

The Impact of Weight Control Belief on Cigarette Consumption among Adults: Findings from the ITC Project

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Abstract:

Background: Previous studies have documented the association between weight concerns and smoking behaviors among teenagers and young adults. Yet, few studies investigate these associations by gender, age and country, or among adults.

Objective: This paper aims to present the prevalence of weight control belief among adult smokers and examine its association with cigarette consumption by gender, age, and country stratifications.

Methods: The International Tobacco Control Policy Evaluation Project (ITC Project) surveys whether smokers agree that smoking helps control weight in the US, the UK, Canada, Australia, Mexico, Uruguay, Malaysia and China. Using data taken from these countries, we plot the adjusted probability of having weight control belief and examine the stability of having the belief in two consecutive waves by the stratifications. We further analyze the association between weight control belief and cigarette consumption. Finally, we estimate whether the weight control belief has an impact on cigarette consumption through price responsiveness as well.

Findings: This study leads to comprehensive findings: First, gender difference in the weight control belief does not exist in some low and middle income countries (LMICs). Unlike high income countries (HICs), younger female smokers in LMICs are more likely to have the belief than older ones. While female smokers are more persistent in holding the weight control belief than male, smokers in LMICs are more likely to change their belief over years than those in HICs. The examination of the association between the belief and cigarette consumption indicates that, although subject to the studied country and gender, weight control belief is associated with more cigarette consumption with a more acute impact on younger female smokers than older ones. Moreover, weight control belief has an interaction impact on cigarette consumption by decreasing price responsiveness among younger US female smokers and older Mexican male smokers. Our findings suggest that weight control belief should be an important policy concern in both HICs and LMICs.

Introduction:

While smoking remains the leading cause of preventable deaths worldwide, many developed countries have observed obesity emerging as another major cause of morbidity and mortality over the past several decades.[1,2] World Health Organization (WHO) announced that obesity worldwide has nearly doubled since 1980.[2] Smoking and body weight are complexly intertwined that their relations are somewhat in disguise. On the one hand, some studies show that smoking may suppress appetite and increase resting energy expenditure that favors weight control. It is also well documented that former smokers are likely to gain weight after quitting.[3-5] However, on the other hand, studies also show that heavy smokers tend to weigh more than light smokers and people who initiate smoking do not experience a lower weight gain than those who never initiate over time.[6] Moreover, smoking is found to be associated with less physical activity and unhealthy diet that may counter the goal of weight control.[7-9] Evidences also indicate that smoking is associated with greater waist circumference and waist-to-hip ratio, which is not desirable for smokers who might think smoking helps to achieve a better physical appearance or body image.[10]

In sum, the combined evidences in the medical and clinical literature suggest that smoking may not help weight control or improve body image.[3] Albeit this conclusion and the fact that smoking harm health in many destructive ways, numerous studies show that weight concerns are major factors that influence smoking behaviors such as smoking participation, initiation, quitting and relapse among adolescents and young adults. In particular, gender difference in weight concerns and smoking behavior changes in response to weight concerns are broadly documented that females are more likely to have weight concerns and alter their smoking behaviors. [11-22] On the other hand, few studies focus on weight concerns and their effects on smoking behaviors among adults. French et al. (1995) studied a working population and found that weight concerns are uncorrelated to smoking cessation or relapse in adults.[23] Similar un-correlation to smoking status is also found by Borrelli and Mermelstein.[24] In addition, age disparity in weight concerns has been found for adults such that older smoker are more likely to view smoking as a weight control tactic.[25] And adults younger than 30 years are more likely to smoke if they try to lose weight.[26]

Despite extensive efforts in studying weight concerns and their effects on smoking behaviors, there is a lack of studies, especially at the population level, that examine the impact of

weight concerns on cigarette consumption among adults by gender and age. Moreover, almost all existing relevant studies come from high income countries (HICs) especially the US. It is not clear that how prevalent weight concerns are and whether weight concerns have similar impact in low and middle income countries (LMICs). In addition, for countries where weight concerns may impact smoking behaviors, no previous studies have shown whether weight concerns have an indirect impact through tobacco control policies such as cigarette prices (taxes). Therefore in this paper, we utilize a unique data that contains self-reported measures from adult smokers on weight control belief and cigarette consumption to study their association by gender, age and country stratifications. We aim to present the prevalence of the weight control belief by these stratifications as well.

Data and Measures:

The International Tobacco Control Policy Evaluation Project (ITC Project) is an international research collaboration across 20 countries. The datasets taken from ITC 4-country (including the US, the UK, Australia, and Canada), China, Malaysia, Mexico, and Uruguay contain responses from smokers on if they agree that smoking helps weight control. Finally, the data used for this study includes ITC 4 waves 1-5; ITC China waves 1-3, Malaysia waves 1-3; Mexico waves 1-5; and Uruguay waves 1-3.

The ITC Project-surveyed data have unique advantages to facilitate our study on the impact of weight control belief on cigarette consumption. Respondents were requested to answer their opinion towards the statement of weight control effect of smoking, which we utilize to determine whether a person believes that smoking helps weight control. The question below was asked as how much a respondent agrees the following statement:

“Smoking helps weight control.”

Answers were coded into a 5-point scale (strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree) in the survey. We used these answers to construct a dichotomous measure of the belief by coding those who answered strongly agree and agree with 1 and others with 0. This measure explicitly shows if a smoker might consider smoking as a potential means to control weight, regardless of his or her actual body weight or body image.

[Table 1 about here.]

Table 1 contains variable description and definition of weight control belief indicator and other correlates. Cigarette consumption pertains to the number of cigarettes that smokers report

to consume per day on average. Given that both HICs and LMICs are examined in our analysis, their income and education levels are of great variability. Therefore for each country we categorize education and income in three levels: low, middle and high. Detailed definitions of these categories are presented in the Table 1.

In addition to psychological and demographic correlates of smoking, ITC surveys asked respondents to report their recent exposure to tobacco control policies as well as tobacco advertisement and promotion. The last purchase information of cigarettes such as the unit of cigarettes and the price per unit (per stick, pack, or carton) was also asked. These self-reported measures of tobacco market environment are crucial determinants of smoking behaviors yet highly correlate to individual unobserved heterogeneity in such behaviors. For example, heavy smokers might be more likely to purchase cheaper cigarettes and thereafter report lower cigarette prices or more likely to notice tobacco advertisement and report more such exposure. As a result, instead of directly using these self-reported measures, we aggregate them at the PSU level and estimate the impact of these PSU average measures, which are less likely to be endogenous, on cigarette consumption. Namely, to obtain PSU cigarette prices, we first calculate individuals' self-reported cigarette prices for a pack of twenty cigarettes, and respectively for each PSU, we construct the PSU aggregated cigarette prices as the median value of prices that were reported by those who live in the PSU. These prices are then converted into 2010 constant international dollars using Purchasing-Power Parity (PPP) and Consumer Price Index (CPI) of the country. PPP conversion and CPI of each country were obtained from the International Monetary Fund World Economic Outlook database. Likewise, individuals' exposures to worksite smoking bans, anti-smoking information broadcasting, manufacturers' promotion, and tobacco advertising are calculated and averaged to PSU level measures (details are presented in Table1).

Methodology:

The first goal of this paper is to understand the weight control belief among adult smokers by country, gender and age. We report smoking correlates including individual demographic characteristics and PSU level tobacco control policy exposure measures by gender and country and test if there correlates differ by gender in each country using two sample mean comparison test. In addition for each country and gender, we estimate the adjusted probability of weight control belief and plot the predicted adjusted probability over age. The estimation equation is as follows:

$$Belief_{it} = \text{logit} (\beta_1 P_{kt} + \beta_2 X_{it} + \varepsilon_{it})(1)$$

Our main interest variable $Belief_{it}$ is a dichotomous measure of the weight control belief (with 1 indicating the respondent agrees that smoking helps control weight and 0 otherwise). P_{kt} are PSU-specific cigarette prices and PSU average measures of exposure to worksite smoking bans, anti-smoking information, tobacco advertising, and tobacco promotion. X_{it} is a vector of individual demographic characteristics including education (low education as omitted category, middle, and high education), income (low, middle, with high income as omitted category), marital status¹ (an indicator of being married), employment (an indicator of being employed), age, a quadratic form of age, and a linear year trend. After conducting the regressions and setting the above control variables (other than age and age squared) to their mean values, we obtain the adjusted probability of having weight control belief for each of the following eight age groups²: 18-25, 26-30, 31-35, 36-40, 41-45, 46-50, 50-55 and 56-65. These adjusted probabilities are plotted in Figures 1 (men) and 2 (women). Next, we exploit the advantage of the longitudinal property of the ITC surveys to examine the transition of the weight control belief by same individuals over time. Separately for smokers who have the belief and those who do not, we report the percentage of having weight control belief in the following wave. The comparison will shed some light on if the belief is deep-rooted among smokers and how much velocity there is in changing the belief.

In order to estimate the impact of weight control belief on cigarette consumption, we restrict our studied sample to adult smokers aged 18-65. Then separately for each country and gender, we estimate a model as in equation (2) using Generalized estimating equations (GEE) after controlling for a comprehensive set of smoking related factors.

$$C_{it} = \alpha_0 + \alpha_1 P_{kt} + \alpha_2 X_{it} + \alpha_3 Belief_{it} + \varepsilon_{it} (2)$$

$$i = 1, \dots, n; k = \text{each of the PSU}$$

P_{kt} is the same vector of PSU specific cigarette prices and exposure measures. X_{it} is a slightly different vector from the one included in Equation 1, instead of age and age squared, indicators for eight age categories are estimated (aged 18-25, 26-30, 31-35, 36-40, 41-45, 46-50, 50-55 and over 55 as omitted category). All regressions also control for indicators of missing employment, education and income. According to the previous studies on smoking behaviors and weight

¹ Marital status is not available in Malaysia surveys.

² For China and Malaysia, very few female observations are available. Therefore, age was divided into fewer groups (Aged 18-40, 41-45, 46-50, 51-55, and 56-65 for China; aged 18-40, 41-45, 46-55, and 56-65 for Malaysia).

concerns, their associations are likely to vary by age.[3,25,26] Therefore, to better understand the impact of weight control belief on cigarette consumption among different adult population, we in addition estimated equation (1) respectively for people aged 18-40 and over 40³. The robust standard errors are estimated throughout the analysis.

Next, we estimate a model that includes the interaction term of weight control belief and cigarette prices as the additional variable to study whether the weight control belief impacts cigarette consumption through price responsiveness. The model can be presented using a modified Equation 2 as follows:

$$C_{it} = \alpha_0 + \alpha_1 P_{kt} + \alpha_2 X_{it} + \alpha_3 Belief_{it} + \alpha_4 Belief_{it} \times Price_{kt} + \varepsilon_{it} \quad (3)$$

Equation 3 provides a formal test on whether price responsiveness differs by weight control belief. A significant estimate of the interaction term of weight control belief and prices suggests that prices responsiveness do vary by weight control belief. And an insignificant estimate suggests otherwise. In addition, under the assumption that prices are negatively associated with cigarette consumption, a positive estimate indicates that smokers who think smoking helps weight control may be price un-responsive or at least less price responsive than those who do not. And a negative sign suggests the opposite.

Results:

In Tables 2A (for HICs) and 2B (for LMICs), we report the summary statistics for each country after weighted using the ITC rescaled cross-sectional weights. The mean and standard deviations of dependent and independent variables were shown for each country. Two-sample comparison test is performed to compare these variables by gender. For all studied countries, male smokers consume more cigarettes than their female counterparts. Other than Uruguay, female smokers are less likely to be employed. And unlike female smokers in HICs and Uruguay, female smokers in Mexico, China, and Malaysia are more likely to reside in PSUs with lower cigarette prices. In addition, female smokers in the US, Canada, Mexico, China, and Malaysia are older than male smokers. Other than Mexico and Uruguay, female smokers are more likely to be in a household at low or middle income levels. In Australia and China, female smokers are more likely to have a low education. In contrast, female smokers in Uruguay, compared with male smokers, are more likely to have a high education. Interestingly, although

³ For China and Malaysia, due to a limited sample size, we did not estimate models separately for female aged 18-40 and 41-65.

female smokers in HICs are 8 to 15 percentage points more likely to have weight control belief than male smokers, the same pattern is not found for some LMICs including Uruguay, China and Malaysia. The tests suggest that, other than Mexico where female smokers are 8 percent more likely to have the belief, no gender difference in weight control belief is detected for LMICs.

[Tables 2A and 2B about here]

In Figures 1 and 2, we exhibit the adjusted probability of having weight control belief by gender, country and age. For male smokers, the trends suggest that the probability of weight control belief is higher for older age groups in HICS. And in LMICs, the corresponding curves are slightly inverted-U shaped, indicating that middle age group in these countries tend to have the highest probability of weight control belief. For female smokers, like their male counterparts, older age groups in HICs tend to have higher probability of weight control belief. In contrast, in Mexico, China and Malaysia, younger age groups tend to have higher probability of weight control belief. Especially for China and Malaysia, female smokers aged 40 or younger are about twenty percentage points more likely to believe smoking helps weight control than are aged 41-45. These results suggest, compared with HICs, the prevalence of weight control belief among female smokers in LMICs only takes off very recently and is adopted mostly by younger female smokers—while the belief is about 20 percentage points less prevalent among oldest 55-65 age group in LMICs than in HICs, it is at about the same prevalent level among female smokers aged 40 or younger as in HICs.

[Figures 1 and 2 about here]

To better understand the weight control belief and how individuals change their belief over years, we use the longitudinal feature of ITC surveys to examine the prevalence of changing belief in any two consecutive waves. The results are reported in Tables 3, separately by gender, age, and weight control belief in the current wave (first of the two consecutive waves that are compared). The results show that among female smokers at all ages in HICs, 63-74% of weight control believers hold their belief and 13-24% of non-believers transition into believers in the following wave. Among their male counterparts, 42-68% of believers and 8-17% nonbelievers believe that smoking helps weight control in the subsequent wave. In addition, male smokers aged 41-65 are about 10% more likely than those aged 18-40 to have the belief in both waves, while the same comparison for female smokers yields a smaller or reversed difference. In contrast to the above conclusions, the change of weight control belief in LMICs shows different

patterns. Only 21-66% of female smokers and 10-55% of male smokers who believe weight control effect continue to believe in the second wave. In addition, 16-31% of female and 12-42% male non-believers become believers in the second wave. Compared with smokers in HICS, regardless of age and gender, smokers in LMICs present more velocities in changing weight control belief. Nevertheless, in most countries, female smokers are more persistent in weight control belief than male smokers.

[Table 3 about here]

In Table 4, we present the results estimated using Equation 2. The results show that in the US, the UK, and Mexico, weight control belief is associated with 0.44-1.24 more cigarette consumption for both genders. It is also associated with about 0.79-0.84 more consumption among female smokers in Canada and Uruguay, and 0.9-1.0 among male smokers in Australia and China. We further estimate the same model by age group and gender for each country (other than female smokers in China and Malaysia). The results from models that allow for age difference indicate that for female smokers in most countries, the impact of weight control belief is more acute for younger age group (18-40) than older group (41-65) that the belief is associated with 0.62-0.77 more cigarette consumption in the US and Canada and is significantly associated with cigarette consumption only among younger group in the UK, Mexico, and Uruguay. On the other hand, male smokers again present different patterns from female smokers. Other than the US where older age group is associated with 0.52 cigarette consumption than the younger one, the difference of the estimated impact is only 0.05-0.23 in the UK, China and Mexico.

[Table 4 about here]

Last, we study if weight control belief impacts cigarette consumption through price responsiveness. Table 5 shows results from models that contains the interaction of weight control belief and cigarette prices. In sum, in most countries, the weight control belief does not impact cigarette consumption through price responsiveness. However, US female smokers aged 18-40 who have weight control belief are much less price responsive than those who do not. This finding is consistent with the literature that found US girls tend to use smoking as a method to control weight.[18] Also, Mexican men aged 41-65 are less price responsive if they have weight control belief. In contrast, among older female smokers (aged 41-65) in the US and Canada and younger male smokers (aged 18-40) in the Australia, those who have weight control belief tend to be more responsive to prices. This finding suggests that the interaction effect of weight control

belief and prices on cigarette consumption may depend on age, which is likely a result of less weight concern among older people even when they have the belief.

Conclusion and Discussion:

This paper examines the impact of weight control belief on cigarette consumption among adults in both LMICs and HICs. We find that gender difference in the weight control belief does not exist in some LMICs. However, unlike HICs, younger female smokers in LMICs are more likely to have the belief than older ones. In addition, female smokers are more persistent in holding the weight control belief than male. And smokers in LMICs are more likely to change their belief over years. The examination of the association between the belief and cigarette consumption indicates that, although subject to the studied country and gender, weight control belief is associated with more cigarette consumption with a more acute impact on younger female smokers than older ones. Moreover, weight control belief has an interaction impact on cigarette consumption by decreasing price responsiveness among younger US female smokers and older Mexican male smokers. Our findings suggest that the weight control belief is an important policy concern in many countries and more studies should be conducted on its impact on smoking transitions such as initiation, quitting and quit attempts in future research.

This analysis may have some limitations. First, our weight control belief measure is based on the agreement on a single statement that smoking helps weight control. It is subject to the individual's understanding as well as the cultural context that what exactly this statement implies. It could mean that smoking offers a way to lose weight, or that smoking helps control the current optimum weight, or that continuing to smoke can avoid the potential weight gain after quitting. Individuals' body composition and body image are not available in the surveys either. It is not yet clear about to what extent the measurement errors in the self-reported weight control belief may vary by individuals' body mass index, body image, smoking history and relevant policy and cultural environment. However, given that we examine how the weight control belief impacts cigarette consumption, it is likely that all relevant weight concerns such as a real weight gain have their impacts on cigarette consumption mediated by the subjective weight control belief anyhow. Moreover, the belief itself, instead of a real change in body weight or image, may be sufficient in altering smoking behaviors such as cigarette consumption. This kind of association is exactly what we examine in this paper. The second drawback is that all the policy variables that are estimated in the paper, cigarette prices included, are derived from self-reported

information. We consider that, since we have used PSU averages instead of individual ones, the measurement errors are less likely to bias our results.

Despite the above concerns, we provide the first study to date on how weight control belief among adult smokers varies by gender, age, and country. In addition, we estimate the impact of the weight control belief on cigarette consumption and test if the price responsiveness varies by the belief. Our findings are very informative policy wise. In light of the results, weight control belief is associated with more cigarette consumption and the association is more pronounced among female and younger smokers aged 18-40, effective policies that inform smokers that smoking does not necessarily helps weight control is highly needed. In addition, female smokers in LMICs show increased weight control belief among the very young aged group, and for all smokers in LMICs, their belief tend to change year to year. These findings suggest that it is urgent in LMICs to adopt policies that inform their smokers, especially young females, that smoking is not a competent method to control weight. Given that smokers in LMICs are more likely to change their belief than those in HICs, appropriate education may be more effective in reducing smoking in LMICs.

What This Paper Adds

No previous studies have examined the impact of weight control belief on cigarette consumption among adults by gender, age and country. This is by far the first study that aims to describe the prevalence of weight control belief and examine its association with cigarette consumption by the stratifications. This study leads to comprehensive findings: First, gender difference in the weight control belief does not exist in some LMICs. Unlike HICs, younger female smokers in LMICs are more likely to have the belief than older ones. While female smokers are more persistent in holding the weight control belief than male, smokers in LMICs are more likely to change their belief over years than those in HICs. The examination of the association between the belief and cigarette consumption indicates that, although subject to the studied country and gender, weight control belief is associated with more cigarette consumption with a more acute impact on younger female smokers than older ones. Moreover, weight control belief has an interaction impact on cigarette consumption by decreasing price responsiveness among younger US female smokers and older Mexican male smokers. Our findings suggest that weight control belief should be an important policy concern in both HICs and LMICs.

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Table 1 Variable Description and Definition

Variable Name	Description
Individual Level	
Consumption	Number of Cigarettes consumed per day
Weight Control	A dichotomous indicator equals one is the respondent agrees on the weight control effect of smoking, 0 otherwise
Men	A dichotomous indicator equals one is the respondent is male, 0 if female
Age	Binary indicators for 8 categories: aged 18-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-65
Married	A dichotomous indicator equals one is the respondent is married, 0 otherwise
Employed	A dichotomous indicator equals one is the respondent is employed, 0 otherwise
Education	Binary indicators for 3 categories: low, middle and high education (For the US, Canada and Australia, these categories refer to high school or less, community college/technical school or some college, and college and above; For the UK, these categories refer to secondary school, some college, and college or above; For China and Uruguay, the categories refer to elementary school or no education, junior to high school, and college or above; For Malaysia, the categories refer to elementary school or no education, secondary school, and some college or above; For Mexico, the categories refer to middle school or less, high school, and some college or above.)
Income	Binary indicators for 3 categories: low, middle and high income (For the US, Canada and Australia, these categories refer to annual household income less than \$30,000, \$30,000-59,999, and \$60,000 or above; For the UK, these categories refer to annual household income at £15,000 or lower, £15,001-30,000, and £30,001 or higher; For china, the categories refer to household income per month that are <1000, 1000-2999, and 3000 or above in local currencies; For Malaysia, these categories refer to annual household income in local currencies at 10,000 or lower, 10,001-30,000, and 30,001 or higher; For Mexico, these categories refer to annual household income at \$3,000 or lower, \$3,001-8,000, and \$8,001 or higher; For Uruguay, these categories refer to annual household income in local currencies at 7,000 or lower, 7,001-30,000, and 30,001 or higher.)
Wgt*Price	An interaction term of weight control belief indicator and cigarette prices
PSU Level	
Price	PSU specific cigarette prices for a pack of 20 cigarettes in constant 2010 dollars, constructed using the median price reported in each PSU
Worksite bans	The PSU level average of individuals' exposure to smoking restrictions at work place (1 no restriction, 2 some restriction, 3 full restriction)
Anti-smoking Info.	Out of a number of anti-smoking broadcasting venues (TV, radio, posters, etc.), the fraction that each respondent was exposed to was calculate. The individual fractions were averaged to the PSU level and rescaled to 1-10 measurement index
Promotion	Out of a number of manufacturers' promotion venues (sport event, samples, gift, etc.), the fraction that each respondent was exposed to was calculate. The individual fractions were averaged to the PSU level and rescaled to 1-10 measurement index
Advertising	Out of a number of manufacturers' advertising venues (TV, radio, posters, etc.), the fraction that each respondent was exposed to was calculate. The individual fractions were averaged to the PSU level and rescaled to 1-10 measurement index

Table 2A Summary Statistics for Smokers Aged 18-65 , by Gender, HICs

	US		CA		UK		AU	
	Male	Female	Male	Female	Male	Female	Male	Female
Consumption	18.85 (11.99)	16.66*** (9.78)	18.08 (10.70)	15.41*** (9.06)	17.23 (9.45)	15.52*** (9.77)	18.10 (11.74)	16.57*** (10.39)
Wgt Control	0.22 (0.42)	0.37*** (0.48)	0.22 (0.41)	0.39*** (0.49)	0.27 (0.44)	0.38*** (0.48)	0.24 (0.43)	0.32*** (0.47)
Price	3.66 (0.72)	3.64 (0.70)	6.01 (0.82)	6.01 (0.82)	7.37 (0.23)	7.37 (0.24)	6.03 (0.22)	6.02 (0.22)
Wgt*Price	0.80 (1.52)	1.35*** (1.81)	1.32 (2.52)	2.35*** (2.99)	1.99 (3.27)	2.79*** (3.58)	1.43 (2.57)	1.95*** (2.82)
Married	0.38 (0.49)	0.40 (0.49)	0.31 (0.46)	0.34 (0.47)	0.37 (0.48)	0.32* (0.47)	0.35 (0.48)	0.32 (0.46)
Employed	0.75 (0.43)	0.60*** (0.49)	0.79 (0.41)	0.67*** (0.47)	0.80 (0.40)	0.62*** (0.48)	0.77 (0.42)	0.61*** (0.49)
Worksite Restriction	2.49 (0.18)	2.48* (0.17)	2.50 (0.21)	2.50 (0.22)	2.29 (0.19)	2.29 (0.19)	2.52 (0.19)	2.53 (0.18)
Anti-smoking Information Promotion	4.20 (0.27)	4.21 (0.27)	4.58 (0.33)	4.59 (0.27)	4.30 (0.35)	4.29 (0.35)	4.72 (0.39)	4.74 (0.39)
Advertising	2.57 (0.26)	2.56 (0.26)	1.07 (0.18)	1.07 (0.18)	1.02 (0.29)	1.03 (0.30)	0.85 (0.19)	0.85 (0.19)
Education								
low	0.11 (0.31)	0.11 (0.31)	0.14 (0.35)	0.15 (0.35)	0.28 (0.45)	0.31 (0.46)	0.36 (0.48)	0.41*** (0.49)
Middle	0.32 (0.47)	0.34 (0.47)	0.34 (0.47)	0.31* (0.46)	0.27 (0.44)	0.28 (0.45)	0.26 (0.44)	0.26 (0.44)
High	0.57 (0.49)	0.56 (0.50)	0.52 (0.50)	0.54 (0.50)	0.45 (0.50)	0.41 (0.49)	0.38 (0.49)	0.34* (0.47)
Income								
Low	0.32 (0.46)	0.39*** (0.48)	0.25 (0.42)	0.31*** (0.45)	0.19 (0.38)	0.36*** (0.46)	0.22 (0.40)	0.31*** (0.45)
Middle	0.38 (0.47)	0.38 (0.47)	0.37 (0.47)	0.38 (0.47)	0.38 (0.47)	0.37 (0.46)	0.36 (0.47)	0.36 (0.47)
High	0.30 (0.45)	0.22*** (0.40)	0.39 (0.47)	0.31*** (0.44)	0.43 (0.48)	0.27*** (0.43)	0.42 (0.48)	0.32*** (0.45)
Age								
Age	40.48 (12.30)	41.58* (12.02)	40.7 (12.04)	41.7* (12.1)	40.92 (12.39)	40.41 (12.71)	39.75 (12.46)	39.99 (12.17)
N	3629	4801	3853	4839	3610	4787	4012	4844

Note: Means were estimated using ITC survey rescaled cross-sectional weight. Standard deviations are in parentheses. * indicates significant difference in means by gender based on two sample comparison test. *0.05 < p ≤ 0.1, **0.01 < p ≤ 0.05, ***p ≤ 0.01

Table 2B Summary Statistics for Smokers Aged 18-65 , by Gender, LMICs

	MX		UY		RC		MY	
	Male	Female	Male	Female	Male	Female	Male	Female
Consumption	7.33 (6.97)	6.17*** (5.96)	16.81 (11.42)	14.19*** (12.05)	17.51 (9.94)	11.58*** (8.39)	13.75 (8.17)	11.50*** (8.26)
Wgt Control	0.15 (0.36)	0.23*** (0.42)	0.33 (0.47)	0.35 (0.48)	0.33 (0.47)	0.34 (0.47)	0.44 (0.50)	0.51 (0.50)
Price	3.80 (0.65)	3.76** (0.61)	2.78 (0.84)	2.78 (0.85)	1.71 (0.49)	1.58** (0.43)	4.06 (0.88)	3.26** (1.41)
Wgt*Price	0.57 (1.38)	0.87*** (1.63)	0.91 (1.39)	1.00 (1.45)	0.54 (0.81)	0.51 (0.73)	1.84 (2.13)	1.95 (2.11)
Married	0.56 (0.50)	0.53 (0.50)	0.37 (0.48)	0.35 (0.48)	0.87 (0.33)	0.82 (0.39)	-- --	-- --
Employed	0.42 (0.49)	0.35*** (0.47)	0.45 (0.50)	0.49 (0.50)	0.75 (0.43)	0.46*** (0.50)	0.43 (0.49)	0.19*** (0.40)
Worksite Restriction	1.25 (0.35)	1.26 (0.36)	2.67 (0.44)	2.69 (0.45)	1.94 (0.23)	1.95 (0.22)	2.36 (0.24)	2.46 (0.30)
Anti-smoking Information Promotion	6.01 (2.40)	5.96 (2.41)	6.07 (2.28)	5.99 (2.27)	4.71 (1.04)	4.90 (1.07)	7.44 (0.78)	7.73** (0.60)
Advertising	1.95 (1.58)	1.88 (1.52)	2.82 (2.09)	3.08** (2.39)	1.29 (0.60)	1.38 (0.58)	2.24 (0.36)	2.20 (0.33)
Education								
Low	6.39 (2.16)	6.39 (2.18)	6.52 (2.43)	6.49 (2.40)	1.99 (0.96)	2.28** (1.00)	3.95 (1.90)	4.35 (2.00)
Middle	0.59 (0.49)	0.60 (0.49)	0.64 (0.48)	0.60 (0.49)	0.38 (0.49)	0.53*** (0.50)	0.82 (0.30)	0.84 (0.28)
High	0.26 (0.44)	0.26 (0.44)	0.25 (0.43)	0.24 (0.42)	0.38 (0.49)	0.34 (0.47)	0.12 (0.26)	0.10 (0.22)
Income								
Low	0.15 (0.36)	0.14 (0.35)	0.10 (0.30)	0.16*** (0.37)	0.24 (0.42)	0.12*** (0.33)	0.06 (0.18)	0.06 (0.20)
Middle	0.23 (0.41)	0.25 (0.42)	0.36 (0.46)	0.38 (0.46)	0.10 (0.29)	0.10 (0.28)	0.30 (0.43)	0.48* (0.44)
High	0.58 (0.48)	0.56 (0.48)	0.44 (0.48)	0.44 (0.47)	0.38 (0.47)	0.49* (0.48)	0.42 (0.46)	0.29** (0.37)
Age								
Low	0.19 (0.38)	0.19 (0.38)	0.19 (0.38)	0.18 (0.36)	0.52 (0.49)	0.41* (0.47)	0.27 (0.42)	0.23 (0.36)
N	37.52 (12.48)	39.11** (12.02)	38.12 (13.19)	39.03 (12.86)	48.32 (9.86)	50.42** (8.85)	37.77 (12.35)	46.57** (14.53)

Note: Means were estimated using ITC survey rescaled cross-sectional weight. Standard deviations are in parentheses. * indicates significant difference in means by gender based on two sample comparison test. *0.05 < p ≤ 0.1, **0.01 < p ≤ 0.05, ***p ≤ 0.01

Table 3, Percentage of Having Weight Control Belief in the Next Wave, by Gender, Belief at the Current Wave, and Age

%	Women				Men			
	Believe		Don't Believe		Believe		Don't Believe	
Current Wave								
Age	18-40	41-65	18-40	41-65	18-40	41-65	18-40	41-65
US	66.99 (3.10)	73.58 (2.19)	17.51 (2.76)	18.63 (1.90)	48.42 (7.75)	59.00 (3.91)	9.45 (2.94)	12.97 (1.66)
CA	67.78 (4.28)	70.20 (2.22)	18.10 (2.15)	22.59 (1.82)	42.36 (5.31)	55.42 (3.76)	11.15 (1.32)	15.71 (1.58)
UK	70.51 (4.03)	64.70 (3.13)	23.64 (3.89)	22.95 (2.14)	54.82 (5.93)	68.24 (2.93)	12.43 (2.81)	16.88 (1.04)
AU	63.39 (6.56)	65.89 (2.42)	12.53 (1.94)	18.21 (1.69)	56.28 (3.24)	65.56 (4.20)	7.69 (1.43)	11.31 (0.99)
MX	39.20 (5.79)	21.80 (4.56)	25.43 (2.98)	15.90 (2.17)	9.77 (2.65)	13.59 (4.05)	14.40 (1.75)	12.09 (1.80)
UY	49.68 (5.59)	56.52 (7.84)	17.19 (3.19)	26.17 (5.06)	44.03 (11.66)	55.43 (8.47)	23.98 (4.24)	29.16 (5.00)
Age	18-65		18-65		18-40		40-65	
RC	61.15 (29.48)	--	18.65 (13.02)	--	13.81 (9.21)	36.40 (16.13)	18.02 (9.19)	38.42 (12.33)
MY	39.03 (16.44)	--	31.04 (14.01)	--	59.15 (6.62)	53.37 (5.92)	35.32 (4.12)	42.74 (3.84)

Note: Means were estimated using ITC survey rescaled cross-sectional weight. Linearized standard errors are in parentheses.

Table4 The Effect of Weight Control Perception and Price on Cigarette Consumption by Gender and Age

HIC	US	US	US	CA	CA	CA	UK	UK	UK	AU	AU	AU
	All	18-40	41-65	All	18-40	41-65	All	18-40	41-65	All	18-40	41-65
Women												
Wgt Con.	1.12*** (0.26)	1.62*** (0.44)	0.85** (0.34)	0.84*** (0.23)	1.26*** (0.32)	0.64** (0.32)	0.44* (0.23)	0.60* (0.35)	0.41 (0.30)	0.31 (0.25)	0.19 (0.36)	0.58 (0.36)
Price	-0.70*** (0.26)	-0.75** (0.38)	-0.67* (0.35)	-0.47** (0.20)	-0.72*** (0.26)	-0.36 (0.30)	-0.46 (0.53)	-0.04 (0.70)	-0.47 (0.76)	-0.83 (0.92)	0.91 (1.24)	-2.50* (1.32)
N	4801	1851	2950	4839	2019	2820	4788	1940	2848	4844	2350	2494
Men												
Wgt Con.	1.24*** (0.41)	1.65** (0.66)	1.13** (0.52)	0.47 (0.50)	0.52 (0.43)	0.49 (0.78)	1.00*** (0.30)	0.97* (0.54)	1.20*** (0.37)	0.90** (0.37)	0.75 (0.53)	1.07** (0.51)
Price	-0.95*** (0.35)	-0.14 (0.47)	-1.62*** (0.52)	-0.89*** (0.26)	-0.70** (0.30)	-1.06** (0.42)	-0.13 (0.69)	-0.28 (1.20)	-0.18 (0.85)	-2.08* (1.14)	-2.24 (1.64)	-1.57 (1.56)
N	3629	1515	2114	3854	1765	2089	3610	1404	2206	4013	2028	1985
LMIC	MX	MX	MX	UY	UY	UY	RC	RC	RC	MY	MY	MY
Women												
Wgt Con.	0.53* (0.31)	1.47*** (0.41)	-0.54 (0.49)	0.79* (0.48)	1.06* (0.58)	0.01 (0.78)	-0.19 (0.93)	-- --	-- --	0.40 (1.95)	-- --	-- --
Price	-0.31* (0.18)	-0.44** (0.22)	-0.08 (0.29)	-0.12 (0.33)	-0.33 (0.34)	0.19 (0.53)	-3.11*** (1.16)	-- --	-- --	-1.19* (0.65)	-- --	-- --
N	2292	1236	1056	1553	835	718	351	--	--	94	--	--
Men												
Wgt Con.	1.03*** (0.32)	1.16** (0.46)	0.96** (0.40)	0.65 (0.65)	0.64 (0.70)	1.16 (1.27)	1.00*** (0.21)	1.05** (0.44)	1.10*** (0.23)	0.06 (0.25)	0.08 (0.32)	-0.01 (0.39)
Price	-0.46*** (0.18)	-0.52*** (0.19)	-0.56 (0.36)	-0.15 (0.37)	-0.34 (0.46)	-0.31 (0.65)	-0.26 (0.24)	-0.36 (0.42)	-0.17 (0.29)	-0.59*** (0.21)	-0.77** (0.30)	-0.37 (0.28)
N	3760	2241	1519	1346	765	581	10381	2398	7983	3966	2181	1785

Note: Robust Standard errors are in parentheses. All regressions also control for education (indicators of middle and high education level), income (indicators of low and middle income level), marital status (indicator of married), employed (an indicator of being employed), indicators of missing education, income and employment status, age (indicators for 8 categories), and exposure indexes of worksite restrictions, anti-smoking information, tobacco promotion, and tobacco advertising. *0.05 < p ≤ 0.1, **0.01 < p ≤ 0.05, ***p ≤ 0.01

Table5 Price Responsiveness by Weight Control Perception, by Gender and Age

HIC	US	US	CA	CA	UK	UK	AU	AU
	18-40	41-65	18-40	41-65	18-40	41-65	18-40	41-65
Women								
Wgt Control	-2.22 (2.20)	3.76** (1.75)	-1.52 (2.44)	5.46** (2.36)	2.35 (8.93)	-1.48 (7.16)	-7.32 (7.07)	1.19 (7.28)
Price	-1.09*** (0.42)	-0.35 (0.41)	-0.87*** (0.30)	-0.03 (0.32)	0.04 (0.84)	-0.57 (0.90)	0.57 (1.24)	-2.46* (1.44)
Wgt Con.*P.	1.03* (0.60)	-0.79* (0.47)	0.45 (0.39)	-0.79** (0.38)	-0.24 (1.22)	0.26 (0.97)	1.23 (1.16)	-0.10 (1.19)
N	1851	2950	2019	2820	1940	2848	2350	2494
Men								
Wgt Control	0.87 (3.01)	5.23* (2.73)	0.70 (2.94)	6.70 (5.35)	9.95 (13.9)	-0.64 (11.3)	37.0** (16.2)	-6.75 (10.7)
Price	-0.17 (0.49)	-1.33** (0.55)	-0.69** (0.31)	-0.76+ (0.47)	0.002 (1.32)	-0.26 (0.92)	-1.35 (1.65)	-1.91 (1.60)
Wgt Con.*P.	0.21 (0.78)	-1.10 (0.69)	-0.03 (0.48)	-1.02 (0.84)	-1.22 (1.89)	0.25 (1.54)	-5.91** (2.63)	1.29 (1.77)
N	1515	2114	1765	2089	1404	2206	2028	1985
LMIC	MX	MX	UY	UY	RC	RC	MY	MY
Women					(18-65)		(18-65)	
Wgt Control	2.42 (2.04)	2.05 (2.46)	0.55 (1.85)	0.55 (3.04)	1.31 (3.58)	--	7.07 (4.81)	--
Price	-0.38 (0.25)	0.06 (0.30)	-0.41 (0.46)	0.27 (0.55)	-2.86*** (1.37)	--	-0.68 (0.70)	--
Wgt Con.*P.	-0.25 (0.50)	-0.69 (0.62)	0.18 (0.59)	-0.19 (1.03)	-1.04 (2.40)	--	-1.90 (1.30)	--
N	1236	1056	835	718	351	--	94	--
Men								
Wgt Control	3.13 (2.38)	-4.40 (3.11)	-1.13 (2.36)	0.97 (3.28)	0.33 (1.41)	1.48* (0.81)	-1.77 (2.33)	-1.12 (1.90)
Price	-0.45** (0.19)	-0.72** (0.36)	-0.54 (0.58)	-0.34 (0.93)	-0.47 (0.45)	-0.10 (0.32)	-0.90** (0.40)	-0.45 (0.31)
Wgt Con.*P.	-0.51 (0.56)	1.43* (0.82)	0.64 (0.84)	0.06 (1.10)	0.43 (0.79)	-0.25 (0.49)	0.45 (0.55)	0.27 (0.46)
N	2241	1519	765	581	2398	7983	2181	1785

Note: Robust Standard errors are in parentheses. All regressions also control for education (indicators of middle and high education level), income (indicators of low and middle income level), marital status (indicator of married), employed (an indicator of being employed), indicators of missing education, income and employment status, age (indicators for 8 categories), and exposure indexes of worksite restrictions, anti-smoking information, tobacco promotion, and tobacco advertising. * $0.05 < p \leq 0.1$, ** $0.01 < p \leq 0.05$, *** $p \leq 0.01$

Figure1, Adjusted Probability of Having Weight Control Belief among Men, by Country and Age

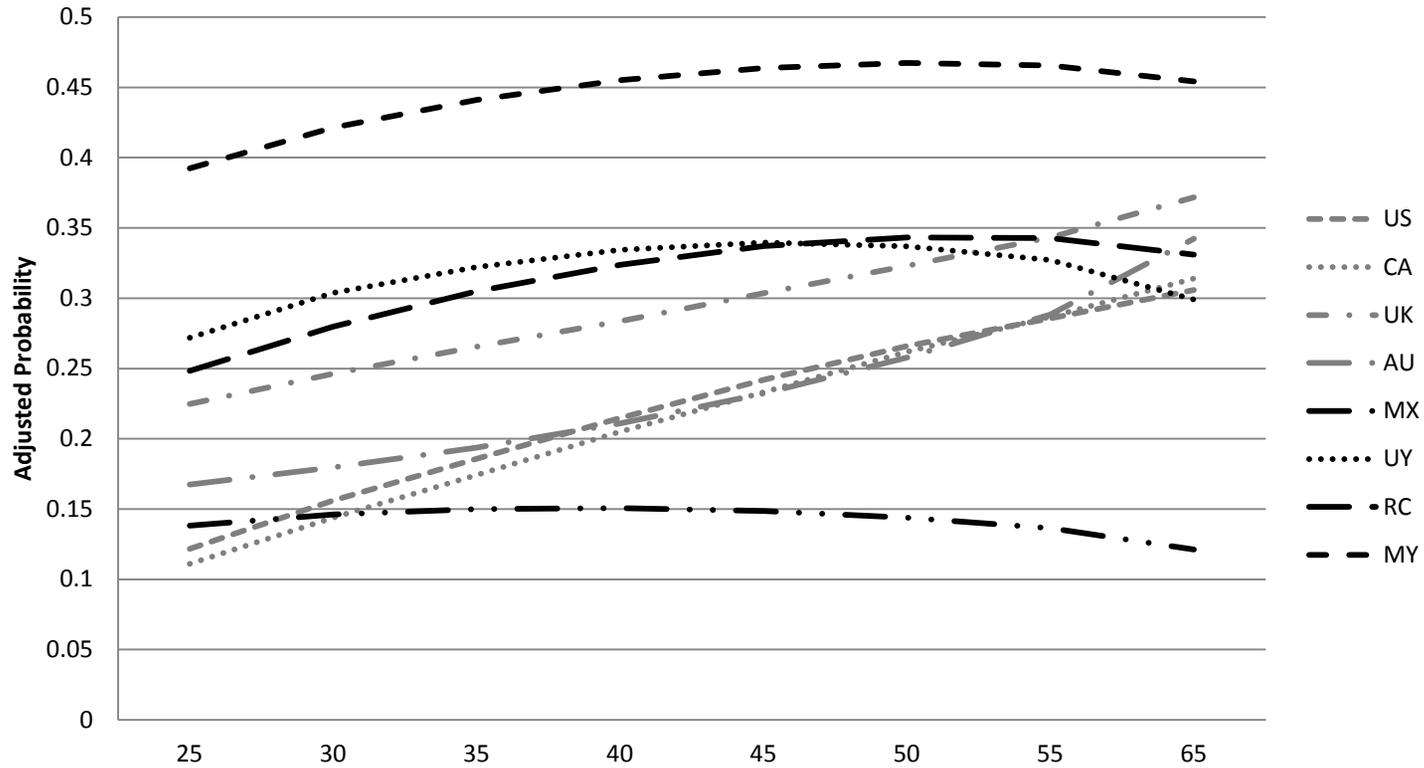
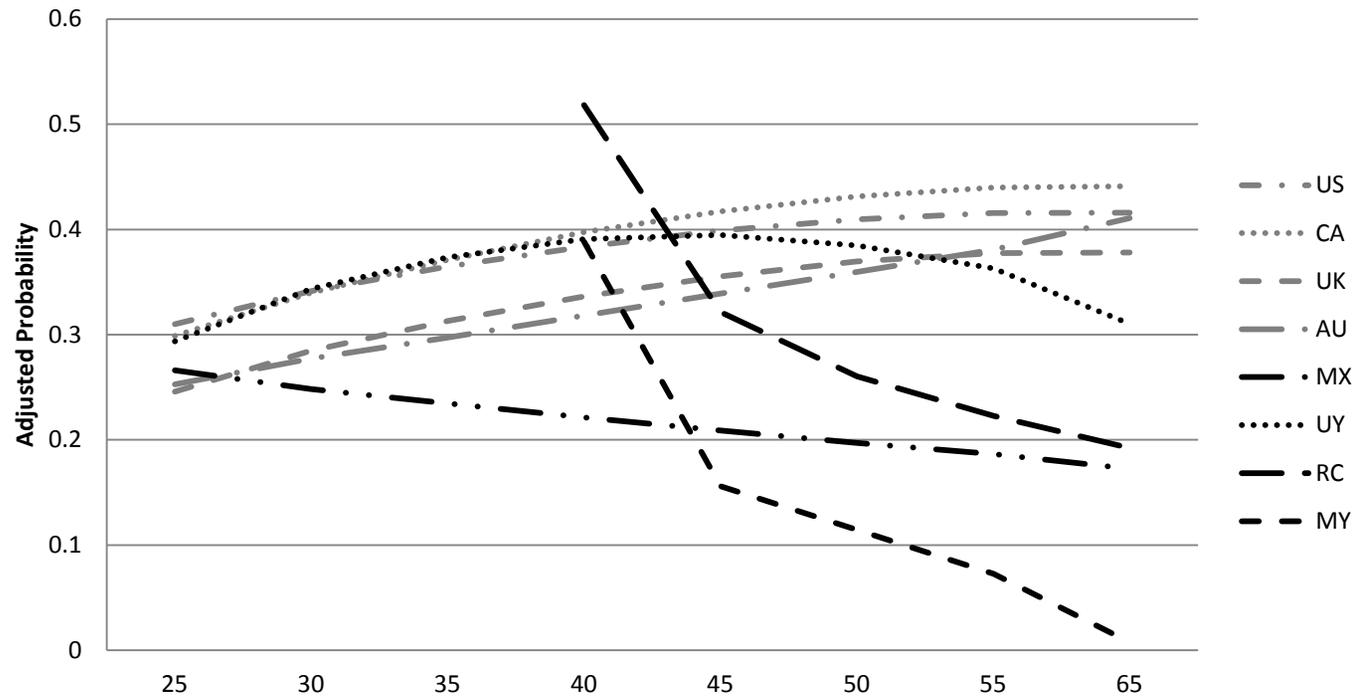


Figure2, Adjusted Probability of Having Weight Control Belief among Women, by Country and Age



Weight Control Belief and Its Impact on the Efficacy of Tobacco Control Policies on Quit Attempts: Findings from the ITC Project

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Abstract:

Background: Weight concerns are widely documented as one of the major barriers for girls and young adult women to quitting smoking. Recent studies have suggested that the health benefit of quitting is still substantial even after taking the weight gain into account. Therefore, it is important to investigate whether smokers who have weight concerns respond to tobacco control policies differently than smokers who do not in terms of quitting and quit attempts, and how this difference varies by gender and country. This study will provide important information for policy makers who want to increase the effectiveness of tobacco control policies by identifying whether weight concerns decrease the policy effectiveness in promoting quit attempts in various countries.

Objective: This study aims to investigate, by gender and country, whether smokers who believe that smoking helps control weight are less responsive to tobacco control policies with regards to quitting and quit attempts than those who do not.

Methods: We use longitudinal data from the International Tobacco Control Policy (ITC) Evaluation Project in the US, the UK, Australia, Canada, China, Malaysia, Mexico, and Uruguay to conduct the analysis. We first constructed a dichotomous indicator for smokers who have the weight control belief and an indicator for those who do not and then interacted these two dichotomous measures with policies including cigarette prices, exposure to warning labels, exposure to work-site, and bar and restaurant smoking bans. The Generalized Estimating Equations (GEE) was employed to examine the disparity in policy responsiveness in terms of quitting and quit attempts by directly estimating the interaction terms of policies and weight control belief indicators.

Findings: We find that weight control belief significantly attenuates the policy impact on promoting quit attempts among US female smokers. The weight control belief was also found to reduce the responsiveness to certain tobacco control policies among smokers who have the belief in other studied countries.

Conclusions: Although our results vary by studied gender and country, the findings suggest that weight concerns do alter policy responsiveness in quitting and quit attempts. Policy makers should take this into account and alleviate weight concerns to enhance the effectiveness of existing tobacco control policies on promoting quitting and reducing smoking.

Introduction

Weight related concerns such as weight gain after quitting are shown to be one of the major reasons that discourage quitting and quit attempts among smokers.[1-5] Nevertheless, the health benefit remains substantial even after taking account of the adverse health impact of the post-cessation weight gain.[6] In addition, for those smokers who use smoking as a weight control method, it may not be an efficient tool to control weight.[7] Existing studies indicate that heavy smokers, compared with light smokers, tend to be heavier in weight as well, and ever-smokers, compared with never-smokers, do not experience a lower weight gain over time.[8] Moreover, smoking is found to be associated with less physical activity and unhealthy diets that may in fact contribute to a weight gain.[9-11] Despite lack of scientific support for the hypothetical health benefits through weight control, smoking is somewhat recognized as a means of losing weight. Using US data, Cawley et al. (2004, 2006) found that a weight gain is significantly associated with smoking initiation among girls.[12,13] Moreover, for adolescents of both genders, 46% of girls and 30% of boys who are currently smoking use cigarettes to control weight. [14] For adults, Shang et al. (2013) showed that 32-39% of female smokers and 22-27% of male smokers agree that smoking helps weight control in some high income countries (HICs) including the US, the UK, Australia and Canada; and more than 30% of current smokers in low- and middle- income countries (LMICs) such as Uruguay, China and Malaysia also agree with the weight control effect of smoking. In addition, their results illustrate that smokers who think that smoking helps weight control tend to smoke more cigarettes than smokers who do not in these countries.[15]

While it is important to educate the public that smoking as a weight control method is indeed ineffective, little is known about how weight concern moderates smokers' responses to tobacco control policies and thereby impacts smoking behaviors, and how likely it attenuates the effectiveness of these tobacco control policies in reducing smoking. Tobacco control policies are effective interventions upon which societies rely to curb the smoking epidemic. Decades of studies in developed countries show that increases in cigarette taxes and ultimately in prices significantly reduce smoking by promoting quitting and preventing smoking initiation. The effectiveness of other tobacco control policies such as cigarette excise taxes and work-site smoking bans on reducing tobacco use has been demonstrated in studies conducted in HICs as

well.[16, 17] In recent years, more evidence has emerged from LMICs that supports the effectiveness of most policies aimed at controlling tobacco use. Specifically, cigarettes prices are shown to significantly reduce initiation and increase quitting among both adolescents and adults in LMICs. [18-20] In addition, many recently adopted tobacco control means in these countries such as work-site smoking bans, anti-smoking messaging and warning labels are linked to higher quitting and quit attempt rates. [21] Therefore, given the consensus on the effectiveness of tobacco control policies overall, it is highly warranted to examine whether their effectiveness is potentially attenuated by weight concerns, featuring an insignificant or reduced impact among population who have these concerns. Shang et al. (2013) investigated how continuous smokers respond to an increase in cigarette prices differently by their belief in weight control effect of smoking and found that female smokers aged 41-65 in the US who have such a belief are less price-responsive in reducing consumption than those who do not when cigarette price increases. [15] However, it remains unclear how price-responsiveness and responsiveness to other policies may vary by the weight control belief in terms of quitting and quit attempts. Moreover, since previous research has some evidence suggesting that smokers are inclined not to quit because of weight concerns, it is of particular interest to empirically examine the weight-concern-attributable disparity in the policy-responsiveness regarding quitting and quit attempts and to provide some direct evidence on whether smokers who have weight concerns will need additional help that increases their incentives and policy-responsiveness to quit smoking and whether they should be targeted specifically.

Although, thus far, very few previous studies explicitly analyzed the differential impact of tobacco control policies on smoking behaviors that are attributable to weight concerns, it is widely documented that these policy impacts are likely to differ by demographics and socio-economic status such as age, race and gender etc. [22-28] Some of these studies to some extent correspond to the prevalence of weight concerns. For instance, almost every single study in the US confirms that weight concerns are higher among female than among male. [1-3, 5, 14, 15, 29] Meanwhile, the price impact on smoking in the US is found to be smaller for female than for male.[23, 25-27] Cawley et al.(2004) exploit the determinants of smoking initiation among the US youth in a longitudinal setting and found that girls are not responsive to rising cigarette prices and are more likely to initiate smoking once experiencing a weight gain.[12] Similar patterns are also found in racial comparisons. Minorities such as African- Americans are more price-

responsive than Whites while Whites report higher prevalence of using cigarettes for weight control and weight concerns. [14, 22-25, 29] The abundant indirect evidence at the very least suggests that weight concerns may be an important gradient that influences responsiveness to tobacco control policies and most likely attenuate the effectiveness of these policies.

In sum, although numerous studies have identified weight concerns as one of the major factors that discourage quitting, very little is known about how the efficacy of tobacco control policies on promoting quitting and quit attempts varies by smoking related weight concerns. In this study, we provide the first evidence of the potential disparity in the efficacy of tobacco control policies due to weight control belief, characterizing both its extent in a variety of tobacco control means including cigarette taxes, anti-smoking messaging, warning labels, work-site smoking bans, bar and pub smoking bans, and restaurants bans, and its roles in shaping the gender difference in the responsiveness to tobacco control policies in many countries including the US, the UK, Australia, Canada, Mexico, Uruguay, China, and Malaysia. Our findings will shed light on how weight concerns alter policy responsiveness in a variety of countries, whether additional caution should be given to promote quitting among smokers who have weight concerns, and add empirical evidence to the emerging concerns on the efficacy of tobacco control policies among certain sub-population.

Methods

Data

The International Tobacco Control Policy Evaluation Project (ITC Project) conducts parallel longitudinal surveys of smokers and other tobacco users across 22 countries. The ITC surveys are designed to evaluate the policies of the WHO Framework Convention on Tobacco Control (Fong et al. 2006) and their longitudinal properties allow us to follow smokers over years and observe their quitting behavior since the initial wave.[30] Compared with cross-sectional data, longitudinal data has many advantages in studying smoking behaviors. For instance, in a longitudinal setting, the same individuals are observed in multiple years. Therefore, our measure of quitting and quit attempts accurately reflects the change in smoking behaviors made by the same group of smokers. In addition, when studying how tobacco control policies or cigarette prices are associated with quitting, real longitudinal data allows a more precise match

of locations where the policies are implemented to the smokers who are exposed to these policies, unlike a cross-sectional data which is built upon retrospective questions on quitting and relies on a strict assumption that people never moved during the studied period.

The datasets taken from the ITC 4-countries (including the US, the UK, Australia, and Canada), China, Malaysia, Mexico, and Uruguay contain responses from smokers in certain waves on their level of agreement with the statement that smoking helps weight control, which helps us to distinguish smokers who may consider smoking as a weight control means from those who may not. Finally, the data used for this study includes ITC 4 waves 1-5 (2002-04, 2006-07), ITC China waves 1-3 (2006, 2008-09), Malaysia waves 1-3 (2005,2007-08), Mexico waves 1-5 (2006,2008, 2010-2011), and Uruguay waves 1-3 (2006,2009, 2011). The ITC project also obtains rich information on tobacco-use related factors including cigarette prices, exposure to a variety of tobacco control policies, and individual-level demographic characteristics.

The ITC data provides a unique opportunity to examine whether smokers respond to a policy change differently because of their weight concerns, specifically, whether smokers who believe that smoking helps weight control will be less policy-responsive in attempting to quit compared with those who do not. In order to identify smokers who have such belief that smoking helps weight control from others, we exploit a question that measures smokers' level of agreement with the following statement using a 5-point scale (strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree):

“Smoking helps weight control.”

The answers are employed to construct a dichotomous measure of the belief by coding those who answered strongly agree or agree with 1 and the rest with 0. This indicator explicitly shows if a smoker may use smoking as a potential means to control weight, regardless of his or her actual body weight or body image. We consider this indicator to be a rudimentary and comprehensive measure of smoking related weight concerns. This measure captures smokers who start smoking or continue to smoke in response to an actual weight gain and it also reflects smokers who may not experience an actual weight gain yet start smoking to maintain an ideal weight or continue to smoke due to concerns on post-cessation weight gain. The generosity of this measure can be further justified by the recent finding that, compared with smokers who

report to have healthy weight, those who report to be either overweight or underweight are more likely to smoke for weight control.[14]

[Table 1 about here.]

Table 1 contains the description and definition of weight control belief indicator, policy measures, and other correlates that are estimated in our analyses. The baseline period to start tracking quitting behavior is the first wave of survey when everyone was smoking. Thus the analyzed sample consists of the second and later waves of each country. The quit attempt indicator is equivalent to the ratio of smokers who quit or ever tried to quit since the last survey. The individual characteristic confounders that are controlled include respondents' age in the survey year (in both linear and quadratic forms), marital status (an indicator for being married), employment status (an indicator for being employed), education (indicators for three categories: low, middle, and high education levels), and income (Indicators for three categories: low, middle, high income levels). Respondents with missing education, income or employment status were dropped from the sample. Because both HICs and LMICs are examined in this study, the three-level income and education categories vary significantly across countries. For instance, high school education is defined as the low-level education in HICs but middle-level education in LMICs. Detailed definitions of these categories are presented in Table 1.

As aforementioned, ITC surveys asked respondents to report their recent exposure to tobacco control policies. The last purchase information of cigarettes such as the unit of cigarettes and the price per unit (per stick, pack, or carton) was also asked. These self-reported measures of tobacco prices and control policies are crucial determinants of smoking behaviors yet highly correlated with individual unobserved heterogeneity in such behaviors. For example, heavy smokers are more likely to purchase cheaper cigarettes and thereafter report lower cigarette prices or more likely to notice tobacco advertisement and report more such exposure. As a result, instead of directly using these self-reported measures in our analyses, we aggregated them at various sampling unit (SU) levels (The sampling levels are strata at various region levels in the US, the UK, Canada and Australia, primary sampling levels (PSUs) at the second stage clustering level in China, PSUs at the state-district level in Malaysia, PSUs in Mexico, and PSUs at the city level in Uruguay.) and analyzed these SU average measures, which are less likely to be endogenous. Namely, to obtain SU cigarette prices, we first calculated individuals' self-

reported cigarette prices for a pack of 20 cigarettes, and respectively for each SU, we constructed the SU aggregated cigarette prices as the median value of prices that were reported by those who live in the SU. These prices were then converted into 2010 constant international dollars using Purchasing-Power Parity (PPP) and Consumer Price Index (CPI) of the country. PPP conversion and CPI of each country were obtained from the International Monetary Fund World Economic Outlook database. Likewise, individuals' exposures to worksite smoking bans, anti-smoking messaging, warning labels, smoking restriction in bars, and smoking restriction in restaurants were calculated and aggregated to SU-level mean measures (details are presented in Table1).

Models

In light of previous studies where significant gender disparity in weight concerns was found, and that tobacco control policies and advocates of smoking harmfulness have only recently emerged in LMICs [17], it is likely that the responses to tobacco control policies are distorted differently. Hence, we stratified our analyses by gender and country in addition to the analyses by pooling both genders. To better analyze the economic determinants of quitting, we restricted our studied sample to adult smokers aged 18-75. Our sample consists of smokers who smoked in the last wave and our dependent variable, the quit attempt indicator, measures both smokers who actually quit since the last wave and smokers who attempted to quit but failed.

The aim of this paper is to analyze whether and how the impacts of tobacco control policies are varied by the weight control belief. In other words, we will study how weight control belief moderates the quitting behaviors through smokers' responses to policies. Therefore, we estimate the following logistic regression to directly test the policy impacts by the weight control belief indicator:

$$\text{logit}(\text{Quit_Attempt}_{it}) = \beta_1 \text{Policy}_{kt} \times I(\text{Belief} = 1)_{it-1} + \beta_2 \text{Policy}_{kt} \times I(\text{Belief} = 0)_{it-1} + \beta_3 X_{it} + \beta_4 I(\text{Belief} = 1)_{it-1} + \varepsilon_{it} \quad (1)$$

Where Quit_Attempt_{it} denotes the indicator of ever making a quit attempt since the last survey. Policy_{kt} denotes SU-specific policies such as cigarette price, work-site smoking bans, and anti-smoking messaging. It also includes bar smoking bans and restaurant smoking bans in the US, the UK, Canada and Australia. $I(\text{Belief} = 1)_{it-1}$ denotes the dichotomous measure of the

weight control belief in the last survey (with 1 indicating that the respondent agrees that smoking helps control weight and 0 otherwise). Following Cawley et al. (2004) [12], we use one lag of the belief indicator instead of the current one to reduce the potential reverse causality between quitting and weight control belief. This is because smokers who quit or attempted to quit may experience a post-cessation weight gain and are more likely to agree that smoking helps weight control. $I(Belief = 0)_{it-1}$ equals $1 - I(Belief = 1)_{it-1}$ and denotes the dichotomous indicator for smokers who do not have the weight control belief in the last survey (with 1 indicating that the respondent does not agree that smoking helps control weight and 0 otherwise). Our main variables of interest are the interaction terms of policy variables and the two belief indicators. A Wald test of the estimates of these two interaction terms provide a direct test of whether policy responsiveness differs by the weight control belief. X_{it} is a vector of individual demographic characteristics including education (low education as the omitted category, middle, and high education), income (low, middle, with high income as the omitted category), marital status (an indicator of being married, not available in Malaysia surveys.), employment (an indicator of being employed), age, a quadratic form of age, and year fixed effects. Moreover, in the regressions using pooled samples of both genders, an indicator of being male is added to the model.

Given that the surveys for each country are longitudinal, to account for the correlation of the same individual over time, we use generalized estimating equations (GEE) to estimate Equation 1. GEE extends generalized linear models by adjusting for the correlated data, and yields consistent estimates even when the covariate structure is mis-specified.[31] The regressions were conducted for each gender and country and robust standard errors were obtained¹. Although we would like to estimate all tobacco control policies in one regression, it is not plausible because of the high co-linearity between SU-level tobacco control policies, their interactions with weight control belief indicators, and year fixed effects. Therefore, we analyzed each SU-tobacco control policy separately using Equation 1. After conducting each regression, a Wald test was used to determine whether the policy impact on quit attempts varies significantly by the weight control belief by testing whether the estimated coefficients for the two interaction terms are equal.

¹ Due to lack of observations, Malaysia female smokers cannot be analyzed using regressions.

Results

We report descriptive summary statistics of the quit attempt indicator and covariates by country and gender in Tables 2 and 3 for HICs and LMICs, respectively. The statistics show that in the studied HICs, quit attempt rates are 36-42% among male smokers and 40-43 % among female smokers. Consistently with the previous literature, we find that the prevalence of weight control belief among female smokers is about 10% higher than the prevalence among male smokers in these HICs. Namely, in the US and Canada, weight-control-belief prevalence is 25% among male smokers and 38% among female smokers; in the UK, it is 20% among male and 41% among female smokers; in Australia, it is 26% among male and 33% among female smokers. The mean age of these smokers is about 43-47 years. In addition, the SU-level policy variables are similar between genders within a country.

[Tables 2 and 3 are about here]

Unlike in HICs, the quit attempt rates and weight-control-belief prevalence do not show any patterns in LMICs. Quit-attempt rates are 41-51% among smokers in Mexico and Uruguay, and 43% among male smokers in Malaysia. In contrast, the quit-attempt rates are extremely low in China, where only 8% of male smokers and 12% of female smokers attempted to quit since the last survey. The prevalence of weight control belief is low among smokers in Mexico: about 13% for male and 19% for female. In Uruguay, the belief prevalence is slightly higher among female smokers than among male smokers (40% versus 32%) and in China and Malaysia the prevalence is 32% and 46%, respectively. Because there are, in general, very few female smokers relative to male in Malaysia, it is impossible to compare the prevalence between genders. Nevertheless, the SU-level policy variables remain similar by genders within a LMIC. Further, in Figure 1, we plot the attempt rates over years for each country and show that, other than China, all countries reach a quit-attempt rate that is higher than 40% at some point. And for most countries, quit attempt rates tend to increase over the survey period, although we do not have enough years to describe the trends.

[Figure 1 is about here]

Tables 4 and 5 show the results from estimating Equation 1 for HICs and LMICs respectively. The estimates reported in Table 4 indicate that cigarette prices and work-site and bar smoking

bans in Canada and Australia do not seem to be significantly associated with quit attempts. In Canada, warning labels and anti-smoking messaging are shown to be associated with more quit attempts, but the impacts do not vary by the belief. Similarly, although anti-smoking messaging is associated with more quit attempts, the association is not significantly different for smokers with different weight control belief. Interestingly, in the UK, while none of these policies seem to impact quit attempts among female smokers, some of them, including cigarette prices, worksite smoking bans, bar smoking bans, and restaurant bans show a negative association with quit attempts among male smokers who have weight control belief, but not among male smokers who do not have the belief. Moreover, while most policies in the US do not show a statistically significant association with quit attempts among male smokers, many policies including cigarette prices, bar smoking bans, restaurant smoking bans, and anti-smoking messaging significantly promote quit attempts among female smokers who do not have the weight control belief, but not among female smokers who have the belief. In addition, the estimated magnitude of the impacts of bar smoking bans and anti-smoking messaging is significantly higher for female who do not have the belief than for those who do. Lastly, female smokers who have the belief somehow reduce their quitting attempts in response to more exposure to health warning labels.

[Table 4 is about here]

Table 5 shows the corresponding estimates of the policy impacts on quit attempts for LMICs. Like in HICs, most policies do not show a significant association with quit attempts. In Mexico, conversely, male smokers who have the weight control belief tend to be more responsive to cigarette price increases than those who do not. However, unlike male smokers, female smokers who do not have the belief tend to increase quit attempts when exposed to more restrict worksite smoking bans, which is not seen for female smokers who have the belief. In addition, Chinese female smokers who do not have the weight control belief tend to increase their quit attempts when exposed to more health warning labels, an association that is not found for female smokers who have the weight control belief. In Malaysia, male smokers who have different weight control belief respond to an increase in cigarette prices so differently that those who have the belief reduce their quit attempts and those who do not increase their quit attempts.

[Table 5 is about here]

The results presented here suggest very different policy responsiveness by the weight control belief. Although we cannot find significant associations between some tobacco control policies and quit attempts, it is likely due to the lack of variations in the policy variables when there are very few SUs or survey waves in certain country. Considering that the tobacco control policies do not vary by an individual's belief in the weight control effect of smoking, the comparison of these policy impacts by the weight control belief remains valid and is more likely to be a lower bound estimate of the difference. Our results pertaining to the US female smokers illustrate that there is a huge heterogeneity in policy-responsiveness between those who have the weight control belief and those who do not, and that the lack of evidence on the effectiveness of tobacco control policies among US female to some extent can be attributed to the lack of responsiveness among female smokers who think smoking helps weight control. This is also consistent with a recent finding which suggests that US female smokers with weight control belief tend to be less price-responsive in reducing cigarette consumption than those without the belief as price increases [15].

Conclusions

This study marks the very first effort to answer whether weight concerns alter smokers' responsiveness to tobacco control policies in quitting. Using data taken from International Tobacco Control project in 8 countries, we analyzed the policy impact by allowing it to differ by whether the smoker agrees that smoking helps weight control. We find that weight control belief significantly attenuates the policy impact on promoting quit attempts among US female smokers. Our findings in part explain why many previous studies found that female US smokers do not seem to respond to price increases by reducing their smoking participation. Our analyses using data taken from other countries further illustrate that weight control belief tends to reduce responsiveness to certain tobacco control policies among smokers who have the weight control belief in both HICs and LMICs and regardless of the development level of the country. In other words, weight concerns do moderate through smokers' responsiveness to tobacco control policies to discourage quit attempts and keep them continue to smoke.

We should note that there are some limitations to this study. First, we constructed our weight control belief measure using self-reported answers which may contain some measurement errors and errors from respondents who reported "neither agree nor disagree". Although our weight

control belief measure is very comprehensive in measuring weight concerns, it is not specific enough to answer whether it is a concern of post-cessation weight gain or other weight related concerns and for most countries there is not enough variation in policy measures that can be employed to identify the policy impacts. Therefore, many of our policy estimates are insignificant. Nevertheless, we were still able to detect some difference in the policy impact by weight control belief. Lastly, although we used one lag of the weight control indicator in the analyses to reduce potential reverse causality between quitting and weight control belief, a better identification strategy such as instrument variable should be explored in the future research to concede consistent estimates for smoker who are different in terms of weight concerns.

Despite these limitations, our findings provide important empirical evidence that the efficacy of tobacco control policies in certain sub-population may be greatly reduced by some unobservable smoking related factors such as weight concerns. The insignificant or small price impact on female smokers in the US to some extent can be attributed to weight concerns that are very prevalent among females. Identifying these potential factors is crucial to improving the efficacy of tobacco control polices in certain sub-populations. Since we found that weight concerns attenuate the policy responsiveness policy makers should take this into account and alleviate weight concerns to enhance the effectiveness of existing tobacco control polices on promoting quitting and reducing smoking.

Competing interests: None declared.

Ethics approvals:

All ITC Surveys were conducted with the approval of the Office of Research Ethics Committee at the University of Waterloo, Canada and the respective internal ethics board for each country.

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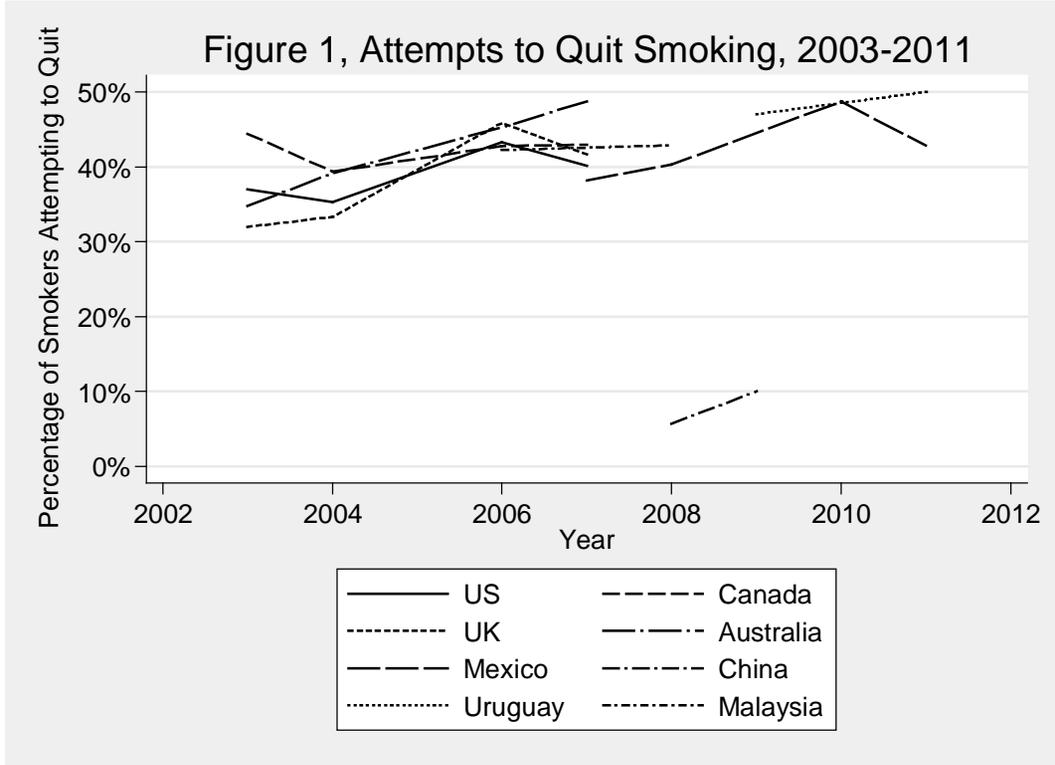


Table 1 Variable Description and Definition

Variable Name	Description
Individual Level	
Quit attempts	A dichotomous indicator equals one is the respondent has attempted to quit since the last wave, 0 otherwise
Weight control belief =1	A dichotomous indicator equals one is the respondent agrees on the weight control effect of smoking in the last wave, 0 otherwise
Age	Age at the survey year
Married	A dichotomous indicator equals one is the respondent is married, 0 otherwise
Employed	A dichotomous indicator equals one is the respondent is employed, 0 otherwise
Education	Binary indicators for 3 categories: low, middle and high education (For the US, Canada and Australia, these categories refer to high school or less, community college/technical school or some college, and college and above; For the UK, these categories refer to secondary school, some college, and college or above; For China and Uruguay, the categories refer to elementary school or no education, junior to high school, and college or above; For Malaysia, the categories refer to elementary school or no education, secondary school, and some college or above; For Mexico, the categories refer to middle school or less, high school, and some college or above.)
Income	Binary indicators for 3 categories: low, middle and high income (For the US, Canada and Australia, these categories refer to annual household income less than \$30,000, \$30,000-59,999, and \$60,000 or above; For the UK, these categories refer to annual household income at £15,000 or lower, £15,001-30,000, and £30,001 or higher; For china, the categories refer to household income per month that are <1000, 1000-2999, and 3000 or above in local currencies; For Malaysia, these categories refer to annual household income in local currencies at 10,000 or lower, 10,001-30,000, and 30,001 or higher; For Mexico, these categories refer to annual household income at \$3,000 or lower, \$3,001-8,000, and \$8,001 or higher; For Uruguay, these categories refer to annual household income in local currencies at 7,000 or lower, 7,001-30,000, and 30,001 or higher.)
SU Level	
Price	SU specific cigarette prices for a pack of 20 cigarettes in constant 2010 dollars, constructed using the median price reported in each SU
Worksite bans	The SU level average of individuals' exposure to smoking restrictions at work place (1 no restriction, 2 some restriction, 3 full restriction)
Bar bans	The SU level average of individuals' exposure to smoking restrictions at bars (1 no restriction, 2 some restriction, 3 full restriction)
Restaurant bans	The SU level average of individuals' exposure to smoking restrictions at restaurants (1 no restriction, 2 some restriction, 3 full restriction)
Warning labels	The SU level average of individuals' exposure to warning labels in the last month (1 never, 2 rarely, 3 sometimes, 4 often, 5 very often)
Anti-smoking messaging	Out of a number of anti-smoking broadcasting venues (TV, radio, posters, etc.), the fraction that each respondent was exposed to was calculate. The individual fractions were averaged to the SU level and rescaled to 1-10 measurement index

Table 2 Summary Statistics for Smokers Aged 18-75 , by Gender, HICs

	US		CA		UK		AU	
	Male	Female	Male	Female	Male	Female	Male	Female
Quit Attempts	0.36 (0.48)	0.41 (0.49)	0.42 (0.49)	0.43 (0.49)	0.36 (0.48)	0.40 (0.49)	0.41 (0.49)	0.42 (0.49)
Weight Control Belief=1	0.25 (0.43)	0.38 (0.49)	0.25 (0.43)	0.38 (0.49)	0.30 (0.46)	0.41 (0.49)	0.26 (0.44)	0.33 (0.47)
Age	46.97 (13.78)	47.71 (13.34)	45.07 (13.37)	45.31 (12.50)	48.22 (13.28)	47.14 (12.44)	43.54 (13.30)	43.21 (12.22)
Married	0.37 (0.48)	0.35 (0.48)	0.32 (0.47)	0.30 (0.46)	0.37 (0.48)	0.30 (0.46)	0.32 (0.47)	0.29 (0.45)
Employed	0.69 (0.46)	0.59 (0.49)	0.76 (0.43)	0.66 (0.48)	0.73 (0.44)	0.62 (0.49)	0.77 (0.42)	0.61 (0.49)
Education								
low	0.09 (0.29)	0.08 (0.28)	0.15 (0.36)	0.14 (0.35)	0.35 (0.48)	0.37 (0.48)	0.36 (0.48)	0.39 (0.49)
Middle	0.28 (0.45)	0.31 (0.46)	0.28 (0.45)	0.27 (0.45)	0.25 (0.43)	0.25 (0.43)	0.25 (0.43)	0.26 (0.44)
High	0.63 (0.48)	0.61 (0.49)	0.56 (0.50)	0.58 (0.49)	0.40 (0.49)	0.38 (0.49)	0.40 (0.49)	0.35 (0.48)
Income								
Low	0.32 (0.47)	0.39 (0.49)	0.23 (0.42)	0.33 (0.47)	0.25 (0.43)	0.37 (0.48)	0.22 (0.41)	0.35 (0.48)
Middle	0.38 (0.49)	0.39 (0.49)	0.40 (0.49)	0.37 (0.48)	0.36 (0.48)	0.37 (0.48)	0.36 (0.48)	0.34 (0.47)
High	0.30 (0.46)	0.22 (0.42)	0.37 (0.48)	0.30 (0.46)	0.39 (0.49)	0.24 (0.43)	0.42 (0.49)	0.31 (0.46)
SU Level Policy								
Price	3.66 (0.71)	3.64 (0.69)	6.11 (0.83)	6.04 (0.83)	7.36 (0.23)	7.37 (0.24)	6.02 (0.22)	6.00 (0.22)
Worksite bans	2.49 (0.17)	2.47 (0.17)	2.50 (0.21)	2.51 (0.22)	2.29 (0.19)	2.29 (0.19)	2.52 (0.18)	2.53 (0.19)
Bar bans	2.04 (0.36)	2.00 (0.33)	2.32 (0.40)	2.33 (0.41)	1.73 (0.21)	1.73 (0.21)	2.09 (0.20)	2.10 (0.22)
Restaurant bans	2.43 (0.30)	2.40 (0.28)	2.59 (0.31)	2.59 (0.31)	2.12 (0.17)	2.12 (0.16)	2.68 (0.12)	2.69 (0.12)
Warning label	2.56 (0.16)	2.57 (0.16)	3.32 (0.19)	3.31 (0.19)	3.83 (0.30)	3.83 (0.30)	3.22 (0.34)	3.22 (0.35)
Anti-smoking Messaging	4.21 (0.27)	4.22 (0.27)	4.60 (0.27)	4.61 (0.27)	4.30 (0.36)	4.23 (0.36)	4.74 (0.39)	4.74 (0.39)
N	1890	2640	2376	3091	2371	3059	2720	3243

Note: Country names in the column headers are written using two-letter names: US- the US, UK- the UK, CA-Canada, AU- Australian.

Table 3 Summary Statistics for Smokers Aged 18-75 , by Gender, LMICs

	MX		UY		RC		MY	
	Male	Female	Male	Female	Male	Female	Male	Female
Quit Attempts	0.41 (0.49)	0.47 (0.50)	0.51 (0.50)	0.47 (0.50)	0.08 (0.27)	0.12 (0.33)	0.43 (0.50)	0.29 (0.46)
Weight Control belief=1	0.13 (0.34)	0.19 (0.39)	0.32 (0.47)	0.40 (0.49)	0.32 (0.47)	0.32 (0.47)	0.46 (0.50)	0.39 (0.50)
Age	41.24 (13.95)	41.50 (12.78)	42.94 (14.40)	41.88 (13.12)	51.51 (10.82)	55.34 (12.41)	43.67 (13.29)	49.54 (13.27)
Married	0.62 (0.49)	0.57 (0.49)	0.45 (0.50)	0.37 (0.48)	0.92 (0.27)	0.84 (0.37)	-- --	-- --
Employed	0.41 (0.49)	0.35 (0.48)	0.45 (0.50)	0.56 (0.50)	0.70 (0.46)	0.48 (0.50)	0.35 (0.48)	0.18 (0.39)
Education								
low	0.62 (0.49)	0.60 (0.49)	0.58 (0.49)	0.55 (0.50)	0.41 (0.49)	0.64 (0.48)	0.84 (0.36)	1 (0)
Middle	0.22 (0.41)	0.26 (0.44)	0.31 (0.46)	0.27 (0.44)	0.37 (0.48)	0.28 (0.45)	0.11 (0.31)	0 (0)
High	0.16 (0.36)	0.14 (0.35)	0.11 (0.32)	0.18 (0.38)	0.23 (0.42)	0.08 (0.27)	0.05 (0.21)	0 (0)
Income								
Low	0.24 (0.42)	0.24 (0.43)	0.29 (0.45)	0.34 (0.47)	0.12 (0.33)	0.19 (0.39)	0.38 (0.48)	0.61 (0.50)
Middle	0.57 (0.49)	0.56 (0.50)	0.44 (0.50)	0.41 (0.49)	0.45 (0.50)	0.45 (0.50)	0.41 (0.49)	0.21 (0.42)
High	0.19 (0.39)	0.20 (0.40)	0.27 (0.44)	0.25 (0.43)	0.43 (0.49)	0.36 (0.48)	0.21 (0.35)	0.18 (0.39)
SU-Level Policy								
Price	4.03 (0.75)	3.94 (0.69)	2.63 (0.83)	2.64 (0.79)	1.50 (0.40)	1.43 (0.38)	4.02 (1.01)	2.68 (1.49)
Worksite bans	1.17 (0.27)	1.19 (0.28)	2.64 (0.44)	2.66 (0.40)	1.90 (0.21)	1.88 (0.21)	2.39 (0.25)	2.42 (0.26)
Warning label	3.21 (0.55)	3.21 (0.56)	3.61 (0.66)	3.69 (0.67)	2.82 (0.26)	2.81 (0.24)	3.27 (0.42)	3.28 (0.37)
Anti-smoking messaging	6.18 (2.22)	6.26 (2.23)	6.34 (2.06)	6.37 (1.98)	4.06 (1.20)	4.24 (1.15)	7.16 (0.68)	7.43 (0.87)
N	2426	1629	607	696	6073	277	1490	28

Note: country names in the column header: MX-Mexico, UY-Uruguay, RC-China, MY-Malaysia.

Table4 The Associations between tobacco control policies and quit attempts by country, gender, and weight control belief, HICs

HIC	US	US	US	CA	CA	CA	UK	UK	UK	AU	AU	AU
	All	Male	Female	All	Male	Female	All	Male	Female	All	Male	Female
	Prices											
Belief =1	0.11 (0.09)	0.13 (0.16)	0.10 (0.11)	-0.08 (0.64)	-0.10 (0.11)	-0.07 (0.08)	-0.29 (0.23)	-1.12*** (0.43)	0.17 (0.28)	-0.16 (0.26)	-0.25 (0.42)	-0.08 (0.34)
Belief =0	0.11* (0.06)	0.02 (0.09)	0.21** (0.08)	-0.02 (0.05)	-0.01 (0.07)	-0.04 (0.06)	0.08 (0.17)	0.05+++ (0.26)	0.10 (0.23)	0.11 (0.20)	0.01 (0.30)	0.20 (0.28)
	Worksite bans											
Belief =1	0.11 (0.34)	0.59 (0.59)	-0.10 (0.42)	0.24 (0.24)	0.42 (0.43)	0.19 (0.29)	-0.16 (0.33)	-1.19** (0.59)	0.49 (0.41)	0.42 (0.31)	0.20 (0.50)	0.51 (0.40)
Belief =0	0.31 (0.24)	0.22 (0.35)	0.43 (0.33)	0.09 (0.18)	0.02 (0.28)	0.13 (0.24)	0.14 (0.53)	-0.50 (0.41)	0.61 (0.37)	0.19 (0.25)	-0.21 (0.39)	0.51 (0.34)
	Bar bans											
Belief =1	0.08 (0.18)	0.46 (0.30)	-0.10+ (0.22)	0.13 (0.13)	0.30 (0.22)	0.09 (0.16)	-0.22 (0.25)	-1.04* (0.54)	0.21 (0.30)	0.12 (0.23)	0.48 (0.37)	-0.12 (0.29)
Belief =0	0.16 (0.13)	0.03 (0.18)	0.31* (0.18)	0.09 (0.1)	-0.01 (0.15)	0.16 (0.13)	-0.09 (0.18)	-0.36 (0.25)	0.10 (0.26)	0.17 (0.17)	0.31 (0.24)	0.05 (0.23)
	Restaurant bans											
Belief =1	0.17 (0.21)	0.58* (0.35)	-0.05 (0.26)	0.18 (0.17)	0.41 (0.30)	0.10 (0.21)	-0.14 (0.32)	-1.16* (0.64)	0.43 (0.39)	0.23 (0.44)	0.34 (0.68)	0.09 (0.58)
Belief =0	0.25* (0.15)	0.17 (0.21)	0.35* (0.21)	0.19 (0.13)	0.14 (0.20)	0.23 (0.17)	-0.14 (0.24)	-0.43 (0.33)	0.05 (0.34)	0.20 (0.34)	0.09 (0.51)	0.35 (0.47)
	Warning labels											
Belief =1	-0.65* (0.78)	-0.37 (0.68)	-0.81* (0.46)	0.42** (0.19)	-0.21 (0.45)	-0.07 (0.35)	0.16++ (0.31)	0.42+++ (0.50)	0.08 (0.41)	-0.06 (0.24)	-0.37 (0.36)	0.18 (0.33)
Belief =0	-0.50** (0.25)	-0.43 (0.37)	-0.53 (0.35)	0.40*** (0.15)	0.05 (0.32)	0.14 (0.29)	-0.28 (0.30)	-0.47 (0.46)	-0.05 (0.41)	-0.04 (0.23)	-0.47 (0.33)	0.30 (0.31)
	Anti-smoking messaging											
Belief =1	-0.15 (0.21)	-0.10 (0.38)	-0.17++ (0.26)	-0.09 (0.27)	0.56* (0.31)	0.36 (0.25)	-0.02++ (0.21)	-0.27 (0.34)	0.12++ (0.26)	0.16 (0.16)	0.50** (0.25)	-0.10 (0.21)
Belief =0	0.16 (0.17)	-0.12 (0.25)	0.45* (0.24)	0.08 (0.21)	0.41* (0.23)	0.42** (0.21)	0.38** (0.19)	0.35 (0.29)	0.37 (0.25)	0.21 (0.14)	0.39* (0.20)	0.05 (0.19)
N	4530	1890	2640	5467	2376	3091	5430	2371	3059	5963	2720	3243

Note: Robust Standard errors are in parentheses. Regressions were conducted separately for each tobacco control policy. * $0.05 < p \leq 0.1$, ** $0.01 < p \leq 0.05$, *** $p \leq 0.01$. Wald test: significant difference at 10% level +, 5 percent level++, 1% level+++.

Table5 The associations between tobacco control policies and quit attempts by country, gender, and weight control belief, LMICs

HIC	MX	MX	MX	UY	UY	UY	RC	RC	RC	MY	MY	MY
	All	Male	Female	All	Male	Female	All	Male	Female	All	Male	Female
Prices												
Belief =1	0.52***+	0.54***+	0.51**	0.01	-0.8	0.08	0.12	0.18	-1.51	-0.16+++	-0.18*+++	--
	(0.13)	(0.17)	(0.20)	(0.11)	(0.17)	(0.15)	(0.22)	(0.23)	(1.24)	(0.10)	(0.10)	--
Belief =0	0.23***	0.25***	0.21*	-0.02	-0.05	0.06	0.01	-0.08	0.62	0.19***	0.19***	--
	(0.06)	(0.07)	(0.11)	(0.09)	(0.12)	(0.13)	(0.15)	(0.15)	(0.66)	(0.06)	(0.07)	--
Worksite bans												
Belief =1	-0.35	-0.45	-0.24+	0.35	0.36	0.27	-0.11	-0.08	-1.13	-0.31	-0.28	--
	(0.27)	(0.37)	(0.39)	(0.23)	(0.32)	(0.33)	(0.34)	(0.35)	(1.44)	(0.32)	(0.33)	--
Belief =0	0.06	-0.29*	0.57***	0.27	0.29	0.23	0.12	0.19	-1.09	-0.27	-0.29	--
	(0.13)	(0.17)	(0.21)	(0.17)	(0.25)	(0.25)	(0.25)	(0.26)	(0.91)	(0.28)	(0.29)	--
Warning labels												
Belief =1	-0.14	-0.2	-0.08	0.00	0.13	-0.12	0.26	0.56	-1.18	0.25	0.23	--
	(0.15)	(0.22)	(0.19)	(0.14)	(0.22)	(0.18)	(0.42)	(0.46)	(1.04)	(0.17)	(0.17)	--
Belief =0	0.01	0.03	-0.02	-0.11	-0.22	0.02	0.37*	0.32	1.74***	0.24	0.27	--
	(0.06)	(0.08)	(0.11)	(0.10)	(0.14)	(0.16)	(0.21)	(0.22)	(0.58)	(0.18)	(0.18)	--
Anti-smoking messaging												
Belief =1	0.00	0.00	0.01	0.00	-0.01	0.02	-0.04	-0.03	-0.33	0.38***	0.41***	--
	(0.04)	(0.05)	(0.05)	(0.05)	(0.07)	(0.06)	(0.07)	(0.08)	(0.34)	(0.13)	(0.13)	--
Belief =0	0.00	0.01	-0.02	-0.06*	-0.08*	-0.03	0.02	0.03	-0.19	0.25**	0.29***	--
	(0.02)	(0.02)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.22)	(0.11)	(0.11)	--
N	4055	2426	1629	1303	607	696	6350	6073	277	1518	1490	--

Note: Robust Standard errors are in parentheses. Regressions were conducted separately for each tobacco control policy. For regressions using Uruguay data, SUs that have missing index for the policy of interest were dropped from the corresponding sample in the analyses. * $0.05 < p \leq 0.1$, ** $0.01 < p \leq 0.05$, *** $p \leq 0.01$. Wald test: significant difference at 10% level +, 5 percent level ++, 1% level +++.