smoking or quit motivation.

HWL policy context in Australia, Canada, Mexico, and the US

Smokers in Canada, Australia, and Mexico are exposed to information about the harms of smoking during pregnancy through pictorial HWLs, whereas only text-based HWLs are on packs in the US. Three of the four countries included in the current study had implemented new pregnancy-related pictorial content 3-5 months before data collection. Warning labels in the US have remained the same since 1985. Canada first implemented pictorial HWLs in 2001 and introduced its second round of warnings in 2012. One of the new HWLs featured a pregnant woman and replaced imagery of a baby in ICU. Australia implemented HWLs in 2006 and introduced a new round of imagery in December of 2012. The new pregnancy related HWL featured a baby in an ICU, which was similar to the old image yet depicted a close up of the baby. Mexico first implemented HWLs in 2010 and has the most rapid rotation of new HWL content in the world, introducing new content every 6 months. The most recent pregnancy-related image featured a low birth weight infant in an ICU and started appearing on cigarette packs in late 2012.

Study Aims

To be most effective, pregnancy-related HWLs should target women of reproductive age but their impact on this and other socio-demographic groups is not well understood. Indeed, targeting to specific populations through HWLs could potentially weaken overall HWL effects among other audiences that are not specifically targeted (e.g., males, older women). Therefore this study had two objectives: 1) To determine whether women of reproductive age (<=40) are more responsive to pregnancy-related HWLs than other age/gender groups (i.e., men <= 40, women > 40, men > 40); and 2) To determine whether pregnancy-related HWLs are perceived as more effective than non-pregnancy related HWLs among women of reproductive age as compared to other age/gender groups. We hypothesized that women of reproductive age would be more responsive to HWLs with pregnancy-related content regardless of the type of imagery and/or text featured in the HWL.

Methods

Sample

Data were drawn from a longitudinal survey of adult smokers recruited from Global Market Insights (GMI: www.gmi-mr.com) online consumer panels in Canada, Australia, the US, and Mexico. Recruitment of participants in each country involved sending invitations to panel participants who were of eligible age and who were known smokers, as well as from general population samples for which smoking status was unknown. Eligible participants were smokers aged 18 to 64 years, who have smoked at least 100 cigarettes in their lifetime, and have smoked at least once in the prior month. Response rates to invitation emails in each country at each wave ranged between 13%-19%. In each country, approximately 1,000 people participated in each wave of data collection, with an additional oversample of 400

Latinos in the US to allow for comparisons with Mexico. Follow-up rates from prior waves ranged from 49%-69%, and new participants were recruited at each wave to maintain the sample size in each country over time. For the current analysis, waves 1 and 2 for Canada (September 2012 and January 2013), waves 2 and 3 for the US (January 2013 and May 2013), and waves 3 and 4 for Australia and Mexico (May 2013 and September 2013), were analyzed. Waves of data used in the analysis were chosen so as to coincide with the timing of pregnancy-related HWL implementation in each country to allow for more comparable data. For example, for Canada, Australia, and Mexico, the first wave of data included in the analysis was 3 to 5 months after new pictorial HWLs with pregnancy imagery were implemented. For the US, no HWL changes were implemented around the time of data collection and therefore the first waves of data collection for the US were included.

Health warning labels (HWLs)

Participants were shown and asked to respond to 4-8 cigarette pack HWLs (presented in random order) that appeared on packs in their respective countries. Participants in Canada, Australia, and Mexico were shown one pictorial pregnancy-related HWL (Figure 1) in addition to several non-pregnancy-related pictorial HWLs. These HWLs included content on: bladder cancer, blindness, emphysema, heart disease, lung cancer, oral cancer, throat cancer in Canada; blindness, emphysema, gangrene, lung cancer, oral cancer in Australia; and emphysema, lung cancer, gangrene, oral cancer, and throat cancer in Mexico.

In the U.S., participants were shown all four text only HWLs that have been on packs since 1985. One discusses the effects of smoking during pregnancy (Figure 1). The label that states "Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy" was excluded from the current analyses since it discussed pregnancy and other health effects simultaneously.

Measures

Dependent variables—After viewing each HWL participants reported responses ranging from 1 (not at all) to 9 (extremely) on the extent to which the HWL: 1) made them feel worried about the health risks of smoking; 2) was believable; and 3) made them likely to quit. Since participants viewed multiple non-pregnancy related HWLs in each country, an average rating for 1) worry; 2) believability; and 3) quit motivation was created across these HWLs. The internal consistency of responses on each question across all non-pregnancy HWLs was high (i.e., alpha > .91 in Canada, Australia, and Mexico, and alpha > .86 in the US). The pregnancy related HWLs ratings were not averaged as the analysis only included responses to one pregnancy HWL per country.

Independent variable—Participants reported their age in years and their gender (0=male, 1=female). Participants were considered of reproductive age if they were 40 years old or younger. Using data on age and gender, participants were classified into four age\gender groups: women 40 or younger; men 40 or younger; women over 40; and men over 40. Women of reproductive age (i.e., 40 or younger) were treated as the reference group in all analyses. The 40 or younger age range was chosen to represent "reproductive age" since it captured the majority of women considered to be in their childbearing years by international

standards (NAPHSIS; 2012), and it provided a relatively even distribution of women in this age group across countries (see Table 1).

Sociodemographic and smoking related variables—Demographic variables included education; annual household income in Canada, Australia and the US and monthly household income in Mexico; living with minors <18; and partnership status. Smoking behaviors included quit intentions, quit attempts, and the "Heaviness of Smoking Index" (HSI) (Heatherton et al., 1989). Daily and nondaily smokers were also distinguished, as our sample included many nondaily smokers who had low HSI scores. Dummy variables were created for survey wave with baseline wave treated as the reference group (i.e., Wave I for Canada, Wave II for the US, and Wave III was the reference group for Australia and Mexico). Lastly, to adjust for potential effects from prior participation in the study, a variable was created to indicate the number of prior surveys to which the participant had responded (i.e., 0=no prior surveys; 1=one prior survey; 2=two prior surveys).

Statistical analysis

A series of Generalized Estimating Equation (GEE) models were estimated to allow for pooling of data across waves while accounting for correlation of ratings for individuals who provided two observations. In all analyses, women of reproductive age (i.e., 40 or younger) served as the comparison group. To determine whether women of reproductive age (<=40) were more responsive to pregnancy-related HWLs than the other age/gender groups, country-specific linear GEE models were estimated regressing ratings for each of the three key outcomes (i.e., worry, believability, and motivation to quit) when presented with the pregnancy HWLs on the age\gender groups. These models adjusted for sociodemographic and smoking related variables as well as the average rating of the non-pregnancy HWLs on each of the outcomes, respectively. Results from those models are reported in Figure 2 in terms of predicted marginal means of each outcome.

To determine whether the pregnancy HWLs were more effective than the non-pregnancy related warnings among women of reproductive age compared to the other age/gender groups, a "rating difference score" by subtracting the average rating of the non-pregnancy warnings from the rating of the pregnancy warning on each of the key outcomes (i.e., worry, believability, and motivation to quit) was created. This variable was then dichotomized into 1 = smokers who rated the pregnancy warning higher than the non-pregnancy warnings (i.e., had a positive difference score) and 0 = smokers who rated the pregnancy warning lower than or equal to the non-pregnancy warnings (i.e., had a zero or negative difference score). Adjusting for sociodemographic and smoking related variables, country specific logistic GEE models were estimated to assess whether women of reproductive age were more or less likely to rate the pregnancy warning higher than the non-pregnancy warning compared to all other age\gender groups. The results from these models are reported in Figure 3 in terms of marginal predicted probabilities of rating the pregnancy warning higher than the non-pregnancy warnings on each of the outcomes. All analyses were conducted using Stata version 13.1.

Results

Sample characteristics

Across countries there was a relatively equal distribution of participants in each of the four age\gender groups (Table 1). Compared to Canada, Australia, and the US, Mexico's sample appears to have lower proportion of women over 40, and higher proportions of participants with higher levels of education and participants with minors living in the home. The Mexican sample also had the lowest % of daily smokers.

Ratings of worry because of the pregnancy HWL—In models for Canada, there were no statistically significant differences between women of reproductive age and all other age\gender groups in their ratings of the pregnancy HWL on worry (Figure 2A). In Australia, compared to women of reproductive age (Mean 4.8), older women and men rated the pregnancy HWL as less worrisome (Mean 4.1 and 4.0, respectively). In both the U.S and Mexico, all age/gender groups had significantly lower worry ratings for the pregnancy HWL than women of reproductive age.

Ratings of believability of the pregnancy HWL—In Canada, only men over 40 rated the pregnancy HWLs as significantly less believable than women of reproductive age (Figure 2B). In both Australia and the US, all age/gender groups rated the pregnancy HWL as significantly less believable than women of reproductive age. In Mexico, young and older men reported the pregnancy HWL as less believable than women of reproductive age.

Ratings of motivation to quit because of the pregnancy HWL—In Canada, there were no statistically significant differences in the rating of the pregnancy HWL on quit motivation between women of reproductive age and the other age/gender groups (Figure 2C). In models for Australia, men and women over 40 rated the pregnancy HWL as significantly less motivating to quit (Mean 3.7 and 3.6, respectively) compared to women of reproductive age (Mean 4.5). In the US and Mexico, all age\gender groups had significantly lower ratings of the pregnancy HWL on quit motivation than women of reproductive age.

Ratings of worry because of HWLs—In Canada, all age/gender groups were equally likely to rate the pregnancy warning as more worrisome than the non-pregnancy warnings (Figure 3A). In Australia, young women (40 or younger) were more likely than men and women over 40 to rate the pregnancy warning as more worrisome than the non-pregnancy warnings. In both the US and Mexico, young women (40 or younger) were more likely than all other age/gender groups to rate the pregnancy warning as more worrisome than the non-pregnancy warnings (Figure 3A).

Ratings of believability of HWLs—In Canada, women of reproductive age were as likely as men and women over 40 to rate the pregnancy warning as more believable than the non-pregnancy warnings (Figure 3B). In all other countries (Australia, the US, and Mexico) women of reproductive age were more likely than all other age/gender groups to rate the pregnancy warning as more believable than the non-pregnancy warnings (Figure 3B).

Ratings of motivation to quit because of HWLs—In Canada, women of reproductive age were more likely than women over 40 to rate the pregnancy warning as more motivating to quit than the non-pregnancy warnings (Figure 3C). In Australia, women of reproductive age were more likely than men and women over 40 to rate the pregnancy warning as more motivating to quit than the non-pregnancy warnings. In both the US and Mexico, young women (40 or younger) were more likely than all other age/gender groups to rate the pregnancy warning as more motivating to quit than the non-pregnancy warnings (Figure 3C).

Discussion

The results from this study suggest that pictorial HWLs meant to demonstrate the risks of smoking during pregnancy by featuring more graphic imagery (premature ICU infant), as in Australia and Mexico, are effectively targeting women of reproductive age. This study also suggests that HWLs featuring more symbolic imagery (pregnant women), such as the Canadian HWL, are not as effective in targeting women of reproductive age. In the context of the US, which currently only uses a small variety of text based warnings; the pregnancy-related text also effectively targets women of reproductive age. In Mexico, Australia, and the US women of reproductive age rated the pregnancy HWL higher than men and women over 40 with regard to reporting greater worry about smoking-related risks and motivating them to quit. A potential drawback to this targeting is that other audiences may disregard these warnings.

The findings that women are more responsive to pregnancy-related HWLs than men are consistent with previous research. Two of the five experimental studies that included pregnancy-related HWLs reported on gender differences and found that women were significantly more likely than men to rate the pregnancy HWL as the most effective label (O'Hegarty et al., 2006; Vardavas et al., 2009) or agree that it would make them quit or remain abstinent (O'Hegarty et al., 2006). Both of these studies used a text plus graphic HWL of an ICU infant. The HWLs employed in all of these studies were novel stimuli for participants, which could have increased participants' reported impact. However, results from the current study suggest that repeated exposure to the pregnancy HWLs does not necessarily diminish their impact. Furthermore, an additional finding, not adequately explored in prior research, was that not all women are equally responsive to pregnancy HWLs, and this responsiveness varied by age. Compared to younger women, women over 40 rated the pregnancy HWL lower on worry and quit motivation in Australia, the US, and Mexico, and lower on believability in Australia and the US.

In order to understand why the graphic pictorial HWLs effectively targeted women of reproductive age, it may be important to consider how the message is framed and depicted. The image of the pregnant woman's abdomen in the Canadian HWL does not illustrate smoking risks, whereas the ICU infant presents a graphic depiction of the physical effects. In other studies, more graphic HWL imagery has been rated as more effective than more abstract representations of risk (Hammond et al., 2012; Thrasher et al., 2012). For example, one of the proposed Food and Drug Administration (FDA) images for HWLs in the US is an ICU infant although it is a cartoon rather than real image. This specific image has already received negative feedback in one focus group study in the US (Reiter et al., 2012). A HWL

with a graphic image of an infant in ICU infant, similar to the pre-existing Australian or Mexican HWLs included in this study, has been rated as more effective than the proposed FDA image in one experiment (Hammond et al., 2013), suggesting that realistic imagery is important. This conclusion is also supported through a focus group based study among US based women of reproductive age, which found participants were more responsive to a real image over a medical illustration on HWLs that demonstrated the risks of smoking during pregnancy (Levis et al., 2014).

These conclusions should be interpreted in the light of the study's limitations. This study does not assess how responses to HWLs are related to subsequent behavior change. Future research may explore this possibility, although countries implement multiple HWLs and so determination of the effectiveness of one HWL compared to others may be difficult to disentangle. An additional limitation is that pregnancy status of participants was unknown, so this study did not evaluate how pregnant women respond to pregnancy-related HWLs and whether they are even more effective for this group than for other women of reproductive age. Future research could specifically focus on pregnant women aged 40 or younger, although our results suggest that women of reproductive age as a whole generally have stronger responses to pregnancy-related HWLs than other groups. Finally, this study used online consumer panels with unknown sampling frames and therefore the results may not be representative of the general population of smokers in each country. In general, however, the Canadian, Australian, and US samples are more similar to the general population of smokers than the Mexican sample, which was significantly more well educated then the general population. Smoking, however, is higher among Mexican women from higher than lower socioeconomic status groups (Buttenheim et al., 2010), so the results may still be relatively representative of female Mexican smokers. Moreover, results from a sensitivity analyses in which we weighted the data to age, sex, and educational profiles of smokers from each country reveal similar results to those unweighted.

Conclusions

Despite these limitations the results of this study can provide useful information to countries in the midst of developing cigarette package HWLs, such as the US, or for other countries currently considering which HWLs to add or keep in rotation on packages. For example, from 2001 to 2012, Canada had a HWL with an ICU infant image and text warning similar to Australia, and they may consider bringing that image back into circulation. For Canadian participants responding to the image of the pregnant woman, there were few differences observed in the perceived effectiveness of the pregnancy HWL across the age/gender groups, whereas in all other countries women of reproductive age appear more responsive to pregnancy themed HWLs than similar age men and older men and women. This study suggests that pregnancy HWLs, if designed effectively, could strengthen beliefs about the dangers of smoking during pregnancy or provide quit motivation for women of reproductive age.

Acknowledgments

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Highlights

- Pregnancy-related HWLs with graphic imagery in Mexico and Australia effectively target women of reproductive age

- Pregnancy-related HWL with symbolic imagery in Canada do not effectively target women of reproductive age

- In the US where text based HWLs are used, the pregnancy-related HWL targets women of reproductive age
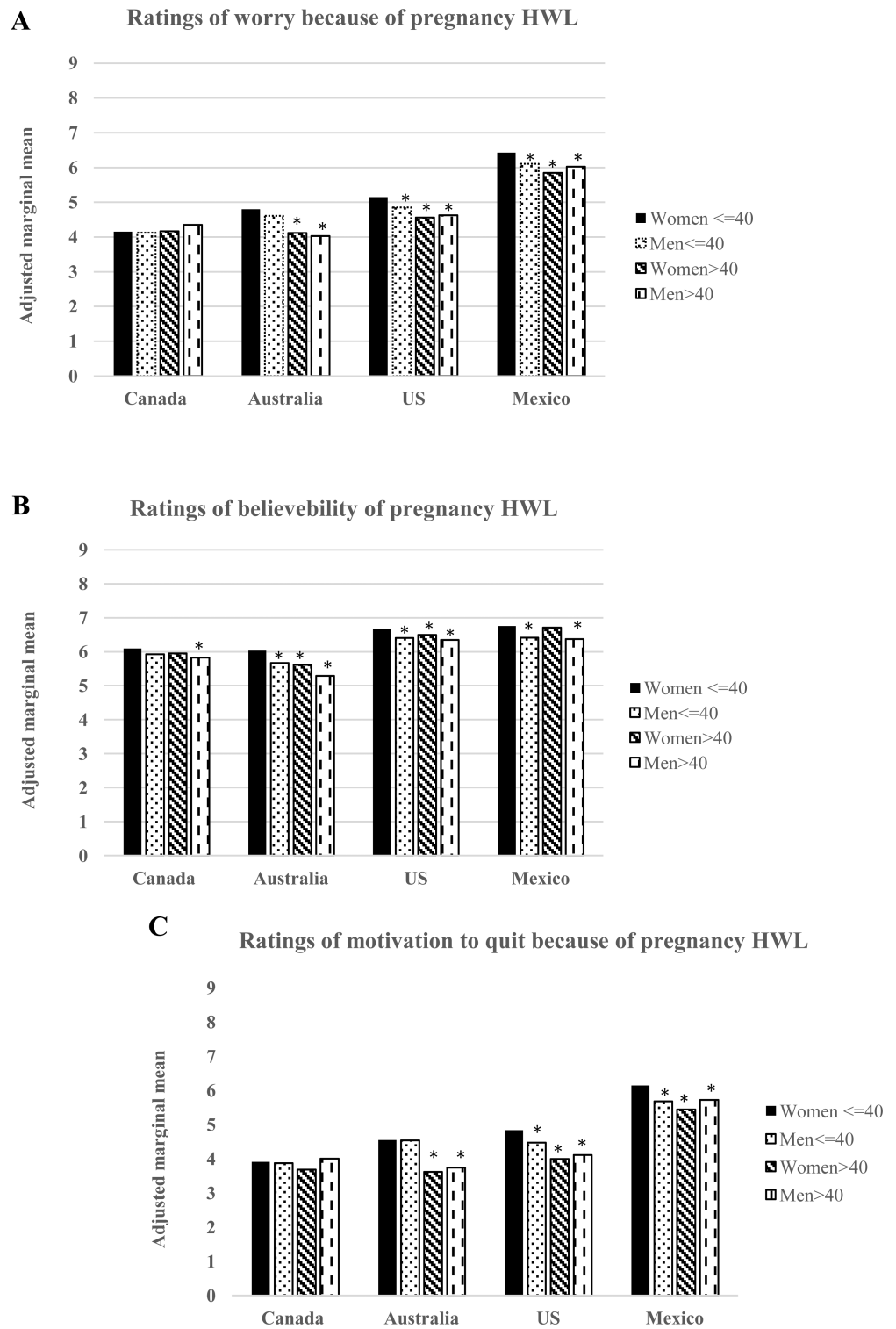
A. Australia

B. Canada

C. Mexico

D. US

Figure 1.
Pregnancy-related cigarette package HWLs

A   **Ratings of worry because of pregnancy HWL**

B   **Ratings of believebility of pregnancy HWL**

C   **Ratings of motivation to quit because of pregnancy HWL**

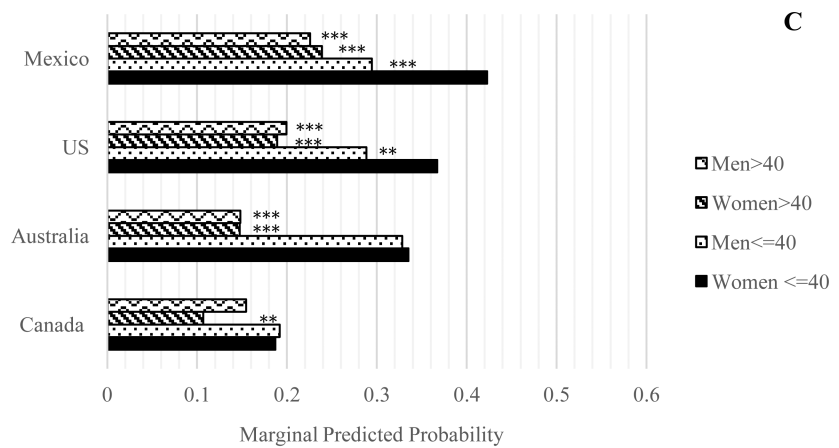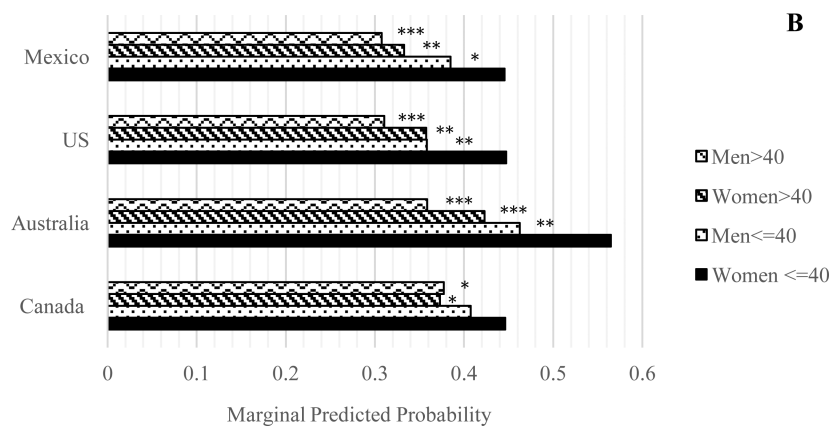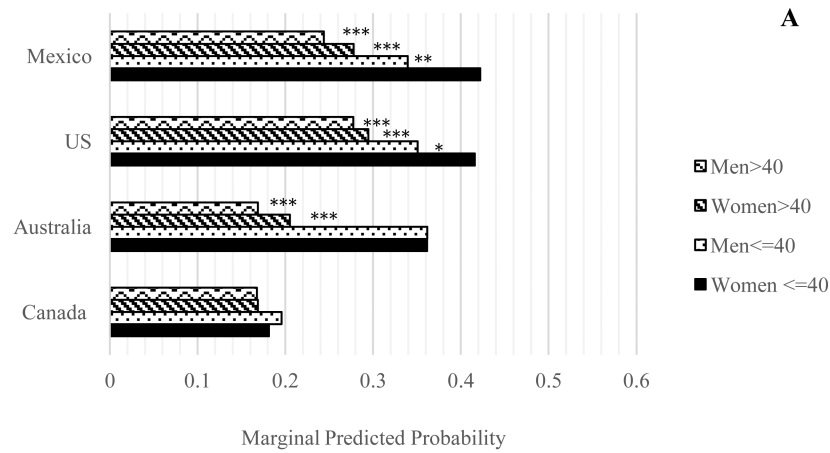Note. Women <=40 are the reference group; * *P* < .05

Figure 2.

Adjusted marginal means of the ratings of the pregnancy warning label on (A) worry, (B) believebilty, and (C) motivation to quit, among smokers from Canada, Australia, United States, and Mexcio.

A

B

C

Note. Women <=40 are the references group; * *P* < .05, ** *P* < .01, *** *P* < .001

Figure 3.
Adjusted marginal predicted probabilities of ratings the pregnancy warning label higher than the non- pregnancy warning labels on (A) worry, (B) believebilty, and (C) motivation to quit, among smokers from Canada, Australia, United States, and Mexcio.

Table 1

Sample characteristics of adults smokers

	Canada (n=1861) Wave 1 & 2	Australia (n=1761) Wave 3 & 4	United States (n=2683) Wave 2 & 3	Mexico (n=1812) Wave 3 & 4
	% or Mean (SD)	% or Mean (SD)	% or Mean (SD)	% or Mean (SD)
Gender/Age Groups [a]				
Women<=40	28	25	28	30
Men<=40	19	19	26	34
Women>40	29	29	23	15
Men>40	24	27	23	21
Education [a]				
High school or less	32	33	34	37
College or some university	45	43	41	20
Completed University or higher	23	24	25	43
Household income [b]				
Low	28	23	35	41
Middle	32	38	35	33
High	40	49	30	26
Minors living at home [a]				
Yes	31	36	45	63
Partner [a]				
None	46	43	48	41
Nonsmoking partner	24	27	29	35
Smoking partner	30	30	23	24
Smoking Behavior				
Daily Smokers[a]	81	87	71	50
HSI (Mean, SD)[a]	2.45 (1.57)	2.80 (1.56)	2.12 (1.57)	0.83 (1.23)
Plan to quit (yes)[a]	45	41	43	47
Recent quit attempt (yes)[a]	41	35	41	54

Note. n = number of observations in each country at the two waves combined.

[a]Chi square or Anova test p<0.001

[b]Annual household income in Canada, Australia and the US (Low=$0 to $29,999, Middle=$30,000 to $59,999, High=$60,000 or more) and monthly household income in Mexico (Low=$0 to $10,000, Middle=$10,001 to $20,000, High=$20,001 or more).