

# Reported Exposures to Anti-smoking Messages and Their Impact on Chinese Smoker's Subsequent Quit Attempts

**Lin Li, Ron Borland, Hua-Hie Yong, Geoffrey T. Fong, Yuan Jiang, Qiang Li, David Hammond & Anne C.K. Quah**

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# Reported Exposures to Anti-smoking Messages and Their Impact on Chinese Smoker's Subsequent Quit Attempts

Lin Li · Ron Borland · Hua-Hie Yong · Geoffrey T. Fong ·  
Yuan Jiang · Qiang Li · David Hammond ·  
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## Abstract

**Background** It is important to monitor whether anti-smoking messages (if any) are noticed by the public in China and whether they have any impact on smokers' quitting behaviours over time

**Purpose** This study aimed to examine Chinese smokers' exposure to anti-smoking messages in a range of channels and to determine if exposure was associated with subsequent quit attempts.

**Method** A prospective cohort design was employed. Participants were 6,509 adult smokers who completed at least one of the first three waves (2006–2009) of the International Tobacco Control (ITC) China Survey sampled from six Chinese cities. The main measures were reported exposure to anti-smoking messages in a range of channels and smokers' subsequent quit attempts. Generalized Estimating Equations (GEE) modelling was used to combine respondents from all three waves while accounting for inherent within-person correlation.

**Results** The overall exposure levels to anti-smoking messages were low and varied between cities and from one channel to another. Television was the medium with the greatest overall exposure (over 50 % in almost all the cities across all the waves). After controlling for a range of covariates, higher level of combined exposure were positively related to higher subsequent quit attempts (adjusted odds ratio=1.03, 95 % CI 1.02~1.05,  $p < .001$ ); among the individual channels, exposures in newspapers and on posters were significant in their own right.

**Conclusion** The findings suggest that anti-smoking warning messages have the potential to stimulate Chinese smokers to make quit attempts, but they also indicate that the levels and strength of warning messages in China need to be increased. China should consider adopting proven international practices, including mandating pictorial health warnings on cigarette packages, adopting prominent point-of-sale warnings, and carrying out strong and ongoing mass media campaigns.

**Keywords** Health warnings · Smoking cessation · Longitudinal research · China

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## Introduction

China has around 301 million smokers [1]. Smoking kills about 1 million Chinese each year with economic costs estimated at 5 billion US dollars [2]. However, there is a lack of awareness about the profound and grave health consequences of smoking among the Chinese public. Recent data suggest that only 68 % of Chinese smokers surveyed in the International Tobacco Control (ITC) China Survey believe that smoking leads to lung cancer and only 36 % believe that smoking causes coronary heart disease [3]. This is much lower than in other countries participating in the ITC Surveys [3, 4]. It highlights the urgent need to increase awareness about the adverse health effects of smoking in China.

The World Health Organization (WHO) has identified “warning everyone about the dangers of tobacco” as one of the six most important tobacco control policies [5]. Various forms and media can be used to communicate the harms of smoking. Most of the research has focused on mass media, particularly television, and the use of health warnings on tobacco packages. International experience shows that strong health warnings on tobacco packets, particularly pictorial warnings, are associated with increased awareness of the health risks of smoking and quitting activities of smokers (including the younger smokers and those with low literacy) [4–8]. Hard-hitting public education campaigns using graphic images of the harms of tobacco use are effective in convincing users to quit [9–12]. Pierce and Gilpin have also shown a relationship between quitting activities and the number of magazine stories on tobacco control [13]. More recently, our group has found a positive association with the generally strong point-of-sale (POS) warnings used in Australia [14]. Some countries, notably Australia, have integrated communications from mass media campaigns, package warnings and POS warnings. This type of integrated, comprehensive campaign has proven to be effective [10, 12, 14].

China has had a relatively low level of anti-smoking activity. The National People's Congress of China ratified WHO Framework Convention on Tobacco Control (FCTC) on August 28, 2005, and the Chinese government started to implement this international health treaty from January 2006. During the study period of this research (2006–2009), China had adopted some tobacco control measures, including conducting public education campaigns via mass media. One nationwide awareness campaign is worth mentioning, and it is relevant to this study. That is the China Tobacco Control Mass Media Campaign, which was officially launched in July 2008 by the Ministry of Health and the National Institute of Health Education. It aimed to better organize and encourage the media (including the Chinese Central Television (CCTV) network) to report and convey key messages on tobacco control and implementation of the FCTC in China [15]. The campaign covered various aspects of tobacco control, including government policies/regulations and related research, and the harms of smoking and second-hand smoking [15, 16]. Also in October 2008, new somewhat stronger but still weak cigarette package health warnings were introduced in China. Although the new warnings met FCTC minimum requirements on size (with the warning occupying 30 % of both the front and back of the package), they were text-only warnings and there were no design elements that set the health warnings apart from the rest of the package; their effectiveness appeared to be minimal [17].

All six cities included in this study (Beijing, Shenyang, Shanghai, Changsha, Guangzhou and Yinchuan) had carried out some forms of tobacco control activities during this period, although the intensity and coverage of their tobacco

control efforts varied. Like in other parts of China, all these cities made use of the opportunities presented in the World No Tobacco Day periods and conducted relevant public awareness and educational activities, through both interpersonal and mass media communications [15, 18]. Mass media, such as televisions and newspapers, were widely used to spread health messages. However, it should be noted that tobacco control efforts and educational activities were not evenly implemented across these six cities. For example, to meet the goal of the smoke-free initiatives in the 2008 Beijing Olympic Games, three of our studied cities (Beijing, Shanghai and Shenyang, where Olympic events were held) implemented more intensive tobacco control measures/campaigns as part of the initiatives. Prior to the 2008 Olympics Games, the municipal governments of Beijing and Shenyang introduced new rules to restrict smoking in public venues. In Beijing, anti-smoking advertisements were widely shown on television screens in buses and other public transportation (including on posters in subways); many government buildings, health facilities, hotels, restaurants and bars were made smoke-free (or at least partially smoke-free during the Olympic Games) [19–21]. Even though the effectiveness of some of these initiatives (e.g. smoking bans/restrictions in restaurants and bars in Beijing) was later found to be very limited (especially when the bans/restrictions were voluntary) [20, 21], they provided some opportunities for the public to become aware of the issue of tobacco use.

It is important to monitor whether anti-smoking messages (if any) are noticed by the public in China and whether they have any impact on smokers' quitting behaviours over time. Such information is critically important in designing evidence-based intervention programs and policies. This study used the first three waves of the ITC China Survey data (collected between 2006 and 2009) and aimed to (1) examine smokers' reported exposure to anti-smoking messages in a range of channels in the cited six cities in China and (2) determine if exposure to anti-smoking messages was associated with smokers' subsequent quit attempts.

## Methods

### Data Source and Participants

The data came from the first three waves of the ITC China Survey for adult smokers. Wave 1 data were collected between April and August 2006, Wave 2 data between October 2007 and January 2008 and Wave 3 data between May and October 2009. A detailed description of the methods of the ITC China Survey has been reported by Wu et al. [22], and more detail is available at <http://www.itcproject.org>. Briefly, the ITC China smoker survey is a prospective face-to-face cohort survey of smokers in six cities in China: Beijing, Shenyang, Shanghai, Changsha, Guangzhou and Yinchuan.

(A seventh city, Kunming, was excluded from analysis because respondents from that city were only started to be surveyed from Wave 3 and did not have any information for the outcome variable of this study (“quit attempts since last wave”) at the time of writing.) These cities were selected based on geographical representations and levels of economic development. Within each city, there was a random sample selected using a stratified multi-stage design. Respondents were aged 18 years or older, had smoked at least 100 cigarettes

in their lifetime and smoked at least weekly at the time of recruitment. The sample size per city is approximately 800 at each wave, with replenishment sampling (from Wave 2) from the same sampling frame used to maintain sample size across waves [22].

The sample size for each city at each specific wave, the number of recontacts and new recruits at each wave and their characteristics are summarised in Table 1. A total of 6,509 respondents who provided complete information for at least

**Table 1** Sample characteristics (by city)

	Beijing n=944	Shenyang n=1,243	Shanghai n=955	Changsha n=1,033	Guangzhou n=1,189	Yinchuan n=1,145	Total n=6,509
Number of participants at each wave							
Wave 1 (2006)	785	781	784	800	791	791	4,732
Wave 2 (2007/8)	784	784	790	795	824	803	4,780
Recontacts	(710)	(583)	(703)	(648)	(560)	(659)	(3,863)
New recruits	74	201	87	147	264	144	917
Wave 3 (2009)	785	776	775	768	819	798	4,721
Recontacts	(696)	(502)	(690)	(680)	(685)	(588)	(3,841)
New recruits	85	261	84	86	134	210	860
Sex (% male)	94.4	93.2	97.7	92.1	93.8	97.4	94.7
Ethnicity (% Han Chinese)	94.2	94.9	98.9	98.6	98.9	81.8	94.4
Age at recruitment (%)							
18–24	1.6	1.4	1.3	1.6	1.4	1.1	1.4
25–39	13.1	13.5	8.7	23.6	14.6	28.9	17.3
40–54	45.3	55.2	55.9	43.7	42.4	46.7	48.2
55+	39.9	29.9	34.1	31.2	41.6	23.3	33.2
Education at recruitment (%) <sup>a</sup>							
Low	9.8	7.5	5.9	16.9	22.1	13.7	12.8
Moderate	63.6	71.5	74.3	60.8	59.9	62.8	65.4
High	26.7	21.0	19.8	22.3	18.0	23.5	21.8
Income at recruitment (%) <sup>a</sup>							
Low	8.4	29.9	13.5	26.0	10.5	21.4	18.7
Moderate	39.9	53.2	42.4	42.2	37.1	47.7	44.0
High	43.9	14.0	39.7	26.1	38.1	22.7	29.9
No information	7.9	2.8	4.4	5.7	14.3	8.2	7.3
Cigarettes per day at recruitment (%)							
1–10	39.1	40.2	34.3	24.3	34.6	43.8	36.2
11–20	48.1	48.1	50.1	51.2	50.1	44.5	48.6
21–30	6.7	7.4	8.9	11.5	8.8	5.6	8.1
31+	6.1	4.4	6.7	13.0	6.5	6.1	7.0
Intentions to quit at recruitment (%)							
Within 1 month	8.2	12.6	4.0	5.9	5.9	10.9	8.1
Within 6 months	7.9	9.9	6.3	6.7	6.5	6.6	7.4
Beyond 6 months	10.7	9.3	7.8	13.6	7.3	15.5	10.7
Not planning to quit	62.5	61.0	74.4	64.8	69.2	51.9	63.7
Don't know	10.6	7.2	7.5	8.9	11.0	15	10.1

Percentages were based on unweighted data. For some variables, the number of cases was fewer than the total due to some “don't know” and “missing” cases

<sup>a</sup> For the definition of each category please see “Methods”

one of the three waves were included in the analysis for this paper. Of the 4,732 smokers surveyed at Wave 1, 3,863 of them were recontacted at Wave 2, with a follow-up rate of 81.6 % between the first two waves. Among 4,780 respondents who were surveyed at Wave 2 (i.e. 3,863 recontacts plus 917 replenishments), 3,841 of them were recontacted at Wave 3, with a follow-up rate of 80.4 %.

## Measures

### *Measures of Exposure to Anti-smoking Messages*

Respondents were asked at each wave if they had noticed advertising or information that talks about the dangers of smoking or encourages quitting in the following 13 channels in the last 6 months (asked separately): television, radio, posters, billboards, newspapers/magazines, shops/stores, street vendors, the internet, working places, public transportation, restaurant/tea houses, entertainment venues (e.g. discos lounges) and cigarette packs. Response options were “yes”, “no”, “refused” and “didn't have access to the channel/don't know”. Those who “refused” to answer a question were excluded in the analysis for that specific channel. Those who answered “yes” were regarded as having been exposed to anti-smoking messages (13 separate variables for individual channels mentioned above) and coded as “1”, otherwise coded as “0” (for “not exposed”). Based on the total number out of the 13 channels a respondent noticed anti-smoking messages, we created a combined measure of exposure (scored from 0 to 13).

### *Covariates*

Socio-demographics measured included sex (male, female), age at recruitment (18–24, 25–39, 40–54, 55 and older), ethnicity group (majority group—Han Chinese, minority group), education (“low” level of education refers to no schooling or having only primary school education, “moderate” were those with high school or technical secondary education and “high” were those with a university or postgraduate degree) and income (those with monthly household income less than 1000 Chinese Yuan (CNY) (approximately US \$150) were coded as “low income”, those between 1,000 and 3,000 CNY (US \$150–450) were coded as “moderate income”, those equal or greater than 3,000 CNY (US \$450) were coded as “high income”, and those who did not provide an answer were coded as “no information”).

Cigarettes per day (CPD) was asked at each wave and recoded to: “already quit”, “1–10 CPD”, “11–20 CPD” and “21+CPD”. In addition, respondents were asked at each wave about their interest in quitting via the following question: “Are you planning to quit smoking?” Response options were “within the next month”, “within the next 6 months”, “sometime in

the future, beyond 6 months”, “not planning to quit” and “don't know”. The first three categories were recoded to “having some interest in quitting” and the remaining as “not having an interest in quitting”. Wave, cohort, city and smoke-free policy (at workplace) were also used as covariates in some analyses.

### *Outcome Measures*

Reported awareness of anti-smoking material in each of the 13 channels was determined. Quit attempts were assessed at the next wave of exposure to anti-smoking messages (i.e. from Wave 2), based on the answer to “Since we last talked to you [in last survey date], have you made any attempts to stop smoking?” or if a respondent stated that s/he had quit smoking since the previous survey date. Those reporting having made at least one quit attempt were coded as “1”; otherwise, the code was “0”.

### *Data Analysis*

Taking into consideration the correlated nature of the data within respondents across survey waves, we used the Generalized Estimating Equations (GEE) approach to compute parameter estimates. The GEE modeling included a specification for an unstructured within-subject correlation structure, and parameter estimates were computed using robust variance. Our large sample size allowed us to assume an unstructured correlation structure in GEE which helped us to estimate all possible correlations between within-subject responses and thus we included them in the estimation of the variances. Because the main outcome variable (quit attempts) was dichotomous, the GEE model included a specification for the binomial distribution of the dependent variables. A “forward” specification was used in the analysis, so the longitudinal association between exposure to anti-smoking messages in each channel and subsequent quit attempts was examined. Potential confounders and other forms of anti-smoking messages were controlled for in the final model. All analyses were conducted using Stata Version 10.1.

### *Ethics Approval*

The study protocol was approved by the Office of Research Ethics at the University of Waterloo (Canada) and the internal review boards at Roswell Park Cancer Institute (the USA), the Cancer Council Victoria (Australia) and the Chinese Center for Disease Control and Prevention (China). All participants gave their informed consent prior to their inclusion in the study.

## Results

### Reported Exposure to Anti-smoking Messages

Table 2 presents reported exposure to anti-smoking messages over waves in the six cities. Overall, the highest proportions of respondents (over 50 % in almost all the cities across all the waves) reported having been exposed to anti-smoking messages on television. These were followed by exposure in newspapers/magazines and cigarette packs. The reported exposure levels were lowest on the Internet.

Overall, the reported exposure levels in Shanghai and Yinchuan were significantly lower than those of Beijing in most of the channels (Tables 2 and 3). Compared to Wave 1, the reported exposure levels were higher at Wave 2 and again at Wave 3 in most of the channels (except for television where the reported exposure level at Wave 2 was significantly lower than that of Wave 1).

### Reported Quit Attempts Between Waves

Of those 3,863 respondents who were surveyed in Wave 1 and later recontacted at the second wave, 979 (or 25.3 %) of them reported having made a least one quit attempt between the first two waves (the reported quit attempt rates in the six cities ranged from 13.2 to 34.1 % (for more details, see Li et al. [23]).

Between Waves 2 and 3, a total of 1,188 (or 30.9 %) out of the 3,841 recontacts reported having made quit attempts (quit attempt rates in the six cities ranged from 17.7 to 43.5 %).

### Associations Between Exposure to Anti-smoking Messages and Subsequent Quit Attempts

Treated individually, reported exposure to all anti-smoking messages tended to predict greater quit activity, but it was only significant for newspapers, posters, television, radio and at workplaces (Table 4). After controlling for a range of covariates, smokers who reported being exposed to anti-smoking messages in newspapers/magazines and on posters were found to be more likely to have made quit attempts at subsequent wave than those who were not exposed (for newspapers: adjusted odds ratio (OR)=1.16, 95 % CI 1.02–1.33,  $p=.023$ ; for posters: adjusted OR=1.26, 95 % CI 1.08–1.47,  $p=.003$ ; Table 4).

We also explored the association between combined exposure (scoring from 0 to 13) and subsequent quit attempts and found an overall positive effect—the more channels a respondent were exposed to, the more likely s/he would have made a subsequent quit attempt (with GEE modelling adjusted OR=1.03, 95 % CI 1.02–1.05,  $p<.001$ ; adjusted for socio-demographics, smoking status, cigarettes per day, wave, cohort and city). We tested for nonlinear effect and found that a

quadratic trend was not quite significant ( $p=0.071$ ), suggesting that the relationship is primarily linear, as shown in Fig. 1.

We did additional analyses to test the moderating effect of city and found none. To check if the associations between exposure to anti-smoking messages and quit attempts were confounded by interest in quitting and workplace smoke-free policy, we included them in the modelling (controlling for all the covariates) and found that the trends remained essentially the same, including the significantly positive associations between exposure to anti-smoking messages in newspapers (and on posters) and quit attempts.

## Discussion

The main objective of anti-smoking messages and warnings is to communicate effectively about the harms of smoking and encourage smokers to quit. Various media and channels can be used to achieve the objective. Our data show relatively low levels of awareness of anti-smoking material in most of the communication channels in the Chinese cities that we studied, with comparatively higher proportions of smokers noticing messages in mass media such as television and newspapers. There was also considerable variation between cities, probably reflecting differential use of channels for communicating risks of smoking. It is notable that respondents' awareness of anti-smoking messages increased at the last two survey waves, especially at Wave 3. This is likely to be at least partly attributable to the China Tobacco Control Mass Media Campaign [15], which was launched between Waves 2 and 3 of our data collection.

Overall, our data show that after controlling for a range of variables, the higher combined exposure to anti-smoking messages was associated with higher subsequent quit attempts. Individual unadjusted odds ratios also indicate a clear trend of positive association between reported exposure to almost every channel of anti-smoking messages and subsequent quitting activities ( $OR>1$ ). We accept that the study is underpowered to find small effects. Given the overall effect that we found, we cannot rule out small positive effects for the individual channels, and we think it is possible that each could have contributed to the overall effects.

Our findings support the potential of educational efforts through different media/channels, as confirmed by research in other countries [4, 7, 10, 11, 14]. Even though our measures of exposure are weaker than in some other studies, our findings are consistent with theirs and provide evidence that mass communications in China are contributing to the increase in quitting activities that have occurred over the last 15 years (the proportions of smokers having made quit attempts increased from 9.4 % in 1996 to 11.5 % in 2002 and then to 16.9 % in 2010) [1, 24, 25]. This is reassuring. It is particularly

**Table 2** Reported exposure to anti-smoking messages in various channels over waves (by city)

	Beijing			Shenyang			Shanghai			Changsha			Guangzhou			Yinchuan			All 6 cities		
	W1, n=785	W2, n=784	W3, n=785	W1, n=781	W2, n=784	W3, n=784	W1, n=784	W2, n=790	W3, n=775	W1, n=800	W2, n=795	W3, n=768	W1, n=791	W2, n=824	W3, n=819	W1, n=791	W2, n=803	W3, n=798	W1, n=4732	W2, n=4780	W3, n=4721
Television (% yes)	62.7	56.9	67.9	61.3	52.5	67.6	57.3	45.1	58.1	62.9	55.2	69.0	58.8	57.4	66.3	64.1	52.9	66.5	61.2	53.4	65.9
Radio (% yes)	32.5	34.8	43.6	36.4	32.9	50.6	28.1	25.1	31.6	20.1	19.9	31.8	19.8	32.3	31.7	13.3	16.1	29.5	24.9	26.8	36.4
Posters (% yes)	24.4	30.3	42.2	26.5	23.8	41.6	22.7	22.2	34.3	26.3	24.6	39.5	20.2	32.9	39.9	7.1	15.6	29.9	21.2	24.9	37.9
Billboards (% yes)	30.3	36.5	55.5	40.5	36.1	59.0	29.2	29.5	41.5	39.0	41.7	53.6	23.5	38.3	47.4	13.7	18.8	38.4	29.4	33.5	49.2
Newspaper/ magazine (% yes)	41.3	41.7	53.3	42.1	37.4	55.2	39.3	34.9	51.6	40.6	41.3	54.0	32.9	42.2	49.4	23.9	26.7	41.3	36.7	37.4	50.8
Shops/stores (% yes)	17.1	24.5	35.9	26.5	25.8	40.2	22.7	21.7	32.8	17.9	19.2	28.1	13.9	27.5	33.3	8.7	9.5	21.6	17.8	21.4	32.0
Street vendors (% yes)	8.9	14.3	20.4	12.9	14.4	20.2	7.2	7.1	10.7	11.0	11.1	18.6	9.8	18.7	18.5	4.8	6.4	17.5	9.1	12.0	17.6
Internet (% yes)	8.8	12.2	21.6	4.6	6.6	19.7	7.0	7.9	11.7	7.0	10.6	21.7	3.8	9.8	11.6	4.3	4.7	14.3	5.9	8.6	16.7
Working places (% yes)	25.4	31.5	51.4	21.5	26.7	43.8	18.9	18.2	27.1	29.3	32.2	48.4	15.7	32.2	33.1	19.5	16.7	35.9	21.7	26.3	39.9
Public transport (% yes)	23.2	34.6	60.5	32.6	37.0	66.2	26.5	26.6	46.3	44.2	49.9	69.7	24.4	43.8	59.2	20.3	23.1	42.9	28.6	35.8	57.4
Restaurants/tea bars (% yes)	14.9	28.2	56.8	16.0	22.5	49.6	13.0	16.8	38.6	23.5	29.5	50.9	20.1	36.1	49.1	8.7	12.6	33.3	16.1	24.3	46.4
Entertainment venues (% yes)	9.9	13.4	24.3	9.4	14.2	29.7	8.9	8.6	17.0	16.0	22.7	37.5	9.0	19.4	21.6	4.4	6.0	19.5	9.6	14.1	24.9
Cigarette packs (% yes)	45.7	54.5	74.7	52.3	58.4	83.2	43.2	55.4	66.9	66.3	66.5	79.7	40.2	60.5	72.5	24.6	39.0	48.7	54.5	55.7	70.9

Percentages were based on unweighted data. For some variables, the number of cases was fewer than the total due to some “don't know” and “missing” cases. Test results for city/wave differences can be found in Table 3

W1 Wave 1 of the survey (this applies to the other waves)



**Table 3** Overall city and wave differences in exposure to anti-smoking messages (main effects)

	City differences <sup>a</sup>						Wave differences		
	Beijing (n=944) OR	Shenyang (n=1,243) OR	Shanghai (n=955) OR	Changsha (n=1,033) OR	Guangzhou (n=1,189) OR	Yinchuan (n=1,145) OR	Wave 1 (n=4,732) OR	Wave 2 (n=4,780) OR	Wave 3 (n=4,721) OR
Television	Ref	.92	.69***	.99	.93	.95	Ref	.72***	1.21***
Radio	Ref	1.15*	.67***	.54***	.65***	.42***	Ref	1.11*	1.73***
Posters	Ref	.94	.76***	.91	.94	.45***	Ref	1.23***	2.26***
Billboards	Ref	1.21**	.73***	1.19**	.83**	.45***	Ref	1.21***	2.36***
Newspapers/ magazines	Ref	.99	.88	.99	.85*	.53***	Ref	1.03	1.76***
Shops/stores	Ref	1.29***	.99	.79**	.95	.44***	Ref	1.25***	2.16***
Street vendors	Ref	1.11	.53***	.92	1.07	.62***	Ref	1.36***	2.03***
Internet	Ref	.71***	.58***	.92	.54***	.52***	Ref	1.51***	3.16***
Working places	Ref	.78***	.47***	1.02	.64***	.55***	Ref	1.28***	2.40***
Public transportation	Ref	1.29***	.75***	1.94***	1.15*	.60***	Ref	1.42***	3.51***
Restaurants/tea bars	Ref	.82**	.57***	1.07	1.09	.42***	Ref	1.70***	4.64***
Entertainment venues	Ref	1.15	.68***	1.85***	1.05	.59***	Ref	1.55***	3.16***
Cigarette packs	Ref	1.31***	.88	1.82***	.97	.41***	Ref	1.54***	3.05***

<sup>a</sup> The results for this table were from generalized estimating equations modelling. There were 13 separate models, one for each channel. In each model, city effect was adjusted for “wave”, and wave effect was adjusted for “city”

OR odds ratio, Ref referent value

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

encouraging to find that over waves there was a significantly positive association between reported exposure to anti-smoking messages in newspapers/magazines (and on posters) and subsequent quit attempts. However, more could be done in China.

Our data show that the reported exposure level via television decreased from Wave 1 (in 2006 when China started to implement the FCTC) to Wave 2 (in late 2007) and that, after controlling for covariates, reported exposure to television was not significantly associated with subsequent quit attempts (although there was a trend). As it was the medium with the greatest overall exposure, it suggests that the television communications are relatively weak in China. Chinese health authorities need to consider the consistent use of stronger and more graphic health education campaigns as have been found to be most effective in many parts of the world, including low- and middle-income countries [11].

Similarly, cigarette pack warning is another area where China could do better. Increasing international evidence show that stronger and more prominent pictorial health warnings on cigarette packs are associated with increased quitting activities [4, 7, 8, 26]. China might consider learning from the experiences of other countries, especially those mandating pictorial pack warnings and adopting such warnings rather than the

weak warnings it introduced in October 2008, which only represents a minimal improvement over the old warnings and were in English on the back of all packages [17].

Another missed opportunity in China is at POS. Our data show that only a small proportion of respondents noticed anti-smoking messages at the POS and no significant association with subsequent quit attempts. In China, POS warnings are small and weak. Text warnings include “smoking is harmful to your health” and “no cigarette sales to minors”. Recent data from the ITC Four Country Survey shows that in Australia where POS warnings are much stronger, awareness is correspondingly higher (ranged from about 40 to 58 %) and the awareness is associated with smokers' interest in quitting and subsequent quit attempts [14].

In addition, experience from Australia highlights the importance of using multi-location strategy (e.g. through using mass media campaigns, pack warnings as well as POS warnings) to convey key anti-smoking messages and enhance effects [10, 12, 14].

Another area worth noting is the reported exposure at workplaces. The overall reported exposure levels at workplaces were low, but in most of the cities there was an overall trend of increase between the latest two waves. In addition, a marginal effect of exposure on quit attempts was identified

**Table 4** Associations between exposure to anti-smoking warnings in various places and subsequent quit attempts—GEE modelling results

	Unadjusted odds ratio	95 % CI	<i>p</i> -value	Adjusted odds ratio <sup>a</sup>	95 % CI	<i>p</i> -value
Newspapers/magazines	1.20	1.08–1.32	.001	1.16	1.02–1.33	.023
Posters	1.24	1.11–1.39	.000	1.26	1.08–1.47	.003
Television	1.15	1.04–1.27	.006	1.11	.98–1.25	.087
Radio	1.18	1.05–1.31	.004	1.05	.91–1.20	.475
Billboards	1.07	.96–1.19	.131	.87	.75–1.01	.059
Shops/stores	1.06	.93–1.19	.390	.98	.83–1.15	.811
Street vendors	1.16	.99–1.35	.058	1.01	.83–1.22	.940
Internet	1.13	.93–1.37	.207	1.05	.84–1.31	.672
Working places	1.13	1.03–1.29	.014	1.14	.99–1.32	.062
Public transportation	1.09	.98–1.20	.120	.96	.83–1.10	.558
Restaurants/tea bars	1.07	.94–1.20	.302	.97	.81–1.15	.734
Entertainment venues	1.02	.87–1.18	.829	.89	.73–1.09	.279
Cigarette packs	1.09	.98–1.20	.197	1.05	.94–1.17	.404

Person-wave observation no.=8432. (For some modelling, the number of observations was fewer than this due to some “don't know” and “missing” cases.) Exposure to anti-smoking messages was coded as ‘1’ for ‘yes exposed’ and ‘0’ for ‘not exposed’ (the referent). “Having made quit attempts” was measured one wave after the exposure to POS messages, and a ‘forward’ specification was used in the analysis

<sup>a</sup> Adjusted for sex, age, ethnicity, baseline education, baseline income, smoking status, cigarettes per day at each wave, wave, cohort, and city, along with other exposure channels

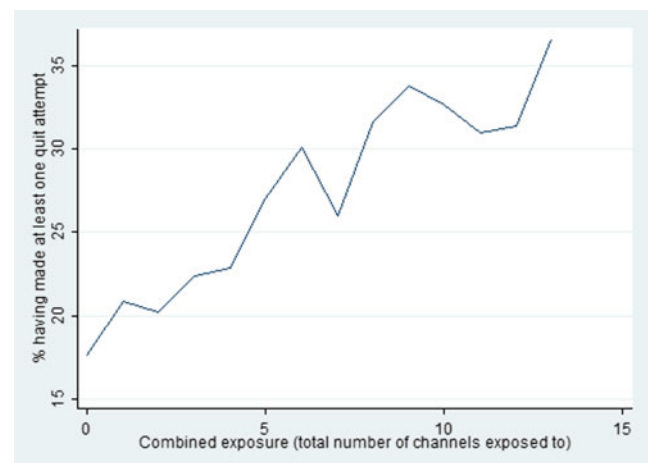
( $p = .062$ ), suggesting that exposure to anti-smoking messages at workplaces may be effective. Recently, the Chinese government has been promoting smoke-free health facilities, and noticeable anti-smoking warning signs in such health facilities are part of the new initiatives [27]. It is important that such initiatives can be expanded and widely introduced to all workplaces in the country to stimulate thoughts of quitting and subsequent attempts to quit.

This study has both strengths and weaknesses. As far as we are aware, little longitudinal research of this kind has been conducted in China. One of the main strengths of this study is its longitudinal design, which allowed for changes in warning exposure and quit attempts over time to be assessed. The use of GEE modelling allowed us to combine respondents from all three waves while accounting for inherent within-person correlation, thereby increasing our sample size and power to detect effects.

The main limitations of the study are that the estimates of exposures are restricted to the six cities and should not be taken as representative of China as a whole. Differences in exposures are likely to vary from place to place and be particularly different in rural areas where low education may reduce the utility of text-based communications. We would expect that education and awareness campaigns would be adjusted to meet local needs. The timing of data collection across survey waves/years could be better planned and more consistent, with big events (such as the World No Tobacco Days) being taken into consideration to make the data more comparable across waves. Furthermore, recall might be imprecise, especially over periods of 6 months. Warnings need to

be remembered to be reported, so these measures may be more an index of the memorability of communications more so than their frequency. The timing of our surveys might also contribute to reported levels of exposure, for example, the closer the survey to periods of activity (e.g. World No Tobacco Day), the more likely the respondents would be to remember any anti-smoking messages that were used. Time in sample is unlikely to be a factor as we controlled for this in our analyses using the replenishment sub-samples at each wave.

The cited limitations are of limited relevance to the predictive analyses. The main limitation here is the reliance on correlations, albeit sometimes lagged in time. It is possible that those who were interested in quitting might be more likely



**Fig. 1** Relationship between combined level of exposure to anti-smoking messages and subsequent quit attempts

to report noticing anti-smoking messages. We did control for interest in quitting in the analyses, and the effects remained but cannot rule out residual confounding. As we discussed elsewhere [14, 28], there is no evidence to suggest that self-report is systematically inaccurate in population-based studies of this kind. Moreover, as noted earlier, the results mirror studies from other countries that used stronger methods [11, 29]. As media/channel has been shown to affect quitting in these methodologically stronger studies, we think that it is likely that at least some of the effect is causal.

In summary, the results of this study show that the overall awareness levels of anti-smoking messages were generally low and varied from one channel to another. Higher level of combined exposure to anti-smoking messages in various channels was positively related to higher quit activities. Exposure to anti-smoking messages in newspapers and on posters appeared to have the strongest positive impact on smokers' subsequent quit attempts. These results from China suggest that anti-smoking warning messages have the potential to stimulate Chinese smokers to make quit attempts, but they also indicate that the levels and strength of warning messages needs to be increased. China should consider adopting proven international practices, including mandating pictorial health warnings on Chinese cigarette packets, adopting more prominent point-of-sale warnings, and carrying out strong and ongoing mass media campaigns that consistently emphasize the harms of smoking and the importance of quitting.

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**Conflict of interest** None

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