Self-reported price of cigarettes, consumption and compensatory behaviours in a cohort of Mexican smokers before and after a cigarette tax increase

Belen Saenz-de-Miera,1 James F Thrasher,1,2 Frank J Chaloupka,3 Hugh R Waters,4 Mauricio Hernandez-Avila,5 Geoffrey T Fong6,7

ABSTRACT

Objective To assess the impact of a 2007 cigarette tax increase from 110% to 140% of the price to the retailer on cigarette price and consumption among Mexican smokers, including efforts to offset price increases.

Methods Data were analysed from the 2006 and 2007 administrations of the International Tobacco Control (ITC) Policy Evaluation Survey in Mexico, which is a population-based cohort of adult smokers. Self-reported price of last cigarette purchase, place of last purchase, preferred brand, daily consumption and quit behaviour were assessed at baseline and follow-up.

Results Self-reported cigarette prices increased by 12.7% after the tax increase, with prices for international brands increasing more than for national brands (13.5% vs 8.7%, respectively). Although the tax increases were not fully passed onto consumers particularly on national brands, no evidence was found for smokers changing behaviour to offset price increases. Consistent declines in consumption across groups defined by sociodemographic and smoking-related psychosocial variables suggest a relatively uniform impact of the tax increase across subpopulations. However, decreased consumption appeared limited to people who smoked relatively more cigarettes a day (>5 cigarettes/day).

INTRODUCTION

A large tax increase on tobacco is the single most effective tobacco control policy.1 Tax increases generally translate into price increases for the consumer, and higher prices are associated with lower levels of consumption, reduced prevalence, increased cessation and reduced initiation.2,3 Price elasticity for tobacco demand has been estimated at −0.4 and −0.8 for developed and developing countries, respectively.4 In other words, a 10% increase in tobacco prices reduces overall consumption by approximately 4% in developed countries and by approximately 8% in developing countries. For Mexico, which is an upper middle-income country, Sesma et al6,6 estimated price elasticity at −0.62; however, this estimate involved analysing prices that were confounded by other factors and excluded households that should have been included in the analysis. After addressing these shortcomings, Jimenez et al7 estimated price elasticity at −0.52, suggesting that a 10% price increase should decrease consumption by 5.2%.

Previous studies of cigarette taxes in Mexico have used aggregate or household-level consumption data and, as such, cannot assess the impact of taxes on individual perceptions and behaviour. Studies using individual-level data have been conducted primarily in high-income countries, where results indicate that higher cigarette taxes and prices prevent youth from starting to smoke and lead current smokers to reduce consumption or quit.3 However, the tobacco industry may use compensating pricing strategies, such as the development of lower price branded generics and the introduction of multipack discounts to offset increases in taxes.5 Furthermore, some smokers offset increases in taxes by making special efforts to buy cheaper cigarettes.10–12

In Mexico, cigarettes are subject to two ad valorem taxes: the special production and services tax (SPST) and value added tax (VAT), both set by the federal government. At the end of 2006, gradual increments to the SPST were approved. At the beginning of 2007, the SPST was increased from 110% of the price to the retailer to 140%, with subsequent annual increases to 150% in 2008 and 160% in 2009. The VAT remained at 15% of the price to the consumer in those years. The taxable base for the SPST (ie, the price to the retailer) includes the factory price and the wholesaler’s profit and overhead. The taxable base for the VAT includes the price to the retailer, the SPST, and the retailer’s profit and overhead, estimated on average at 10.7% of the price to the retailer after SPST. Expressed as a percentage of the final price, the joint incidence of the SPST and the VAT was 54.2% in 2006 and 58.9% in 2007. Because of the addictive nature of cigarettes and the oligopolistic structure of the cigarette industry, an increase in taxes is expected to increase final prices at least in the same proportion.2 As such, a tax increase from 110% of the price to the retailer to 140% would be expected to increase the final price by 14.5%.13

This study assesses the potential impact of this cigarette tax increase by examining the following data in a cohort of adults Mexican smokers before and after the tax increase: (1) changes in general...
and brand-specific self-reported price of the most recent cigarette package purchased, (2) brand switching and other behaviours that could offset price increases and (3) changes in cigarette consumption, including quit behaviour.

METHODS
Study sample
Data for this study were taken from the Mexican administration of the International Tobacco Control Policy Evaluation Survey (ITC-Mexico), a population-based longitudinal survey of adult smokers designed to evaluate the behavioural and psychosocial effects of national-level policies promoted by the WHO Framework Convention on Tobacco Control (FCTC). Baseline ITC-Mexico data were collected between September and November 2006, and wave 2 follow-up data were collected between November and December 2007. Participants were randomly selected using a stratified multistage sampling design within the urban areas of four large Mexican Cities (Mexico City, Guadalajara, Tijuana and Ciudad Juarez), for which ITC-Mexico data are representative. Within each city, 40 block groups were selected, with selection probability proportional to the number of census tract and block-group inhabitants, according to the 2000 census. Households in selected block groups were visited in a random order, up to 4 times on different hours and days of the week, in order to enumerate households and identify eligible adult smokers (ie, 18 years or older, smoked at least once a week and had smoked at least 100 lifetime cigarettes). A maximum of one woman and one man were interviewed per household, and approximately seven interviews were conducted in each selected block group. Data were collected through face-to-face interviews taking 40 to 50 min. At baseline, contact was established with 68% (2787/4282) of households approached, of which 90% were enumerated, yielding a household enumeration rate of 58%. Interviews were conducted with 89% (1079/1216) of smokers selected to participate from these enumerated households. Of the 1079 participants interviewed at baseline (ie, 263 in Mexico City, 280 in Guadalajara, 273 in Tijuana and 263 in Ciudad Juarez), 70.1% (n=756) were followed-up in 2007. The follow-up protocol involved visiting households up to 10 times at different times and days in order to reinterview participants. Data on reasons for attrition are incomplete and unable to be analysed. The sampling weights account for the probability of household selection, with additional adjustment for the number of smokers of the same sex within the household, so that weighted population estimates are representative of the urban populations sampled.

Measures
Smoking perceptions and behaviour
Various smoking-related cognitions and behaviour were assessed. After assessing daily or non-daily smoking, daily smokers reported their average daily cigarette consumption, whereas non-daily smokers reported the average quantity they smoked each week, from which average daily consumption was derived. For some stratified analyses, the sample was divided into heavy versus light consumption using median daily consumption. Questions were also asked concerning preferred brand; the place of last purchase, with precoded response options reflecting most prevalent purchase sites (eg, convenience stores), as well as those used to avoid taxes (eg, duty free, internet); whether the last purchase was a single cigarette, a pack, or a carton of packs (ie, 10 packs of 20 cigarettes each); and the brand purchased and nominal price paid at last cigarette purchase. To derive the real price, self-reported nominal prices were adjusted for inflation using the general price index. At both waves, respondents indicated how long ago their last serious quit attempt ended, from which a variable reflecting a quit attempt in the previous year was derived. Intention to quit was also assessed (ie, in the next month; the next 6 months; after the next 6 months; or no intention to quit), which was recoded to reflect intention to quit in the next 6 months versus not, as previous work suggests this variable predicts subsequent cessation efforts. Smokers at both waves were also asked how much (ie, not at all; somewhat; very much) the price of cigarettes had caused them to think about quitting in the last 6 months. At follow-up, participants were asked if they had quit smoking, and those who had quit for 30 days or more were classified as quitters.

Control variables
Standard questions assessed age, sex, marital status, highest level of educational achievement, employment status and monthly household income. The seven response options for educational achievement were recoded to terciles (low=primary school or less; mid=secondary or technical school; high=high school or more), as were the seven options for monthly household income (low=<$0 to $300; mid=$5001 to $5000; high=more than $5000).

Analysis
The primary analytic sample for this study consisted of smokers who were successfully followed-up over time, in order to control for unmeasured characteristics that may otherwise confound the results. The secondary analytic sample for sensitivity analyses included the entire baseline sample, including those who were and were not followed-up. Analyses were conducted with Stata V9.2 (Stata, College Station, Texas, USA). Tests and independent sample t tests were used to compare sociodemographic characteristics and smoking behaviour among participants who were and were not successfully followed-up, as well as to compare the baseline sample with the subsample that was followed. All other estimates and significance tests were adjusted for sampling weights and the survey design, including pair sample t tests to assess differences in continuous variables (eg, price, consumption) and χ² tests for categorical variables (eg, consumption of single cigarettes, place of last purchase). Logistic models were estimated, regressing self-reported quit status at follow-up on baseline intensity of consumption and other explanatory variables. Sensitivity analyses of cigarette consumption changes involved estimating bivariate and multivariate random effects linear regression models, adjusting for intraindividual correlation of data from participants observed at both waves. The survey wave was included as a dummy variable to assess changes over time.

RESULTS
Table 1 presents characteristics of the entire baseline sample, as well as of the smokers who were and were not followed-up. No statistically significant differences were found between the entire baseline sample and the sample that was followed-up. However, when compared to those who were not followed-up, those who were successfully followed-up were more likely to be women, older, less educated and have a lower household income than respondents who did not participate in the second wave. No significant differences in smoking-related variables were found between those who were and were not followed-up.

Most smokers reported buying packs of cigarettes at their last purchase, but the proportion decreased at wave 2 (from 89.9% to 78.3%; p<0.01), while the proportion of smokers who bought...
single cigarettes followed the opposite pattern (from 9.9% to 20.2%; p<0.01). The average price per cigarette increased (from 1.9 to 2.4 pesos; p<0.015), with a higher price per cigarette than when sticks were purchased in packs (1.0 to 1.1 pesos). Only two smokers bought cartons of cigarettes in both waves, so the price per cigarette was not estimated.

Table 2 shows the self-reported price of last cigarette pack purchased at waves 1 and 2, including only those whose last purchase was a pack in both surveys. An overall price increase of 12.7% was found (p<0.01). When analysing price for those who purchased an international brand at both waves independent of the type of international brand, the price increase was higher than for those who bought national brands at both waves (13.5% vs 8.7%, respectively; p<0.01). In Mexico, international and national brands are rough equivalents of premium and discount brands, as indicated by significant different price across types. Brand-specific estimates were calculated only for people who bought that brand at both waves. At wave 2, no international brand was cheaper than any national brand. Table 2 shows the brand-specific prices for the most prevalent brands purchased in our sample; statistically significant increases in price were found across all brands but two, which had small sample sizes.

A quarter of the smokers who continued smoking switched their preferred brand (n=158). No clear switching pattern was found, however. Of those who switched, approximately a quarter switched from a national to a more expensive international brand (n=41), a quarter switched from an international to a less expensive national brand (n=41), whereas the rest switched within national or international brand categories (n=24 and 52, respectively).

In both waves, nearly 95% of last cigarette purchases were made in local or convenience stores (from 79.3% to 83.8%), 24 h convenience stores (from 11.2% to 6.6%) or supermarkets (from 3.5% to 3.3%), none of which changed significantly over time. Sources that could offset price increases were used infrequently (ie, duty free shops from 3.3% to 0.4%; purchase outside the country from 0.1% to 0.1%) or not at all (ie, internet 0% to 0%).

### Table 1

<table>
<thead>
<tr>
<th>Characteristics at baseline (2006)</th>
<th>All participants at wave 1 (n=1079)</th>
<th>Followed-up (n=756)</th>
<th>Not followed-up (n=323)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age**</td>
<td>Mean/% n</td>
<td>Mean/% n</td>
<td>Mean/% n</td>
</tr>
<tr>
<td>Sex*</td>
<td>39.10 1079</td>
<td>40.2 756</td>
<td>36.5 323</td>
</tr>
<tr>
<td>Female</td>
<td>39.5% 426</td>
<td>41.8% 316</td>
<td>34.1% 110</td>
</tr>
<tr>
<td>Male</td>
<td>60.5% 653</td>
<td>58.2% 440</td>
<td>65.9% 213</td>
</tr>
<tr>
<td>Marital status</td>
<td>65.6% 706</td>
<td>66.5% 502</td>
<td>63.6% 204</td>
</tr>
<tr>
<td>Couple</td>
<td>12.6% 136</td>
<td>12.6% 95</td>
<td>12.8% 41</td>
</tr>
<tr>
<td>Separated/widowed</td>
<td>21.7% 234</td>
<td>20.9% 158</td>
<td>23.7% 76</td>
</tr>
<tr>
<td>Education level**</td>
<td>30.3% 320</td>
<td>33.4% 248</td>
<td>22.9% 72</td>
</tr>
<tr>
<td>Primary graduate or less</td>
<td>37.4% 395</td>
<td>34.6% 257</td>
<td>43.8% 138</td>
</tr>
<tr>
<td>Secondary graduate</td>
<td>32.4% 342</td>
<td>31.9% 237</td>
<td>33.3% 105</td>
</tr>
<tr>
<td>Employment status</td>
<td>68.7% 337</td>
<td>67.8% 511</td>
<td>70.9% 229</td>
</tr>
<tr>
<td>Monthly household income*</td>
<td>31.3% 740</td>
<td>32.2% 243</td>
<td>29.1% 94</td>
</tr>
<tr>
<td>Low ($0 to $3000 pesos)</td>
<td>25.2% 248</td>
<td>27.9% 190</td>
<td>19.1% 58</td>
</tr>
<tr>
<td>Medium ($3001 to $5000 pesos)</td>
<td>32.5% 320</td>
<td>30.8% 210</td>
<td>36.2% 110</td>
</tr>
<tr>
<td>High ($5001 pesos or more)</td>
<td>42.4% 418</td>
<td>41.3% 282</td>
<td>44.7% 136</td>
</tr>
<tr>
<td>Smoking status</td>
<td>77.8% 840</td>
<td>77.9% 589</td>
<td>77.7% 251</td>
</tr>
<tr>
<td>Daily</td>
<td>22.2% 239</td>
<td>22.1% 167</td>
<td>22.3% 72</td>
</tr>
<tr>
<td>No. of cigarettes per day</td>
<td>1052 8.1</td>
<td>739 7.9</td>
<td>313</td>
</tr>
<tr>
<td>Pack of cigarettes</td>
<td>90.5% 963</td>
<td>90.4% 671</td>
<td>90.7% 292</td>
</tr>
<tr>
<td>Single cigarette</td>
<td>9.1% 97</td>
<td>9.3% 69</td>
<td>8.7% 28</td>
</tr>
<tr>
<td>Carton of 10 cigarette packs</td>
<td>4% 4</td>
<td>0.3% 2</td>
<td>0.6% 2</td>
</tr>
<tr>
<td>Self-reported price of last pack purchased (MX$ November 2007)</td>
<td>20.83 957</td>
<td>20.76 666</td>
<td>21.00 291</td>
</tr>
<tr>
<td>Made serious quit attempt in previous year</td>
<td>Yes 25.8% 278</td>
<td>26.5% 200</td>
<td>24.2% 78</td>
</tr>
<tr>
<td>No</td>
<td>74.2% 801</td>
<td>73.5% 556</td>
<td>75.9% 245</td>
</tr>
<tr>
<td>Plan to quit</td>
<td>Within the next month/next 6 months</td>
<td>17.0% 171</td>
<td>17.3% 122</td>
</tr>
<tr>
<td>Beyond 6 months/not planning to quit</td>
<td>83.0% 833</td>
<td>82.7% 584</td>
<td>83.6% 249</td>
</tr>
</tbody>
</table>

Statistically significant differences between the sample that was and was not followed-up are indicated with *p<0.05; **p<0.01.

Unweighted means and proportions shown and used when conducting t tests and $\chi^2$ tests of significant differences between samples. No differences were found between the baseline sample and followed-up sample.

Inactive means retired or on a pension, student, or home duties.
Survey adjusted average daily cigarette consumption decreased significantly from 6.9 to 4.9 cigarettes/day (p<0.01) when including no consumption for participants who reported having quit at follow-up (see table 3). This overall reduction remained statistically significant when removing quitters from the analysis (7.2 to 5.7 cigarettes/day; p<0.01). A statistically significant decrease in consumption was found across all sociodemographic subgroups, as well as among those who did and did not intend to or try to quit in the previous year. The only evidence for differential effects over time involved baseline smoking intensity. Among heavy smokers (ie, at or above the median of five cigarettes per day at wave 1), a statistically significant decrease in consumption was found across all sociodemographic subgroups, as well as among those who quit smoking at follow-up. However, light smokers (ie, less than five cigarettes/day) generally maintained their consumption level over time, with a statistically significant increase found when excluding those who had quit. In sensitivity analyses that included the entire baseline and follow-up samples, consumption was regressed on time (ie, baseline vs follow-up) and other study variables. Results indicated that time was inversely associated with consumption, and planning to quit was the only other statistically significant predictor of consumption in multivariate models (results not shown). Tests of interaction between time and other variables indicated no statistically significant interactions.

A total of 98 baseline smokers (13.1%; 95% CI 9.7%,16.5%) reported being quit for at least 30 days at follow-up. Bivariate and multivariate logistic regression models were estimated to determine predictors of being quit (see table 4). The greater likelihood of quitting among light versus heavy daily consumption was the only statistically significant predictor in either bivariate (RRlight vs heavy=2.32) or the model that adjusted for sociodemographics, quit intentions and quit behaviour (ARRlight vs heavy=2.66). When excluding from both waves all those who were quit at wave 2, the proportion of smokers who reported making serious quit attempts in the previous year increased from 26.1% at wave 1 to 34.5% at wave 2 (p<0.001). In addition, the price of cigarettes increased its relevance as a reason to consider quitting for those who were still smoking after the tax increase (very much: from 5.9% to 14.7%; somewhat: from 19.4% to 35.5%; p<0.01). Among smokers who had quit by follow-up (n=98), 40.1% reported that the price of cigarettes was either a very important (12.7%) or a somewhat important (27.4%) reason for quitting. Nevertheless, other self-reported reasons for quitting appeared more relevant than price, such as one’s family being concerned about their health (75.8% = very much) and health reasons (60.0%= very much).

**DISCUSSION**

This study adds to the evidence base on how tax increases are passed on to consumers, which rarely has been studied in low-income and middle-income countries. Results indicated that the average self-reported real price for cigarettes, which is a valid estimate of price, increased by 12.7% from 2006 to 2007. Given the characteristics of how taxes are applied in Mexico, a price...
increase of 14.5% was hypothesised. Hence, the overall price increase was lower than expected, but less so for international brands (13.5%). The lower relative price increase for national brands (8.7%) suggests that the full tax was not passed onto consumers of these cheaper brands. This strategy likely aims to reduce the impact of the tax increase by keeping some brands cheap, including the possibility of encouraging switching to a cheaper brand instead of quitting. How taxes are passed onto consumers may re...
smokers with a lighter habit. This finding reflects general economic theory about greater relative declines in consumption among people who consume more of the product. Nevertheless, lighter smokers were more likely than heavier smokers to quit over the observation period, which is a more desirable public health outcome than reduced consumption. Furthermore, prevalence of single cigarette consumption increased over this time, which other studies have indicated that Mexican smokers use as a quitting strategy, since single cigarettes cost more and it requires extra effort to obtain each cigarette, as opposed to the easy access that a pack provides.

A limitation of this analysis concerns the inability to attribute the observed decreases in consumption directly to the tax increase. Since the cigarette tax was implemented at the national level, there is no unexposed control group with which to compare changes found. Furthermore, since this is the first longitudinal study of a population-based representative sample of Mexico smokers, we cannot compare cessation rates in our sample with those that have occurred over a similar time period in the absence of a tax increase. Increases in media coverage of proposed tobacco control legislation could help account for our findings, however, no media campaigns or other tobacco control policies were implemented in 2007, at either the national level or within the cities considered. Indeed, key predictors of cessation (ie, past year quit behaviour, intention to quit) did not predict being quit for 30 days in our sample, suggesting that some other variable accounts for observed changes. Given the great consistency of tax impacts, it appears that at least some of the observed changes in consumption can be attributed to the tax increase.

The panel design we used strengthened our study’s internal validity, although a number of factors may have compromised the generalisability of the results. Our data were from a population-based, representative sample of smokers from four of the largest cities in Mexico, but these smokers may differ from smokers in other cities and in rural areas. The baseline average daily consumption of cigarettes by smokers in our sample (6.9 cigarettes/day) was nevertheless comparable to consumption reported in the 2002 National Survey on Addiction (6.4 cigarettes/day). The enumeration of households selected from within our sampling frame was lower than desired (58%), which may have introduced selection bias even though participation was high (89%) among smokers identified from enumerated households. We did not collect data on households or people who did not participate in the study; hence, the directionality of this potential bias could not be assessed. Nevertheless, the socioeconomic characteristics of our sample are consistent with those from the 2006 Mexican National Household Income and Expenses Survey, providing some evidence for the external validity for the results. Furthermore, no statistically significant differences were found between the baseline sample and the subsample that was successfully followed-up, even though the attrition rate was higher than desired (50%), and participants who were and were not followed-up differed in terms of some sociodemographic characteristics. The somewhat lower income among those who were followed-up may have resulted in a primary analytic sample that was more price sensitive than the entire baseline sample. However, within the primary analytic sample, decreases in consumption were consistent across income levels, and no differences were found between the two samples with regard to smoking-related variables, which suggests that attrition bias may be minimal. Finally, sensitivity analyses that included all baseline observations produced results that were consistent with those reported in detail. Although a number of factors may have compromised the external validity of the study results, there is some evidence to suggest that the results are somewhat generalisable.

Conclusions

This study expands the evidence around the impact of tax increases in low-income or middle-income countries. Results indicate that the tax increase implemented in January 2007 effectively increased the prices that Mexican smokers paid for cigarettes and that average consumption decreased concurrently across sociodemographic groups. The decrease in consumption was higher than price elasticity estimates would predict. Although the lack of an overall reduction among lighter smokers is suggestive of a differential impact, these smokers were more likely than heavy smokers to have quit at follow-up. Future research should aim to rule out potential biases that may account for these results. However, this study was the first population-based, longitudinal study of tax impacts among adult smokers in Mexico, and results support the emphasis on tax policy within the WHO FCTC.

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Competing interests

None.

Ethics approval

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