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## Short Communication

# The impact of multipolicy tobacco control legislation on smoking behavior

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## ARTICLE INFO

## Article history:

Received 16 December 2013

Received in revised form

30 January 2015

Accepted 13 May 2015

Available online 24 June 2015

## Introduction

The Taiwan government enacted the Tobacco Hazards Prevention Amendment Act in 2009 (2009 Act), strengthening the existing legislations by implementing multiple tobacco control policies. The key changes included: (1) adding of graphic warnings on cigarette packages in January 2009; (2) extending of smoke-free areas in almost all enclosed workplaces and public places in January 2009; and (3) raising of tobacco health surcharges by NT \$10 (US \$0.30) per pack in June 2009. Before 2009, only text health warnings were shown on cigarette packets in Taiwan in 12-point font and covered 25% of the front of the packaging. After January 2009, the legislations required the warning labels to cover at least 35% of the package front and back, include one of six graphic warnings with vividly colored images, contain written warnings on the risks of smoking, and include the smoking quit-line telephone number.<sup>1</sup> Prior to 2009, smoking was banned in public areas but allowed in indoor designated

smoking areas. The 2009 Act completely prohibits smoking in public areas with the exception of outdoor dining areas of restaurants and bars after 9 p.m. Promotional activities were held to ensure that business proprietors posted 'No smoking' signs at all entrances to their establishments.<sup>1</sup>

Increasing excise taxes and prices are effective in preventing people from starting to smoke, promoting cessation, and lowering the number of current smokers and cigarettes consumption.<sup>2,3</sup> Before 2009, the average retail price of cigarettes in Taiwan was NT \$55 (US \$1.85)/pack. This included NT \$34.16 (US \$1.15)/pack for Taiwan cigarettes and NT \$61.68 (US \$2.08)/pack for imported cigarettes.<sup>4</sup> On June 1st 2009, the government, as stipulated in the 2009 Act, raised the cigarette tax from NT \$10 (US \$0.34) to NT \$20 (US \$0.67) per pack. Consequently, the average cigarette retail price increased by 18% to approximately NT \$65 (US \$1.96) per pack.<sup>5</sup>

The new warnings and smoke-free policies have demonstrated a positive effect on intention to quit smoking among Taiwan smokers in the first three months;<sup>1</sup> the implementation of the 2009 Act also increased quit attempt rate and annual cessation rate among recent smokers in the first year.<sup>6</sup> To have an overall picture of the change of smoking behavior, we assessed (1) the impact of 2009 Act on smoking prevalence among Taiwan adults, and smoking intensity (average number of cigarettes smoked per day) among current smokers; and (2) factors attributable to smoking behavior.

Data were retrieved from the 2007–2011 Taiwan Adult Smoking Behavior Surveys undertaken by the Health Promotion Administration aimed to monitor smoking behavior in Taiwan adults aged 18 or older. By county-based random

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<http://dx.doi.org/10.1016/j.puhe.2015.05.013>

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telephone interview, the surveys were administered to approximately 16,000 non-institutionalized residents (400–800 residents per county) each year from July to September. Current smokers were interviewees who had smoked more than 100 cigarettes in their lifetime, and smoked in the previous month. The non-current smokers included never-smokers (those who had never smoked or who had smoked fewer than 100 cigarettes in their lifetime) and former smokers (who had smoked over 100 cigarettes in their lifetime but had not smoked in the previous month). On exclusion of subjects with missing smoking status (0.3%), we obtained a total sample of 81,869 adults including 13,163 current smokers and 68,706 non-current smokers. Multivariate logistic regression analysis was conducted to examine the association between the 2009 Act and current smoking among all adults. We used two model specifications to analyze the correlations of smoking behavior. Model 1 included the dummy variable 'Post 2009' while controlling other independent variables to evaluate the overall effect after the 2009 Act. Model 2 included the four year dummy variables plus all other independent variables to evaluate the time-variant effects of the 2009 Act on smoking behavior. All statistical estimations were performed using the STATA version 11.0 software. Estimates were weighted to reflect the respondents' probability

of sampling selection and to be representative of the age-, gender-, area-, and education-specific populations, based on the 2000 Taiwanese census.

### General statistics

During the period 2007 to 2011, current smoking prevalence dropped from 22.3% to 18.17% ( $P < 0.0001$ ); there was no significant change in smoking intensity among current smokers (dropped from 19.3 cigarettes per day to 19.0 cigarettes,  $P = 0.4554$ ). Over the five-year period, males had much higher current smoking prevalence rate than females (35.4% vs 4.3%,  $P < 0.0001$ ). On average, male smokers smoked 19.8 cigarettes/day, significantly higher than that of females at 12.4 cigarettes/day ( $P < 0.0001$ ). Current smoking prevalence rates (over 20%,  $P < 0.0001$ ) were higher in age groups between 25 and 54 years. Adults with junior high school and high school education level had the highest current smoking prevalence rates (31.7% and 24.6%,  $P < 0.0001$ ). For employment, the employed subjects had higher smoking rates (26.9% vs 12.3%,  $P < 0.0001$ ) than the unemployed. For marital status, single adults had higher current smoking prevalence rate (23.6% vs 19.0%,  $P < 0.0001$ ) than the married and the divorced/widowed/separated. The above results are not shown in the table.

**Table 1 – Logistic regressions on smoking among Taiwanese adults aged 18 years or above, 2007–2011.**

	Model 1			Model 2		
	OR	95% CI	P-value	OR	95% CI	P-value
Period						
Pre-act (2007–2008) (Ref)	–	–	–	–	–	–
Post-act (2009–2011)	0.84	0.79–0.90	0.000	–	–	–
Year						
2007 (Ref)	–	–	–	–	–	–
2008	–	–	–	0.96	0.90–1.02	0.164
2009	–	–	–	0.87	0.80–0.94	0.001
2010	–	–	–	0.83	0.75–0.91	0.000
2011	–	–	–	0.78	0.71–0.85	0.000
Gender						
Female (Ref)	–	–	–	–	–	–
Male	13.52	11.58–15.79	0.000	13.51	11.58–15.76	0.000
Age group in years						
18–24 (Ref)	–	–	–	–	–	–
25–34	2.54	2.22–2.91	0.000	2.54	2.21–2.91	0.000
35–44	2.38	2.01–2.82	0.000	2.38	2.01–2.82	0.000
45–54	1.42	1.17–1.73	0.001	1.42	1.17–1.73	0.001
55–64	0.91	0.76–1.08	0.274	0.91	0.76–1.09	0.280
≥65	0.60	0.48–0.73	0.000	0.60	0.48–0.74	0.000
Education degree						
Undergraduate or above (Ref)	–	–	–	–	–	–
High school	2.48	2.32–2.65	0.000	2.48	2.32–2.65	0.000
Junior high school	4.10	3.64–4.62	0.000	4.10	3.64–4.62	0.000
Elementary or below	3.17	2.76–3.64	0.000	3.17	2.76–3.64	0.000
Employment						
Unemployed (Ref)	–	–	–	–	–	–
Employed	1.45	1.32–1.59	0.000	1.45	1.33–1.59	0.000
Marital status						
Single (Ref)	–	–	–	–	–	–
Married	0.94	0.85–1.04	0.223	0.94	0.84–1.04	0.208
Divorced/widowed/separated	1.77	1.52–2.07	0.000	1.76	1.51–2.06	0.000

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