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Effect of cigarette tax increase in combination with mass media campaign on smoking behavior in Mauritius: Findings from the ITC Survey

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Abstract

Background—Mauritius has made great strides in adopting evidence-based tobacco control measures, including an increase in its cigarette excise tax and anti-tobacco mass media (Sponge) campaign. The primary objective of this study is to examine the combined effect of these measures on smoking behavior.

Methods—This study used longitudinal data from the International Tobacco Control Mauritius Survey, 2009–2011. Waves 1 and 2 were conducted before the tax increase and wave 3 was conducted shortly after the Sponge campaign and six months after the cigarette excise tax increase. Generalized estimating equations were used to examine the effects of these two key tobacco control measures on smoking prevalence and the quantity of cigarettes smoked.

Results—The results showed that the combination of cigarette tax increase and the Sponge campaign had a significant negative effect on the prevalence of smoking in Mauritius and the

number of cigarettes smoked among continuing smokers. Specifically, the measures significantly reduced the odds of being a smoker (AOR 0.88, 95% CI 0.81–0.97). For average daily cigarettes smoked, the measures had a significant reduction in cigarettes per day by about 6% (Incidence-rate ratios 0.94, 95% CI 0.89–0.99).

Conclusions—The combination of policy measures significantly reduced the consumption of cigarettes in Mauritius. While these results are encouraging, these efforts must be part of a sustained effort to further reduce the smoking prevalence in Mauritius.

INTRODUCTION

Tobacco use remains the leading cause of preventable death worldwide, with nearly six million deaths attributable to smoking annually (1). About 80% of smokers live in low- and middle-income countries (LMICs) (1). Based on current trends, it is estimated that by 2030 tobacco use will be responsible for more than eight million deaths annually (1). Evidence-based tobacco control measures are needed in many jurisdictions, especially in developing countries (2,3). Increasing tobacco taxes and prices is well documented as the most cost-effective tobacco control intervention and a critical component of a comprehensive tobacco control strategy (4–6). Article 6 of the WHO Framework Convention on Tobacco Control (FCTC) obligates countries that have ratified the treaty to use tax and price policies to reduce tobacco consumption (7). Higher tobacco taxes are effective for promoting cessation, preventing initiation and reducing consumption, and also provide significant government revenue. Anti-tobacco mass media campaigns have similarly been shown to be an effective population-wide intervention tool, especially when combined with other tobacco control measures (8–11).

Mauritius has made great strides in adopting evidence-based tobacco control measures. The WHO Framework Convention on Tobacco Control (FCTC) was signed by Mauritius in June 2003 and ratified in May 2004. In collaboration with the World Health Organization and several other stakeholders, the Mauritian government developed a National Action Plan on Tobacco Control from 2008 through 2012. The main objective of this Action Plan was to reduce tobacco-related mortality and morbidity by preventing the use of tobacco products, promoting cessation, and reducing second-hand smoke exposure. Results from the 2008 Mauritius Non-Communicable Diseases Survey found that the adult smoking prevalence in Mauritius in 2008 was 40.3% for men and 3.7% for women, which is among the highest smoking prevalence rates in Africa (12). To address this high smoking prevalence, Mauritius passed the Public Health (Restrictions on Tobacco Products) Regulations 2008, which updated its 1999 policies on smoking in public places; packaging and labeling of tobacco products; tobacco advertising, promotion, and sponsorship; and illicit trade. These 2008 restrictions on tobacco products were implemented in two phases. In phase one, regulations to strengthen policies on smoking in public places, illicit trade (e.g., the display of official excise stamps and a provision requesting that cigarette packs carry a statement -"sale allowed in Mauritius only") and tobacco advertising, promotion, and sponsorship were implemented on March 1, 2009. Regulations on pictorial warning labels (occupying 65% of the pack's area), packaging descriptors, and banning the sale of single cigarettes followed on June 1, 2009.

While evidence on the effectiveness of tobacco control measures in LMICs using individual-level data is accumulating, many previous studies have used macro/time series data (4). LMIC's policymakers' hesitation to adopt tobacco control measures based on results from high income countries contributed to the growth of LMIC studies since the early 2000s (13–16). Due to a lack of individual-level data in Mauritius, there is limited evidence on the effect of tobacco control measures on smoking behavior.

The International Tobacco Control Policy Evaluation (ITC) Mauritius Project offers a unique and timely opportunity to fill this gap. The primary objective of this study is to examine the combined effect of cigarette excise tax increase and an anti-tobacco mass media campaign on smoking prevalence and quantity of cigarettes smoked using longitudinal data from the ITC Mauritius Project (2009–2011). The Mauritian Ministry of Health and Quality of Life launched the Sponge campaign, a national anti-tobacco mass media campaign in May, 2011, with technical and financial support from the World Lung Foundation (WLF). "Sponge" was first created as part of a national health awareness campaign, focussing on the negative effects of smoking in Sydney, Australia (11). The WLF has promoted the Sponge campaign worldwide in order to graphically illustrate the harmful effect of smoking on smokers' lungs. The Mauritian Sponge campaign used television, radio and billboards, with messages in local languages (Creole and Bhojpuri) to warn smokers and non-smokers about health risks of tobacco use.

METHODS

Data

The ITC Mauritius Project started in 2009 to evaluate the impact of tobacco control legislation in Mauritius. The ITC Mauritius Survey is part of the larger ITC Project, conducted in more than 20 countries, primarily to evaluate WHO FCTC policies (17,18). The ITC Mauritius Survey is a nationally representative longitudinal face-to-face survey of adult smokers and non-smokers in Mauritius. Smokers were adults (aged 18 years) who reported having smoked at least 100 cigarettes in their life, and had smoked at least once in the previous 30 days. The survey is based on a stratified multistage sampling framework, where respondents were randomly selected from households within strata defined by the nine geographic districts of Mauritius. This sampling procedure accounts for the urban-rural population split in Mauritius (43% urban and 57% rural). Waves 1 and 2 were conducted in April–May 2009 and August–September 2010 respectively (before the tax increase). Wave 3 was conducted in June–July 2011(six months after excise tax increased by 25% and approximately one month after the Sponge campaign). In Wave 1, a total of 598 smokers and 239 non-smokers were surveyed. In Wave 2, 601 smokers and 239 non-smokers were surveyed. In Wave 3, a total of 602 smokers and quitters and 238 non-smokers were re-contacted and successfully re-interviewed. The retention rate at Wave 3 was 96.2% for smokers and 95.8% for non-smokers. These retention rates are exceptionally high among longitudinal cohort surveys (on average, the retention rate of the ITC Survey is between 75% and 80%). In the present study, we restricted our analysis to a balanced panel (surveyed in all three waves and with no missing observation), yielding 725 respondents and 2175 person-year observations. Of the 725 respondents included in our analysis, about 67% were

current smokers (521 in wave 1, 477 in wave 2, and 462 in wave 3) and 33% were non-smokers (204 in wave 1, 248 in wave 2, and 263 in wave 3). Due to the high retention rate, attrition bias is highly unlikely; however, to test for non-response bias, we used the simple-addition variable test suggested by Verbeek & Nijman (19). We created two variables reflecting survey response patterns: a dummy indicating if an individual responds in the next wave, and also a dummy showing whether the individual responds in all waves. We used probit regression for smoking participation and linear regression for number of cigarettes using the unbalanced sample with each of the response variables included. As expected, the results did not reject the null hypothesis of no attrition bias at the 10% significance level.

The survey and research protocol was reviewed and given ethical clearance by the Office of Research Ethics, University of Waterloo and the Mauritius National Ethics Committee.

Mauritius Cigarette Tax Structure—Table 1 shows the cigarette tax structure over time in Mauritius. Prior to 2008, a combination of ad valorem and specific excise taxes was levied on all locally produced cigarettes as well as value-added tax (VAT). Imported cigarettes had custom and excise duties as well as VAT (see Shang et al., (20) for a cross-country comparison). After domestic tobacco manufacturing stopped in 2008, only imported cigarettes were sold. In July 2008, a specific excise tax of Mauritian Rupees (MUR) 2,200 ($70.00 US)[1] was imposed per thousand sticks of cigarettes and VAT of 15% on the sum of excise tax and the base cost of cigarettes. In November 2010, excise tax increased by 25% to MUR 2,750 ($88.00 US). In November 2011, excise tax increased 15% to MUR 3,160 ($101.00 US) and increased again in November 2012 by 12% to MUR 3,540 ($113.00 US). The VAT has remained at 15% of the VAT-exclusive price to the consumer.

Empirical Strategy

To examine the combined effect of cigarette tax increase and Sponge campaign on the smoking behavior of individuals, we used the following approach

$$Y_{it} = \beta_0 + \beta_1 Policy_t + \boldsymbol{\beta_2 X_{it}} + \varepsilon_{it}$$

where Y_{it} represents individual smoking outcomes (smoking participation and average daily number of cigarettes) at survey time t. The variable $Policy_t$, key variable of interest, is a dummy variable that captures the increase in cigarette tax and the implementation of the Sponge campaign. The $Policy_t$ variable was zero for all individuals for survey years 2009 (wave 1) and 2010 (wave 2) since both waves were completed before the measures were implemented. In wave 3 (survey year 2011), $Policy_t$ equaled one for all individuals. Both measures did not occur simultaneously, but using a dummy variable to account for the combined effect is logical given that Wave 3 of the ITC Mauritius Survey (June–July 2011) almost coincided with the Sponge campaign[2]. For the smoking participation outcome, β_1 represents the average change in the probability of smoking between pre- and post-policy periods. In estimating the daily number of cigarettes smoked, β_1 indicates the average

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[1]Exchange rate 9 (1 MUR to 0.032 US) as at December 15,2014 from xe.com
[2]Due to the limited variability in self-reported prices at the primary sampling unit level (local district level); we were not able to estimate price elasticity by using the price variable in the regression.

change in the number of cigarettes smoked daily. The analysis also controlled for individual socio-demographic characteristics, vector X_{it}, including age, gender, education, income, marital status and employment status.

Population-averaged panel-data model was estimated using generalized estimating equations (GEE) with a link function (logit) and a family distribution (binomial) for the binary outcome and a link function (log) and a family distribution (Poisson) for number of cigarettes (21). A flexible working correlation structure (unstructured correlation) was used in the GEE estimations. The regression analysis was population-weighted using the survey weights in order to adjust for unequal probabilities of selection between smokers and non-smokers.

RESULTS

Table 2 shows the average sample characteristics for waves 1–3. Of the 725 respondents included in our analysis, the majority of the participants were males (76%), married (75%), completed at least a school (56%) and had a household monthly income of less than MUR 15,000 ($480.00 US). The weighted data (not reported) showed that 32.2% of males and 2.8% of females in wave 1, 30.6% males and 2.5% females in wave 2, and 28.6% males and 2.39% females in wave 3 were smokers. Among smokers, the average cigarettes smoked per day (CPD) was 9.12 in wave 1, 9.64 in wave 2 and 8.94 in wave 3.

Tables 3–4 shows the estimation results from the GEE model. In Table 3, we examine the effect of the tax increase in combination with anti-tobacco national media campaign on smoking participation and CPD using data from waves 1–3. The results showed that the combination of policy measures significantly reduced the prevalence of smoking in Mauritius and the number of cigarettes smoked among continuing smokers. The odds of being a smoker fell by about 12 percent as a result of the policy measures (AOR 0.88, 95% CI 0.81–0.97). For average daily cigarettes smoked, the policy reduced the average number of cigarettes smoked per day by 6% (Incidence rate ratios (IRR) 0.94, 95% CI 0.89–0.99). Given that the increase in cigarette tax and the Sponge campaign were the main tobacco control measures implemented between 2010 and 2011[3], we restricted our analysis by using data from waves 2–3 and the results are shown in Table 4. Similar results were found, with the policy having significant effects on smoking participation (AOR 0.85, 95% CI 0.76–0.95) and daily number of cigarettes consumed (IRR 0.94, 95% CI 0.88–1.00).

DISCUSSION

The current study provides empirical evidence that the cigarette tax increase in combination with anti-tobacco national media campaign implemented in Mauritius, had significant effects on smoking behavior. The policy measures significantly reduced the odds of being a smoker by about 12 percent and reduced average CPD by about 6 percent. Our findings are consistent with prior research showing that mass media campaigns are effective when combined with other tobacco measures (8–10). For example, a recent review study by

[3]Of note, Wave 3 of the ITC Mauritius Survey was conducted before government supported cessation clinics were implemented in November, 2011.

Durkin et al. (8) found consistent evidence that mass media campaigns are particularly effective in reducing adult smoking prevalence when conducted as part of a comprehensive tobacco control program. Similarly, results from a time-series analysis showed that increases in cigarette costliness and exposure to tobacco control media campaigns significantly reduced smoking prevalence in Australia (9). Our finding is also in keeping with a recent ITC Mauritius report indicating that the Sponge campaign was successful in reaching smokers and non-smokers (22).

The study has some limitations. First, the data are self-reported, which may introduce recall and social desirability biases. Second, the observed changes may not be attributed only to the tax increase and the national mass media campaign. While no new policies were implemented between Waves 2 and 3 except for the tax rate revision and an anti-smoking media campaign, to what extent our results, in part, reflect other tobacco measures are unknown. Third, our estimate may also reflect a potential underlying downward trend in smoking prevalence, and we were unable to control for time trend due to collinearity between the policy variable and the inclusion of survey year. Finally, the ITC Survey does not have data to measure the impact of increased taxation on underage smokers and smoking initiation among youth.

In conclusion, the 2010 increase in cigarette taxes and prices had a significant effect on smoking behavior by reducing smoking prevalence and smoking intensity in continuing smokers. These results are particularly encouraging given the strong commitment of the Mauritian government in implementing evidence-based tobacco control measures. The findings shown in this study provide an important policy and practice considerations, especially for policymakers in developing countries. While there is no one-size-fits-all tobacco control measure, other African countries can potentially benefit from the Mauritian experience.

Acknowledgements

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What this paper adds

➤ Mauritius has implemented evidence-based tobacco control measures. While the evidence of tobacco control policies is accumulating in Africa, not much is known about the effects of these regulations in Mauritius.

➤ This study showed that an increase in cigarette taxes, in combination with other WHO FCTC tobacco control policies implemented in Mauritius, significantly reduced cigarette smoking.

➤ These results may be useful for policy intervention in other developing countries, especially in Africa.

Table 1

Mauritius Cigarette Tax Structure, 2007–2011

	Excise duty (MUR per 1000 stick)	Customs duty[†]	Ad valorem excise tax[††]	VAT	Remarks
2007–2008	2,370	30%		15%	Category A
	1,770	30%		15%	Category B
	2,010		30%	15%	Category C
	2,130		30%	15%	Category D
July 1, 2008 – Nov 19, 2010	2,200	Nil		15%	Only one category
Nov 20, 2010– Nov 4, 2011	2,750	Nil		15%	Only one category
Nov 5, 2011– Nov 9, 2012	3,160	Nil		15%	Only one category
Nov 10, 2012	3,540	Nil		15%	Only one category

Source: Mauritius Revenue Authority

[†] Customs duty applies to imported cigarettes based on cost, insurance and freight (CIF) value

[††] Ad valorem (sales tax) applies to locally produced cigarettes based on ex-factory price

Category A: cigarettes at the top end of the international markets- foreign brands (e.g. Benson & Hedges, Camel, Dunhil, Marlboro).
Category B: other foreign cigarettes not classified under category A.
Category C: local cigarettes
Category D: other cigarettes not classified under A, B or C and whether containing tobacco or not.

Table 2

Average Sample Characteristics, 2009–2011

	Unweighted	Weighted
	Mean/proportion	Mean/proportion
Sex		
Male	0.757	0.759
Female	0.243	0.241
Age		
18 to 24	0.078	0.100
25 to 39	0.328	0.335
40 to 54	0.377	0.332
55 or more	0.217	0.233
Education		
Some/completed university	0.112	0.114
Form 1–4/SC completed	0.445	0.431
Primary School or less	0.443	0.455
Income		
MUR 30,000 or more	0.076	0.080
MUR 15,000 to 29,999	0.259	0.270
Less than MUR 15,000	0.665	0.650
Marital status		
Married	0.745	0.707
Separated/widowed	0.096	0.100
Single	0.159	0.193
Employed	0.771	0.772
Unemployed/inactive	0.229	0.228

The sample includes 725 (67% are current smokers and 33% are non-smokers) respondents and yielding 2175 person-year observations.

Table 3

GEE Estimates for Prevalence of Cigarette Smoking and Number of Cigarettes Smoked Daily, 2009–2011

	Smoking Participation		Average Daily Cigarettes	
	AOR	95% CI	IRR	95% CI
Policy	0.88***	0.80 – 0.96	0.94**	0.89 – 0.99
Male	13.95***	8.26 – 23.58	1.09	0.92 – 1.29
Age	0.99*	0.97 – 1.00	1.00*	1.00 – 1.01
Education				
Some/completed university	0.77	0.55 – 1.08	0.89	0.68 – 1.15
Form 1–4/SC completed	0.87	0.69 – 1.10	1.04	0.95 – 1.14
Primary School or less	1		1	
Income				
MUR 30,000 or more	0.66	0.39 – 1.10	1.08	0.88 – 1.33
MUR 15,000 to 29,999	1.09*	0.98 – 1.22	1.05	0.95 – 1.15
Less than MUR 15,000	1		1	
Marital status				
Married	1.16	0.87 – 1.55	1.08	0.91 – 1.28
Separated/widowed	1.14	0.86 – 1.53	1.17	0.96 – 1.44
Single	1		1	
Employed	1.14	0.89 – 1.46	1.25***	1.11 – 1.41
Unemployed/inactive	1		1	

*** p<0.01,

** p<0.05,

* p<0.1, AOR = adjusted odds ratio, IRR = Incidence rate ratios

The sample includes 725 respondents and yielding 2175 person-year observations. For the CPD analysis, the sample includes 521 smokers, yielding 1460 person-year observations.

Table 4

GEE Estimates for Prevalence of Cigarette Smoking and Number of Cigarettes Smoked Daily, 2010–2011

	Smoking Participation		Average Daily Cigarettes	
	AOR	95% CI	IRR	95% CI
Policy	0.85***	0.76 – 0.94	0.94**	0.88 – 1.00
Male	13.37***	7.93 – 22.57	1.15	0.92 – 1.43
Age	0.98*	0.97 – 1.00	1.01**	1.00 – 1.01
Education				
Some/completed university	0.54**	0.33 – 0.88	0.94	0.70 – 1.26
Form 1–4/SC completed	0.72*	0.50 – 1.02	1.01	0.90 – 1.12
Primary School or less	1		1	
Income				
MUR 30,000 or more	0.76	0.48 – 1.21	1.07	0.85 – 1.35
MUR 15,000 to 29,999	1.09	0.96 – 1.24	1.05	0.94 – 1.17
Less than MUR 15,000	1		1	
Marital status				
Married	1.06	0.68 – 1.65	1.09	0.89 – 1.32
Separated/widowed	1.05	0.64 – 1.72	1.06	0.82 – 1.38
Single	1		1	
Employed	1.25*	0.96 – 1.56	1.24**	1.06 – 1.46
Unemployed/inactive	1		1	

***
 $p < 0.01$,

**
 $p < 0.05$,

*
 $p < 0.1$, AOR = adjusted odds ratio, IRR = Incidence rate ratios

The sample includes 791 respondents and yielding 1,582 person-year observations. For the CPD analysis, the sample includes 532 smokers, yielding 1,028 person-year observations.