香港吸煙與健康委員會
HONG KONG COUNCIL ON SMOKING AND HEALTH

Effectiveness of New and Enlarged Pictorial Health Warnings on Cigarette Packs Tobacco Control Policy-related Surveys 2018

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1. Introduction

Under Article 11 of the Framework Convention on Tobacco Control (FCTC), the World Health Organization (WHO) highly recommends its signatories to adopt pictorial health warnings that large, visible, clear and legible messages on harms of tobacco use should be displayed on the principal areas of each tobacco pack[1]. Pictorial health warnings are a cost-effective channel to disseminate knowledge of harms of smoking. Previous studies have shown that pictorial health warnings effectively arouse negative emotional reactions (e.g. fears and worries), preventing smoking initiation in never smokers and promoting intention to quit in smokers[2-5]. As of 11 February 2020, 109 countries and jurisdictions have finalized pictorial health warnings that cover at least 50% of the principal areas of each tobacco product pack, with 8 having the warnings covering at least 85%[6].

Pictorial health warnings on tobacco packages were first introduced in Hong Kong in 2007, after the adoption of text health warnings in 1983[7]. Each package was required to bear one of 6 pictorial health warnings that covered at least 50% of the area of the 2 largest surfaces[8]. A territory-wide study in Hong Kong found pictorial health warnings might have made the social environment less favourable for smoking, even in hardcore smokers[9].

Remaining unchanged for a decade, these pictorial health warnings might have become less effective in discouraging smoking. The Smoking (Public Health) (Notices) (Amendment) Order 2017 (the Amendment Order), which aimed to amend the requirements on the pictorial health warnings, was passed in June 2017. The Amendment Order requires at least 85% of the 2 largest surfaces of each cigarette pack to be covered by one of the 12 new pictorial health warnings (including damaged toes, lung cancer, a body at mortuary, a funeral with a portrait of the deceased young lady, burning banknotes, a downward curving cigarette, a man using oxygen mask, a woman using nasogastric tube in hospital, a wrinkled woman, throat with hole, use of walker and an ill child)[10](Appendix). The Integrated Smoking Cessation Hotline (1833 183) must also be shown. A 6-month transitional period (from 21 December 2017 to 20 June 2018) was granted, during which it was still legal to sell tobacco products with the old warnings. Tobacco products must be covered by the new pictorial health warnings from 21 June 2018.

The new and enlarged warnings with stronger images and warning messages aim to reduce tobacco use in Hong Kong, but the effectiveness has not been studied. Smokers may have counteractions in response to the new pictorial

health warnings, which were understudied. Effects of the new pictorial health warnings and the counteractions of smokers should be examined.

The Hong Kong Council on Smoking and Health (COSH) has commissioned the Tobacco Control Policy-related Survey (TCPS), a regular cross-sectional survey, to collect population-representative information on smoking and related public opinions since 2013. Since 2015, each survey recruits around 5,100 respondents, with oversampling of current smokers and ex-smokers. TCPS 2018 included 2 waves of surveys, conducted during the transitional period of the Amendment Order (Wave 1) and after full implementation (Wave 2). Together with TCPS 2017, effects of the new pictorial health warnings can be evaluated. The periods of TCPS 2017, TCPS 2018 Wave 1 and TCPS 2018 Wave 2 are hereafter referred to as pre-implementation, transitional period and post-full implementation, respectively.

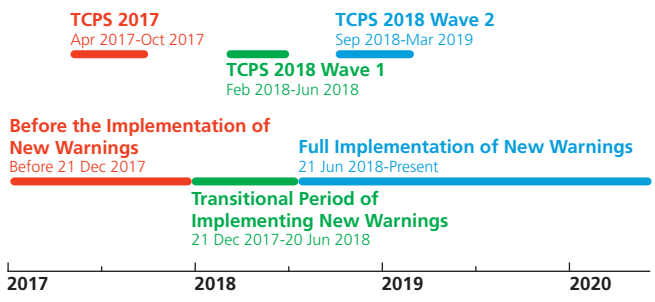
2. Methods

2.1 Study design and participants

Anonymous computer-assisted telephone interviews were conducted by the Public Opinion Programme, The University of Hong Kong (currently known as Hong Kong Public Opinion Research Institute Limited). Figure 1 shows the 3 survey periods of TCPSs in relation to the schedule of implementation of the new health warnings: April to October 2017 (pre-implementation), February to June 2018 (transitional period) and September 2018 to March 2019 (post-full implementation). Respondents aged 15 years or above and spoke Cantonese were recruited. They were divided into 3 groups: (a) current smokers, who smoked daily or occasionally at the time of survey; (b) ex-smokers, who smoked previously but did not smoke any at the time of the survey; and (c) never smokers, who had never smoked in their lifetime. Smoking referred only to using cigarettes in 2017, and using all types of tobacco products in the 2 waves of surveys in 2018. This renders the results between 2017 and 2018 less comparable. Telephone calls took place between 2:00 pm and 10:30 pm on weekdays and weekends to cover respondents of different occupations and working hours. Each randomly selected telephone number was called 5 times, at different hours and days of the week, before being considered as "non-contact". All respondents provided oral consent before the interview and could withdraw from the interview at any time. The protocol of this study, including respondent recruitment, oral informed consent procedures and data collection, was approved by the Institutional Review Board of The University of Hong Kong/Hospital Authority Hong Kong West Cluster.

Figure 1

Timeline of conducting TCPSs and implementation of new pictorial health warnings



2.2 Sampling methods and respondent selection

Telephone numbers were randomly selected from a sampling frame originated from the residential telephone directories. To capture unlisted numbers, another set of numbers was generated by a computer programme using the "plus/minus one/two" method and appended to the sampled numbers. After eliminating duplicated numbers, the remaining numbers were dialled in random order. When a telephone contact was successfully established with a target household, one eligible person would be selected from all eligible family members who were at home at the time of the interview, using the "next birthday" procedure.

2.3 Questionnaire development

The questionnaires used in TCPS 2017 (pre-implementation), TCPS 2018 Wave 1 (transitional period) and TCPS 2018 Wave 2 (post-full implementation) were modified from those in previous rounds of surveys, including core questions and random questions. Random question sets were designed for random subsamples of respondents with certain smoking status. Socio-demographic characteristics, such as sex, age, education attainment, monthly household income, and employment status were core questions for all respondents. Questions on pictorial health warnings in TCPS

2017 (pre-implementation) were mostly random questions for current smokers, and in TCPS 2018 Wave 1 (transitional period) and TCPS 2018 Wave 2 (post-full implementation) were mostly core questions for current smokers. Questions on point-of-sale tobacco displays were covered in various random subsets for all smoking status.

2.4 Weighting and statistical analysis

TCPS 2017 (pre-implementation) recruited 5,131 respondents, including 1,712 never smokers, 1,715 ex-smokers and 1,704 current smokers. TCPS 2018 Wave 1 (transitional period) recruited 5,132 respondents, including 1,713 never smokers, 1,707 ex-smokers and 1,712 current smokers. TCPS 2018 Wave 2 (post-full implementation) recruited 5,156 respondents, including 1,714 never smokers, 1,739 ex-smokers and 1,703 current smokers. Data of each survey wave were weighted against the projected sex and age distribution of the Hong Kong population and smoking status in the corresponding year to produce population-representative estimates. All percentages shown in this report are estimates for the general population.

Results presented in this report include: (a) socio-demographic characteristics of respondents, (b) awareness of pictorial health warnings (i.e. saw in the past 30 days), (c) impacts of new pictorial health warnings on smoking-related risk perceptions and behaviours, (d) counteractions of current smokers to avoid seeing pictorial health warnings, and (e) awareness of point-of-sale tobacco displays (i.e. saw in the past 30 days). The survey methods and statistical analysis used in these 3 surveys were similar.

Univariate analysis of variables of interest by smoking status was conducted using Chi-square tests. Poisson regression yielded relative risks (RRs) to estimate the effect size of the impacts of new pictorial health warnings (relative change) during the transitional period and post-full implementation. Statistical significance was set at $p<0.05$. Statistical analysis was conducted using Stata (Version 15.1, TX: StataCorp LLC).

3. Results

3.1 Socio-demographic characteristics of respondents

Table 1 shows that males constituted 45.2% of TCPS 2017 (pre-implementation) sample, 45.1% of TCPS 2018 Wave 1 (transitional period) sample, and 44.9% of TCPS 2018 Wave 2 (post-full implementation) sample. Over half the respondents were aged 15-49 years in all waves (54.0% in TCPS 2017, 53.1% in TCPS 2018 Wave 1 and 53.3% in TCPS 2018 Wave 2). Most attained at least secondary education (88.1% in TCPS 2017, 88.6% in TCPS 2018 Wave 1 and 88.9% in TCPS 2018 Wave 2). About half were employed (49.0% in TCPS 2017, 54.9% in TCPS 2018 Wave 1 and 50.0% in TCPS 2018 Wave 2).

3.2 Awareness of pictorial health warnings

Figure 2 shows that before implementation of the new warnings, 39.0% of all respondents (77.6% of current smokers, 27.1% of ex-smokers and 35.3% of never smokers) were aware of (i.e. saw in the past 30 days) pictorial health warnings. The awareness increased to 41.8% (88.3% of current smokers, 34.6% of ex-smokers and 36.5% of never smokers) during the transitional period.

Figure 2 also shows that the awareness of the new pictorial health warnings further increased to 45.2% (88.6% of current smokers, 37.4% of ex-smokers and 40.3% of never smokers) after full implementation.

Figure 3 shows that 11.3% of all respondents and 45.6% of current smokers saw new pictorial health warnings in the past 30-days during the transitional period. Out of 100 cigarette packs they saw, the median proportion of new health warnings was 80% (IQR 50%-100%, not shown in the figure).

The difference among these 3 surveys was statistically significant for all respondents ($p<0.001$) and for each smoking status group (all $p<0.001$). Table 2 shows that current smokers and ex-smokers in the transitional period were more likely to be aware of pictorial health warnings than before implementation. After full implementation, all respondents were 14% (95% CI 4%–26%) and current smokers were 15% (95% CI 7%-23%) more likely to be aware of pictorial health warnings than those in the pre-implementation period. Compared with the population in the transitional period, respondents were 8% (95% CI 1%-16%) more likely to be aware of the pictorial health warnings after full implementation.

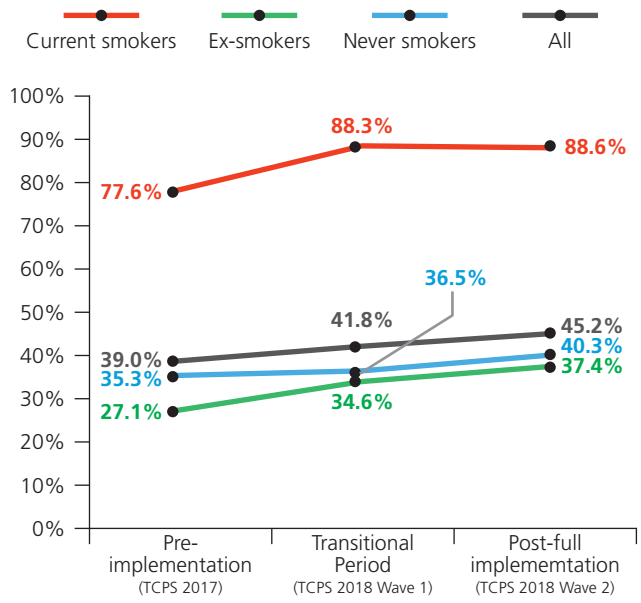
Table 1 Socio-demographic characteristics of respondents in TCPS 2017 (Pre-implementation), TCPS 2018 Wave 1 (Transitional period) and TCPS 2018 Wave 2 (Post-full implementation)

	TCPS 2017 (Pre-implementation)	TCPS 2018 Wave 1 (Transitional period)	TCPS 2018 Wave 2 (Post-full implementation)
Number of all respondents	(N=5,131)	(N=5,132)	(N=5,156)
Sex (%)			
Male	45.2	45.1	44.9
Female	54.8	54.9	55.1
Age group, years(%)			
15-29	19.2	18.5	18.6
30-39	17.5	17.4	17.5
40-49	17.3	17.2	17.2
50-59	19.1	18.6	18.7
60 or above	26.4	27.3	27.4
DK/RTA	0.5	1.0	0.6
Education attainment (%)			
Primary or below	11.6	10.7	11.1
Secondary	43.7	43.1	46.0
Tertiary	44.4	45.5	42.9
DK/RTA	0.3	0.7	0.0
Employment status (%)			
Employed	49.0	54.9	50.0
Student	10.6	8.7	9.6
Homemaker/Unemployed/Retired	39.5	35.6	40.1
DK/RTA	0.9	0.8	0.3

DK/RTA: Didn't know or refused to answer. Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex, age and smoking status to the 2017 or 2018 Hong Kong population.

Figure 2

Seeing pictorial health warnings on cigarette packs in the past 30 days



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex, age and smoking status to the 2017 or 2018 Hong Kong population. Statistical significance was tested by chi-square test. All: p<0.001; CS: p<0.001; ES: p<0.001; NS: p<0.001

TCPS 2017: All=1,546; NS=839; ES=420; CS=287

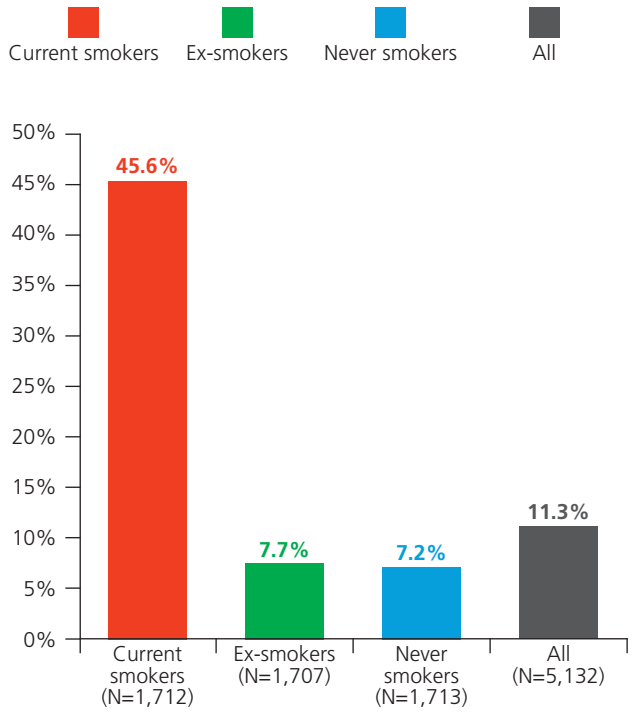
TCPS 2018 Wave 1: All=5,132; NS=1,713; ES=1,707; CS=1,712

TCPS 2018 Wave 2: All=5,156; NS=1,714; ES=1,739; CS=1,703

All: All respondents; NS: Never smokers; ES: Ex-smokers; CS: Current smokers.

Figure 3

Seeing the new pictorial health warnings on cigarette packs in the past 30 days during the transitional period (TCPS 2018 Wave 1)



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex, age and smoking status to the 2018 Hong Kong population.

Table 2 Changes in awareness of pictorial health warnings on cigarette packs, from pre-implementation to the transitional period and post-full implementation

	Relative Risk [RR] (95% Confidence Interval)			
	All	Current smokers	Ex-smokers	Never smokers
Transitional period vs. Pre-implementation	1.06 (0.97-1.17)	1.14 (1.06-1.23) ***	1.26 (1.05-1.51) **	1.03 (0.91-1.16)
Post-full implementation vs. Pre-implementation	1.14 (1.04-1.26) **	1.15 (1.07-1.23) ***	1.37 (1.14-1.63) ***	1.13 (0.99-1.27)
Post-full implementation vs. Transitional period	1.08 (1.01-1.16) *	1.00 (0.98-1.03)	1.08 (0.99-1.19)	1.10 (1.00-1.21)

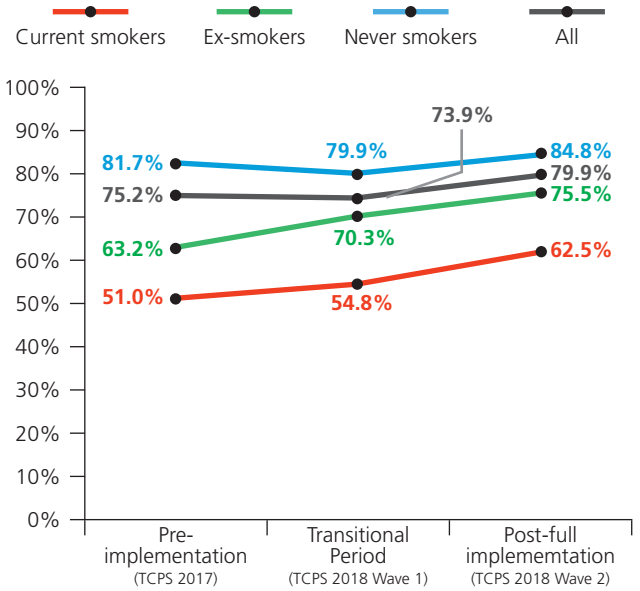
Weighted by sex, age and smoking status to the 2017 or 2018 Hong Kong population.
* p<0.05; ** p<0.01; *** p<0.001

3.3 Impacts of new pictorial health warnings on smoking-related risk perceptions and behaviours

Figure 4 shows that 75.2% of all respondents (51.0% of current smokers, 63.2% of ex-smokers and 81.7% of never smokers) thought about the harms of smoking after seeing pictorial health warnings on cigarette packs in the past 30 days before implementation of the new warnings. The prevalence remained similar (73.9% of all respondents) during the transitional period but increased to 79.9% (62.5% of current smokers, 75.5% of ex-smokers and 84.8% of never smokers) after full implementation. The difference among these 3 surveys was statistically significant for all respondents ($p<0.05$), current smokers ($p<0.001$) and ex-smokers ($p<0.05$). Table 3 shows that current smokers were 23% (95% CI 6%-43%) more likely to think about the harms of smoking after seeing pictorial health warnings post-full implementation than pre-implementation. Compared with the transitional period, all respondents were 8% (95% CI 3%-13%) and current smokers were 15% (95% CI 7%-23%) more likely to think about the harms of smoking post-full implementation.

Figure 4

Thought about the harms of smoking after seeing pictorial health warnings on cigarette packs in the past 30 days



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex, age and smoking status to the 2017 or 2018 Hong Kong population. Statistical significance was tested by chi-square test. All: $p<0.05$; CS: $p<0.001$; ES: $p<0.05$; NS: $p=0.31$

TCPS 2017: All=607; NS=268; ES=115; CS=224

TCPS 2018 Wave 1: All=2,598; NS=564; ES=565; CS=1,469

TCPS 2018 Wave 2: All= 2,633 NS=550; ES=608; CS=1,475

All: All respondents; NS: Never smokers; ES: Ex-smokers; CS: Current smokers.

Table 3 Thought about the harms of smoking after seeing the pictorial health warnings in the past 30 days, from pre-implementation to the transitional period and post-full implementation

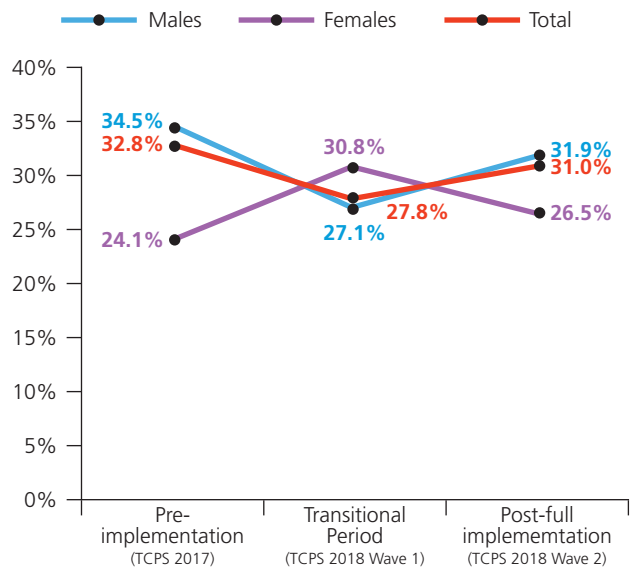
Relative Risk [RR] (95% Confidence Interval)				
	All	Current smokers	Ex-smokers	Never smokers
Transitional period vs. Pre-implementation	0.99 (0.92-1.06)	1.08 (0.93-1.25)	1.11 (0.95-1.31)	0.98 (0.91-1.06)
Post-full implementation vs. Pre-implementation	1.06 (1.00-1.14)	1.23 (1.06-1.43) **	1.20 (1.03-1.40) *	1.04 (0.97-1.12)
Post-full implementation vs. Transitional period	1.08 (1.03-1.13) **	1.15 (1.07-1.23) ***	1.08 (1.00-1.16)	1.06 (1.00-1.12) *

Weighted by sex, age and smoking status to the 2017 or 2018 Hong Kong population.
* $p<0.05$; ** $p<0.01$; *** $p<0.001$

Figure 5 shows that, before implementation, 32.8% of current smokers thought about quitting after seeing the pictorial health warnings on cigarette packs in the past 30 days. The prevalence decreased to 27.8% during the transitional period but then increased to 31.0% post-full implementation. The difference among these 3 surveys was not statistically significant. Table 4 also shows no significant change across surveys, except that male current smokers were more likely to think about quitting after full implementation than during the transitional period.

Figure 5

Thought about quitting after seeing pictorial health warnings on cigarette packs in the past 30 days in current smokers



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018. Statistical significance was tested by chi-square test. CS: p=0.29; M: p=0.06; F: p=0.56

TCPS 2017: CS=224; M=183; F=41

TCPS 2018 Wave 1: CS=1,469; M=1,231; F=238

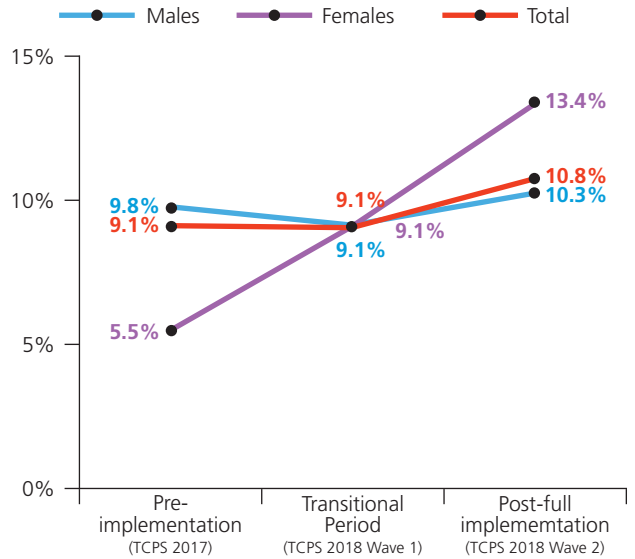
TCPS 2018 Wave 2: CS=1,475; M=1,257; F=218

CS: Current smokers; M: Male current smokers; F: Female current smokers.

Figure 6 shows that the prevalence of current smokers holding back from smoking after noticing pictorial health warnings remained unchanged as 9.1% before implementation and during the transitional period, but increased to 10.8% after full implementation. A sharp increase was observed in female current smokers that the prevalence increased from 5.5% to 13.4% over the same period. The difference among these 3 surveys was not statistically significant. Table 5 shows that female current smokers were 138% (95% CI -30%-720%) and 47% (95% CI -20%-170%) more likely to hold back from smoking after full implementation of new pictorial health warnings than pre-implementation and during the transitional period, respectively. The difference in prevalence and RRs for female current smokers were remarkable but not significant, possibly due to the small number of them in the surveys.

Figure 6

Holding back from smoking after seeing pictorial health warnings on cigarette packs in the past 30 days in current smokers



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018. Statistical significance was tested by chi-square test. CS: p=0.58; M: p=0.86; F: p=0.16

TCPS 2017: CS=224; M=183; F=41

TCPS 2018 Wave 1: CS=1,469; M=1,231; F=238

TCPS 2018 Wave 2: CS=1,475; M=1,257; F=218

CS: Current smokers; M: Male current smokers; F: Female current smokers.

Table 4 Thought about quitting after seeing pictorial health warnings in the past 30 days in current smokers, from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)			
	All current smokers	Male current smokers	Female current smokers
Transitional period vs. Pre-implementation	0.86 (0.68-1.08)	0.80 (0.62-1.02)	1.30 (0.72-2.34)
Post-full implementation vs. Pre-implementation	0.96 (0.76-1.21)	0.94 (0.73-1.20)	1.12 (0.60-2.03)
Post-full implementation vs. Transitional period	1.12 (0.98-1.27)	1.18 (1.02-1.36) *	0.85 (0.61-1.19)

Weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018.
* p<0.05; ** p<0.01; *** p<0.001

Table 5 Holding back from smoking after seeing pictorial health warnings on cigarette packs in the past 30 days in current smokers, from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)			
	All current smokers	Male current smokers	Female current smokers
Transitional period vs. Pre-implementation	1.00 (0.63-1.58)	0.93 (0.57-1.52)	1.62 (0.47-5.58)
Post-full implementation vs. Pre-implementation	1.18 (0.75-1.86)	1.05 (0.64-1.70)	2.38 (0.70-8.14)
Post-full implementation vs. Transitional period	1.18 (0.92-1.51)	1.12 (0.86-1.46)	1.47 (0.80-2.70)

Weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018.
* p<0.05; ** p<0.01; *** p<0.001

3.4 Counteractions of current smokers to avoid seeing pictorial health warnings

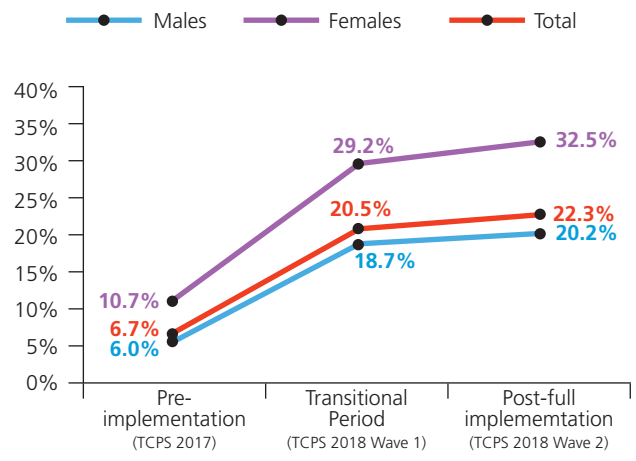
TCPS 2017 (pre-implementation), TCPS 2018 Wave 1 (transitional period) and TCPS 2018 Wave 2 (post-full implementation) explored 4 possible counteractions of current smokers to avoid seeing pictorial health warnings: (a) covering cigarette packs, (b) keeping cigarette packs somewhere out of sight, (c) changing to another cigarette package, and (d) avoiding buying specific cigarette packs.

Figure 7 shows that 6.7% of current smokers took at least one of these 4 counteractions in the past 30 days before implementation of new pictorial health warnings. The prevalence increased to 20.5% during the transitional period, and slightly further increased to 22.3% after full implementation. The difference among these 3 surveys was statistically significant for all current smokers ($p<0.001$). A similar significant increase was observed in both male ($p<0.001$) and female ($p<0.05$) current smokers. Table 6 shows that current smokers (including both male and female) were more likely to take counteractions during the transitional period than before implementation. After full implementation, current smokers were 231% (95% CI 104%-437%) more likely to take at least one counteractions to avoid seeing pictorial warnings than those before implementation. A similar increase in likelihood was observed in both male (235%, 95% CI 89%-507%) and female (204%, 95% CI 32%-599%) current smokers. The results during the transitional period and post-full implementation were similar.

Figure 8 shows that 1.0% of current smokers covered the cigarette packs in the past 30 days before implementation of new pictorial health warnings. The prevalence increased to 5.9% during the transitional period and remained similar (6.0%) after full implementation. The difference among these 3 surveys was statistically significant for all current smokers ($p<0.05$). Table 7 shows that current smokers were around 5 times more likely to cover cigarette packs during the transitional period and after full implementation, than before implementation. The results during the transitional period and post-full implementation were similar.

Figure 7

Any counteractions* to avoid seeing pictorial health warnings in the past 30 days in current smokers



* See Figure 8, 9, 10 and 11 for specific actions.

Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018. Statistical significance was tested by chi-square test. CS: $p<0.001$; M: $p<0.001$; F: $p<0.05$

TCPS 2017: CS=224; M=183; F=41

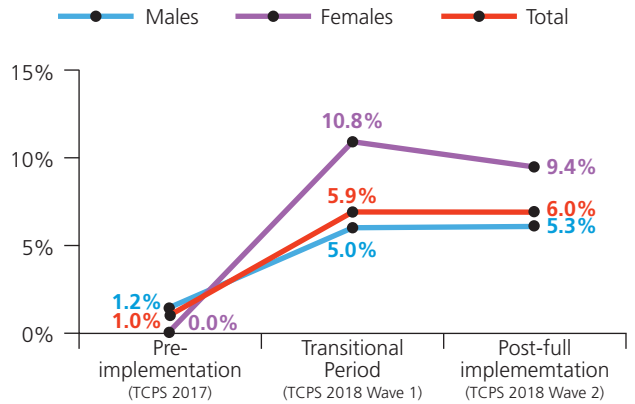
TCPS 2018 Wave 1: CS=1,469; M=1,231; F=238

TCPS 2018 Wave 2: CS=1,475; M=1,257; F=218

CS: Current smokers; M: Male current smokers; F: Female current smokers.

Figure 8

Covering the cigarette packs in the past 30 days in current smokers



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018. Statistical significance was tested by chi-square test. CS: $p<0.05$; M:$p=0.06$; F: $p=0.27$

TCPS 2017: CS=224; M=183; F=41

TCPS 2018 Wave 1: CS=1,469; M=1,231; F=238

TCPS 2018 Wave 2: CS=1,475; M=1,257; F=218

CS: Current smokers; M: Male current smokers; F: Female current smokers.

Table 6 Any counteractions to avoid seeing pictorial health warnings in the past 30 days in current smokers, from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)			
	All current smokers	Male current smokers	Female current smokers
Transitional period vs. Pre-implementation	3.06 (1.89-4.96) ***	3.17 (1.77-5.68) ***	2.74 (1.20-6.26) *
Post-full implementation vs. Pre-implementation	3.31 (2.04-5.37) ***	3.35 (1.89-6.07) ***	3.04 (1.32-6.99) **
Post-full implementation vs. Transitional period	1.08 (0.92-1.27)	1.07 (0.89-1.28)	1.11 (0.81-1.52)

Weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018.
* p<0.05; ** p<0.01; *** p<0.001

Table 7 Covering cigarette packs in the past 30 days in current smokers, from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)			
	All current smokers	Male current smokers	Female current smokers[#]
Transitional period vs. Pre-implementation	6.14 (1.89-19.97) **	4.32 (1.31-14.20) *	N/A
Post-full implementation vs. Pre-implementation	6.19 (1.90-20.21) **	4.59 (1.40-15.09) *	N/A
Post-full implementation vs. Transitional period	1.01 (0.72-1.41)	1.06 (0.72-1.58)	0.88 (0.46-1.68)

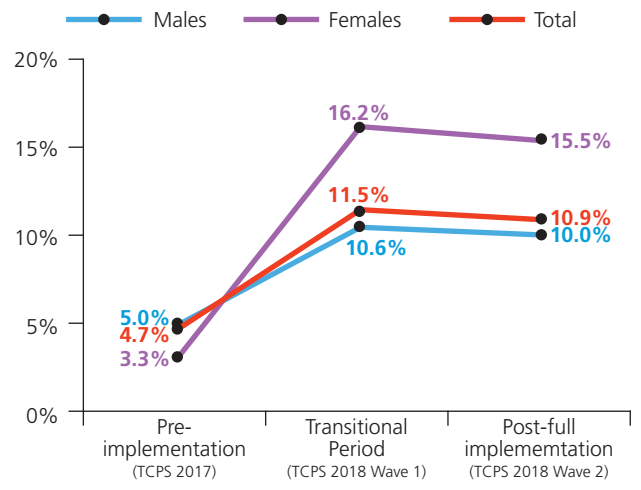
Weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018.
RR cannot be calculated as no female current smokers covered the cigarette packs in the past 30 days in 2017
* p<0.05; ** p<0.01; *** p<0.001

Figure 9 shows that 4.7% of current smokers kept cigarette packs out of sight before implementation of new pictorial health warnings. The prevalence increased to 11.5% during the transitional period and remained similar (10.9%) after full implementation. The difference among 3 surveys was statistically significant for all current smokers ($p<0.05$). Table 8 shows that current smokers were nearly 1.5 times more likely to keep cigarette packs out of their sights during the transitional period and after full implementation of new pictorial health warnings, than before implementation. The results during the transitional period and post-full implementation were similar.

Figure 10 shows that 1.7% of current smokers changed to another cigarette package in the past 30 days before implementation of new pictorial health warnings. The prevalence increased to 6.3% during the transitional period and remained similar (6.6%) after full implementation. The difference among these 3 surveys was marginally significant for all current smokers ($p=0.07$). Table 9 shows that current smokers were more than 2.5 times more likely to change to another cigarette package during the transitional period and after full implementation of new pictorial health warnings, than before implementation. The results during the transitional period and post-full implementation were similar.

Figure 9

Keeping cigarette packs out of sights in the past 30 days in current smokers



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018. Statistical significance was tested by chi-square test. CS: $p<0.05$; M: $p=0.13$; F: $p=0.36$

TCPS 2017: CS=224; M=183; F=41

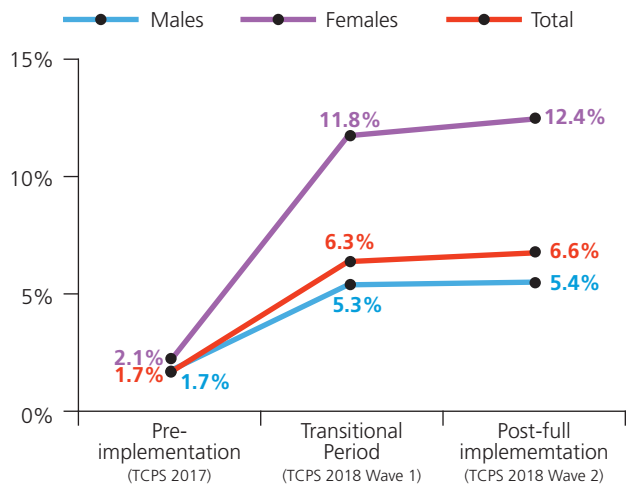
TCPS 2018 Wave 1: CS=1,469; M=1,231; F=238

TCPS 2018 Wave 2: CS=1,475; M=1,257; F=218

CS: Current smokers; M: Male current smokers; F: Female current smokers.

Figure 10

Changing to another cigarette package in the past 30 days in current smokers



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018. Statistical significance was tested by chi-square test. CS: $p=0.07$; M: $p=0.21$; F: $p=0.24$

TCPS 2017: CS=224; M=183; F=41

TCPS 2018 Wave 1: CS=1,469; M=1,231; F=238

TCPS 2018 Wave 2: CS=1,475; M=1,257; F=218

CS: Current smokers; M: Male current smokers; F: Female current smokers.

Table 8 Keeping cigarette packs out of sight in the past 30 days in current smokers, from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)			
	All current smokers	Male current smokers	Female current smokers
Transitional period vs. Pre-implementation	2.48 (1.34-4.58) **	2.16 (1.10-4.22) *	4.94 (1.20-20.38) *
Post-full implementation vs. Pre-implementation	2.35 (1.27-4.36) **	2.03 (1.04-3.99) *	4.73 (1.13-19.83) *
Post-full implementation vs. Transitional period	0.95 (0.75-1.20)	0.94 (0.72-1.23)	0.96 (0.59-1.56)

Weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018.
* p<0.05; ** p<0.01; *** p<0.001

Table 9 Changing to another cigarette package in the past 30 days in current smokers, from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)			
	All current smokers	Male current smokers	Female current smokers
Transitional period vs. Pre-implementation	3.69 (1.28-10.63) *	3.22 (0.94-10.99)	5.46 (0.75-39.85)
Post-full implementation vs. Pre-implementation	3.83 (1.33-11.03) *	3.30 (0.97-11.24)	5.75 (0.78-42.40)
Post-full implementation vs. Transitional period	1.04 (0.75-1.43)	1.02 (0.69-1.51)	1.05 (0.60-1.86)

Weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018.
* p<0.05; ** p<0.01; *** p<0.001

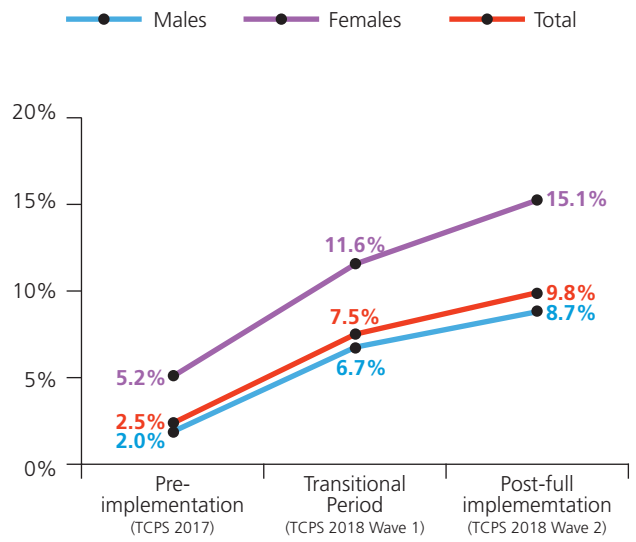
Figure 11 shows that 2.5% of current smokers avoided buying cigarette packs with specific pictorial health warnings in the past 30 days before implementation of new pictorial health warnings. The prevalence increased to 7.5% during the transitional period and further increased to 9.8% after full implementation. The difference among these 3 surveys was statistically significant for all current smokers ($p<0.001$). Table 10 shows that current smokers were about 2 to 3 times more likely to avoid buying cigarette packs with specific pictorial health warnings during the transitional period and post-full implementation than pre-implementation. The difference between transitional period and post-full implementation was not statistically significant.

3.5 Awareness of point-of-sale tobacco displays

Figure 12 shows that before implementation of the new pictorial health warnings, 64.0% of all respondents (76.4% of current smokers, 58.4% of ex-smokers and 62.9% of never smokers) were aware of point-of-sale tobacco displays (i.e. saw in the past 30 days). The awareness increased to 69.2% during the transitional period and remained similar (69.3%) after full implementation. A greater increase was observed in current smokers and ex-smokers than in never smokers since the transitional period. The difference among these 3 surveys was statistically significant for all respondents ($p<0.001$) and for each smoking status group (all $p<0.05$). Table 11 shows that all respondents were 10% (95% CI 4%-17%) and current smokers were 19% (95% CI 10%-28%) more likely to be aware of point-of-sale tobacco

Figure 11

Avoiding buying cigarette packs with specific pictorial health warnings in the past 30 days in current smokers



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex and age distribution of current smokers in Hong Kong 2017 or 2018. Statistical significance was tested by chi-square test. CS: $p<0.01$; M: $p<0.01$; F: $p=0.23$

TCPS 2017: CS=224; M=183; F=41

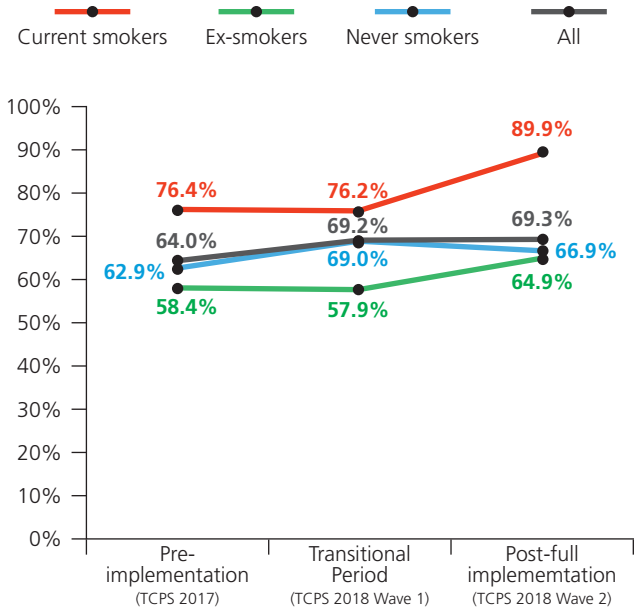
TCPS 2018 Wave 1: CS=1,469; M=1,231; F=238

TCPS 2018 Wave 2: CS=1,475; M=1,257; F=218

CS: Current smokers; M: Male current smokers; F: Female current smokers.

Figure 12

Seeing point-of-sale tobacco displays in the past 30 days



Sample sizes (N) refer to the actual number of respondents. Percentages were weighted by sex, age and smoking status to the 2017 or 2018 Hong Kong population. Statistical significance was tested by chi-square test. All: $p<0.001$; CS: $p<0.001$; ES: $p<0.05$; NS: $p<0.01$

TCPS 2017: All=1,546; NS=839; ES=420; CS=287

TCPS 2018 Wave 1: All=1,582; NS=861; ES=430; CS=291

TCPS 2018 Wave 2: All=1,619; NS=893; ES=425; CS=300

All: All respondents; NS: Never smokers; ES: Ex-smokers; CS: Current smokers.

Table 10 Avoid buying cigarette packs with specific pictorial health warnings in the past 30 days in current smokers, from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)			
	All current smokers	Male current smokers	Female current smokers
Transitional period vs. Pre-implementation	3.00 (1.43-6.29) **	3.38 (1.34-8.52) *	2.23 (0.65-7.61)
Post-full implementation vs. Pre-implementation	3.88 (1.86-8.11) ***	4.36 (1.74-10.92) **	2.88 (0.84-9.88)
Post-full implementation vs. Transitional period	1.29 (0.99-1.70)	1.29 (0.94-1.77)	1.29 (0.75-2.22)

Weighted by sex and age distribution of current smokers in Hong Kong in 2017 or 2018.
* p<0.05; ** p<0.01; *** p<0.001

Table 11 Change in awareness of point-of-sale tobacco displays in the past 30 days from pre-implementation to the transitional period and post-full implementation

Relative Risk [RR] (95% Confidence Interval)				
	All	Current smokers	Ex-smokers	Never smokers
Transitional period vs. Pre-implementation	1.06 (0.99-1.13)	1.05 (0.96-1.15)	1.02 (0.91-1.14)	1.07 (0.99-1.15)
Post-full implementation vs. Pre-implementation	1.10 (1.04-1.17) **	1.19 (1.10-1.28) ***	1.15 (1.04-1.28) **	1.08 (1.01-1.16) *
Post-full implementation vs. Transitional period	1.04 (0.98-1.10)	1.14 (1.06-1.22) ***	1.13 (1.02-1.26) *	1.02 (0.95-1.09)

Weighted by sex, age and smoking status to the 2017 or 2018 Hong Kong population.
* p<0.05; ** p<0.01; *** p<0.001

displays post-full implementation than pre-implementation. Current smokers were 14% (95% CI 6%-22%) more likely to be aware of point-of-sale tobacco displays post-full implementation than during the transitional period.

4. Discussion

Over one-tenth of respondents had already seen the new pictorial health warnings during the transitional period, soon after the new warnings were implemented in December 2017. These respondents reported that the majority of the pictorial health warnings they saw were the new ones. Public awareness of the pictorial health warnings, regardless of smoking status, increased during the transitional period (TCPS 2018 Wave 1) and further increased after full implementation (TCPS 2018 Wave 2).

Pictorial health warnings efficiently disseminate the harms of smoking to not only smokers but also non-smokers. Compared with pre-implementation, the proportion of respondents who thought about the harms of smoking increased after full implementation. Such an increase was more prominent in current smokers and ex-smokers. The results of TCPS 2018 Wave 1 (transitional period) and Wave 2 (post-full implementation) indicated the short-term effects of enlarged pictorial health warnings with stronger images and warning messages. Future TCPSs should continue to evaluate the longer-term effects. The present results shall also support other countries and jurisdictions where proposals on enlarging pictorial health warnings on cigarette packs are under consideration.

Although more current smokers thought about harms of smoking after full implementation of new pictorial health warnings, no substantial increase in thinking about quitting or holding back from smoking after noticing pictorial health warnings was observed. This suggests the effectiveness of new pictorial health warnings in promoting quitting is not

conclusive. The small sample size might explain. Another possible reason was that many smokers in Hong Kong, with the smoking prevalence among the lowest in the developed world, were hardcore smokers and were reluctant to quit, even they had thought more about the harms of smoking after implementation. Further evaluations with a greater sample size are warranted to assess the effects of new pictorial health warnings on current smokers.

There was a sharp increase in counteractions of current smokers to avoid seeing the warnings during the transitional period (TCPS 2018 Wave 1), followed by a small increase post-full implementation (TCPS 2018 Wave 2). A possible reason was that nearly half the current smokers had already seen the new pictorial health warnings and might have reacted during the transitional period. The increase in counteractions post-full implementation was less obvious. A previous study suggested these counteractions often have the opposite effect of increasing "unwanted" thoughts, such as thinking about the harms of smoking, and can increase motivation to quit smoking[11]. Investigations on the association of these counteractions with subsequent quitting behaviours are warranted.

To further reduce the attractiveness of cigarette packs, plain packaging should also be introduced as recommended by WHO FCTC Article 11[1]. At present, nearly 20 countries have implemented plain packaging (e.g. Australia, France, Ireland, Thailand, Canada, Singapore and Uruguay) or passed the law (e.g. Romania)[12, 13]. Plain packaging means that all distinctive tobacco brand characteristics including slogan, logo, colour and promotional elements are not allowed while only brand names in standardized typeface, unattractive colour and large health warnings can be used. Apart from reducing the attractiveness of cigarette packs, plain packaging may also reduce smokers' misperceptions that some cigarette brands are less harmful and increase the effectiveness of health warnings as the warnings without the distraction of the logos, etc., would be more noticeable[11, 14].

Since the impacts of the same pictorial health warnings will decrease over time[15, 16], the HKSAR Government should consider rotation in due course. FCTC Article 11 suggests rotation of pictorial health warnings to maintain the effects of pictorial health warnings[1]. Rotation every 1 to 2 years is highly recommended[11]. The HKSAR government should prepare another set of pictorial health warnings and implement rotation as soon as possible. We also strongly recommend that the warnings should include "smoking kills at least one out of two smokers" to further emphasize the harms of smoking.

Awareness of point-of-sale tobacco displays in current smokers remained similar during the transitional period (TCPS 2018 Wave 1 vs. TCPS 2017), and started to increase after full implementation (TCPS 2018 Wave 2 vs. TCPS 2018 Wave 1). This might be due to counterbalance measures by the tobacco industry to reduce smokers' exposure to the new pictorial health warnings at point-of-sale of cigarettes. For example, some shops only display the bottom or top side of the cigarette packs, which is not covered by the pictorial health warnings but clearly shows the logos, colours and designs of the cigarette brands. Glamourous boxes are also used to display tobacco products. These measures can attract smokers to use these products[17]. Previous studies found that the removal of point-of-sale tobacco displays reduces the use of tobacco products and promotes quitting[18, 19]. We advocate the HKSAR Government to consider banning point-of-sale tobacco displays in accordance with Article 13 of FCTC[20], which has been implemented in Macau since January 2018[21]. The Article affirms that a comprehensive ban on advertising, promotion and sponsorship, which includes point-of-sale tobacco displays as a type of sale and distribution arrangement, would reduce the consumption of tobacco products[22].

To encourage quitting, more effective tobacco control measures such as a substantial and annual tobacco tax increase, and further expansion of smoke-free areas should be implemented. More funding should be allocated to public education, free smoking cessation services, development of more effective interventions, and rigorous evaluation of all tobacco control measures.

5. Limitations

This study had several limitations. First, the term "current smokers" included both daily and occasional smokers, and "ex-smokers" included both ex-daily and ex-occasional smokers. Smoking-related behaviours, perceptions, and opinions may be different between daily and occasional users, but distinguishing the two is not an objective of the current study. Second, all information was collected by telephone interviews without verification of smoking status by the interviewer. However, this method can ensure anonymity that more truthful data might be collected. Third,

the cross-sectional design limited our ability to measure changes over time in the same group of respondents. A cohort study or panel survey with longitudinal data would be better in measuring changes within the same individuals over time. Finally, all data were self-reported, which may be subjected to recall bias.

6. Conclusions

Public awareness of pictorial health warnings progressively increased when the new pictorial health warnings gradually replaced the old ones. After full implementation, more current smokers had thought about the harms of smoking, but the evidence of more current smokers thinking about quitting or holding back from smoking was not conclusive. These results show some short-term effects of the new pictorial health warnings, but also suggest that continuous evaluation on longer term effects is warranted. To maintain the effects of pictorial health warnings, the HKSAR government should prepare a new set of pictorial health warnings for rotation as soon as possible. The increased awareness of point-of-sale tobacco displays after full implementation of new pictorial health warnings might indicate the tactics of the tobacco industry to counteract the new warnings and encourage smoking. Hence, a total ban on the displays is warranted.

7. Other key results of TCPS 2018 Wave 1 and Wave 2

7.1 Awareness (i.e. had heard of or seen) and ever use of electronic cigarettes (e-cigarettes) and heat-not-burn (HNB) tobacco products

- Majority (81.3%) of all respondents (86.9% of current smokers, 83.2% of ex-smokers and 80.5% of never smokers) in Wave 1 were aware of e-cigarettes. The awareness was not assessed in Wave 2.
- Ever e-cigarette use was reported by 3.6% of all respondents in Wave 1 and 2.9% in Wave 2. In current smokers, the prevalence of ever use was 25.9% and 27.0%, respectively (in Wave 1 and 2). In ex-smokers, it was 2.9% and 2.3%, respectively (in Wave 1 and 2).
- Current e-cigarette use (past 30-day use) was reported by 0.7% of all respondents in both Wave 1 Wave 2. In current smokers, the prevalence of current use was 5.2% and 6.5%, respectively (in Wave 1 and 2).
- A quarter (24.5%) of all respondents (43.6% of current smokers, 23.4% of ex-smokers and 22.3% of never smokers) in Wave 1 were aware of HNB tobacco products. The awareness increased to 27.4% in Wave 2 (53.1% of current smokers, 23.3 of ex-smokers and 24.5% of never smokers).
- Ever HNB tobacco product use was reported by 1.7% of all respondents in Wave 1 and 2.5% in Wave 2. In current smokers, the prevalence of ever use was 14.5% and 24.1%, respectively (in Wave 1 and 2). In ex-smokers, it was 1.6% and 0.4%, respectively (in Wave 1 and 2).
- Current HNB tobacco product use (past 30-day use) was reported by 0.7% of all respondents in Wave 1 and 1.0% in Wave 2. In current smokers the prevalence of current use was 6.4% and 9.8%, respectively (in Wave 1 and 2).

7.2 Single and multiple tobacco product use in current smokers in the past 4 weeks

- Majority (81.5%) of current smokers in Wave 2 reported they had used only 1 tobacco product in the past 4 weeks (conventional cigarettes: 76.0%, HNB tobacco products: 2.3%, e-cigarettes: 1.2% and other tobacco products: 2.1%). Multiple use in the past 4 weeks was not assessed in Wave 1.
- About 13.7% reported they had ever used 2 or more tobacco products in the past 4 weeks.
- The most common combination of use of multiple tobacco products included "conventional cigarettes and HNB tobacco products" (4.5%), "conventional cigarettes and e-cigarettes" (2.8%), "conventional cigarettes, HNB tobacco products, and e-cigarettes" (1.6%), and "HNB tobacco products and e-cigarettes" (0.2%).

7.3 Smoking and quitting characteristics of current smokers

- In Wave 1 and Wave 2, current smokers consumed 12.4 (SD 8.3) and 12.7 (SD 8.3) cigarettes per day in the past 7 days on average, respectively.
- Nearly half (46.7% in Wave 1 and 44.9% in Wave 2) the current smokers smoked the first cigarette within 30 minutes after waking up.

- Half (50.9% in Wave 1 and 54.7% in Wave 2) the current smokers had no intention to quit using all forms of tobacco products. Few (18.7% and 15.7% in Wave 1 and Wave 2) planned to quit within 6 months.
- About 13.1% and 13.2% of current smokers in Wave 1 and Wave 2 had ever used smoking cessation services. About 20.5% and 19.2% of them, respectively (in Wave 1 and 2), had ever used smoking cessation products.

7.4 Secondhand smoke (SHS) exposure at home

- In all respondents in Wave 1 and Wave 2, about 14.0% and 14.2% reported SHS exposure at home in the past 7 days, respectively. Excluding respondents who reported no SHS exposure at home in the past 7 days, the average number of days with SHS exposure at home in the past 7 days was 4.4 and 4.5, respectively (in Wave 1 and 2).

7.5 Raising tobacco tax

- Most (81.4% in Wave 1 and 79.6% in Wave 2) respondents supported the Government to raise tobacco tax next year, in which 51.6% and 54.2%, respectively, thought that the increment should be equivalent to or higher than inflation.
- Most (75.6% in Wave 1 and 70.9% in Wave 2) respondents supported the Government to raise tobacco tax annually, in which 51.0% and 47.5%, respectively, thought that the increment should be equivalent to or higher than inflation.

7.6 Tobacco promotion, advertising and sponsorship

- More than two-thirds (67.8% in Wave 1 and 70.6% in Wave 2) thought that point-of-sale tobacco displays were cigarette advertisements and promotions. Around two-thirds (66.8% in Wave 1 and 65.0% in Wave 2) supported a ban on point-of-sale tobacco displays.

7.7 Expansion of smoke-free areas

- More than 90% of respondents (93.7% in Wave 1 and 96.0% in Wave 2) supported to extend the statutory smoke-free areas to all public transport stops such as taxi stands, public light bus stops, bus stops and tramways stops.
- More than 90% of respondents (94.7% in Wave 1 and 93.7% in Wave 2) supported to totally ban smoking from queueing lines in public areas.
- More than 80% of respondents supported to extend statutory smoke-free areas to pedestrian walkways (82.5% in Wave 1 and 83.4% in Wave 2) and busy streets (84.0% in Wave 1 and 83.1% in Wave 2).
- In addition, more than 80% of respondents (85.5% in Wave 1 and 84.8% in Wave 2) supported to increase the fines of smoking at smoking-free areas.

7.8 Opinion on future tobacco control policies

- Majority of all respondents (83.3% in Wave 1 and 79.5% in Wave 2) and current smokers (67.3% in Wave 1 and 69.3% in Wave 2) supported to increase the legal age of buying cigarettes from 18 to 21.
- Over 90% of all respondents (90.1% in Wave 1 and 92.7% in Wave 2) and over 3 quarters of current smokers (75.6% in Wave 1 and 83.6% in Wave 2) supported that only shops with a licence can sell tobacco products.
- Nearly 80% of all respondents (79.0% in Wave 1 and 79.4% in Wave 2) supported to set a cigarette sale quota that decreased year by year. This measure was also supported by 47.9% and 39.7% of current smokers, respectively (in Wave 1 and 2).
- Majority (65.9% in Wave 1 and 68.0% in Wave 2) of all respondents agreed to totally ban smoking when the smoking prevalence in Hong Kong decreases to 5% or lower. This measure was also supported by 39.7% and 34.8% of current smokers, respectively (in Wave 1 and 2).
- Majority of all respondents (65.9% in Wave 1 and 70.8% in Wave 2) supported a total ban on the sale of all forms of tobacco products. This measure was also supported by 35.5% and 33.1% of current smokers, respectively (in Wave 1 and 2).
- Over two-thirds of all respondents (69.1% in Wave 1 and 72.7% in Wave 2) supported a total ban on using all forms of tobacco products. This measure was also supported by 31.8% and 33.6% of current smokers, respectively (in Wave 1 and 2).

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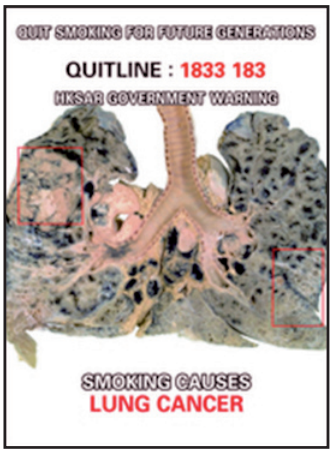
Appendix: The 12 pictorial health warnings in Hong Kong first introduced on 21 December 2017 and fully implementated on 21 June 2018

Description:
Damaged toes



Description:
Lung cancer

Description:
A body at a mortuary

Description:
A funeral with a portrait of the deceased young lady

Description:
Burning banknotes

Description:
A downward curving cigarette

Description:
A man using an oxygen mask

Description:
A woman using a nasogastric tube in hospital

Description:
A wrinkled woman

Description:
Throat with hole

Description:
Use of walker

Description:
An ill child

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