

BMJ Open Identifying credible attribution sources for cigarette health warning labels in China: results from a cross-sectional survey of Chinese adults

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ABSTRACT

Objective The Framework Convention on Tobacco Control recommends health warning labels (HWLs) include an attribution source. Little is known regarding the perceived credibility and effectiveness of different message sources. This study examined perceptions of four HWL attribution sources among adults in China – the world's largest consumer of cigarettes.

Design Cross-sectional experimental survey design.

Participants Data were collected in 2017 from a convenience sample of 1999 adults across four cities in China; 80% of the sample were current smokers.

Main outcome measures Participants viewed four versions of the same HWL, each with a different attribution source: the China Center for Disease Control (ref. group); the regulatory arm of China's domestic tobacco company (STMA); Liyuan Peng, China's first lady; and the WHO. Respondents indicated which HWL was the most: (1) credible, (2) effective at making people quit and (3) effective at preventing youth initiation.

Results Multinomial logistic regression models estimated adjusted relative risk ratios (aRRRs) of the three outcomes. Controlling for demographics and smoking status, HWLs attributed to STMA and Liyuan Peng, respectively, were perceived as significantly less credible (aRRR=0.81, $p<0.001$; aRRR=0.31, $p<0.001$), less effective at making people quit (aRRR=0.46, $p<0.001$; aRRR=0.24, $p<0.001$) and less effective at preventing young smoking (aRRR=0.52, $p<0.001$; aRRR=0.39, $p<0.001$) than the China CDC HWL. There were no significant differences in perceived effectiveness of between the WHO and China CDC HWLs. Participants viewed the WHO HWL as significantly more credible (aRRR=1.21, $p<0.001$) than the China CDC HWL.

Conclusion Results suggest the unique role of health organisations in conveying smoking-related messages that appear credible and effective at motivating others to quit smoking or never start smoking in China. Findings can inform global recommendations regarding HWL attribution sources.

INTRODUCTION

China faces an unparalleled public health burden from tobacco. The country is home to the largest number of cigarette smokers in

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Use of a large cross-sectional experimental survey design (n=1999 adults in China).
- ⇒ All participants were exposed to the same set of 4 stimuli images, where each image included the same health warning label (HWL) but a unique message source.
- ⇒ Study design limited in ability to control for order effects of stimuli exposure.
- ⇒ Only one HWL was tested in this study, limiting ability to test the effect of different combination of HWLs and message sources on perceived credibility and effectiveness.

the world.¹ In 2018, 307.6million adults, or 26.6% of the total population age 15 years or older, were current smokers.² Rates of smoking are highest among men, older versus young adults and individuals with lower levels of education and income.^{2 3} At the same time, secondhand smoke (SHS) exposure is very common in China. According to the 2018 China Global Adult Tobacco Survey conducted by the Chinese Center for Disease Control and Prevention, 12.9% of adults were exposed to SHS on public transportation, 44.9% in the home, 50.9% in the workplace and 73.3% in restaurants.² As a result, tobacco remains a leading cause of death in China, where approximately 2.6million people die from smoking-related diseases annually.⁴

China is also the largest cigarette producer in the world and responsible for 41% of cigarettes manufactured each year.⁵ In China, the tobacco industry is a part of the government – cigarettes are manufactured, distributed and sold by the state-owned Chinese National Tobacco Company (CNTC), and the State Tobacco Monopoly Administration (STMA) is the regulatory arm that oversees CNTC activities and plays a role in policy-making.^{6 7} In practice, the CNTC and STMA

are one entity in China, as they operate within the same organisation.⁷ This complex relationship may influence the pace and strength at which effective tobacco control policies are implemented in an effort to reduce smoking and tobacco use in China.⁸

China ratified the WHO's Framework Convention on Tobacco Control (WHO FCTC) in 2006. However, many of the WHO FCTC tobacco control recommendations, like the implementation of pictorial health warning labels (HWLs) on at least 50% of the cigarette pack but no less than 30% of the principal display areas of the cigarette pack, have not yet been achieved.^{9 10} Currently, the STMA requires that manufacturers include one of two options for a text-only HWLs that covers 35% of the front and back panel of the cigarette pack: 'Smoking may harm your health' and 'Quit[ting] smoking early is good for your health'.^{11 12} In addition, the STMA requires that each HWL include the following statement at the top of the text warning, 'Reminder from our company, [warning text]'¹² suggesting that the warning is provided by the cigarette manufacturer, which in the case of China, is most frequently the government but may include other foreign manufacturers.

The WHO FCTC recommends including an attribution statement which highlights the source—or entity responsible for the warning—and can serve as a heuristic cue to increase the perceived credibility of the HWL's message.^{13 14} Tobacco-related health information attributed to credible or trustworthy organisations can increase harm perceptions and reduce product use compared with messaging attributed to less credible sources (eg, tobacco industry).^{13 15} Only a few studies to date from the USA and Israel have examined the credibility of HWL sources. These studies suggest that HWL messages attributed to a government health agency such as the Ministry of Health are viewed as equally credible¹⁶ or more credible¹⁷ than messages attributed to other sources (eg, national health non-for-profit organisation;¹⁶ healthcare system experts;¹⁷ 'medical research'¹⁷) or HWL messages without an attribution source.^{16 17} However, more limited research on HWL source credibility is available in the specific context of low-income and middle-income countries where the burden of tobacco use is highest. Furthermore, no studies to date have examined the extent to which different attribution sources may impact the perceived effectiveness of the HWL message on smoking behaviours.¹³

Implementation of larger, graphic HWL messages have been shown to be effective at increasing knowledge of smoking-related risks and reducing smoking-related behaviours, globally and among urban populations in China.^{18 19} In the context of China, identifying a credible and effective message source for HWLs on cigarette packs may be one pathway to strengthen the implementation of HWL communication and reduce smoking in a country with the highest burden of tobacco-caused disease. This study examined the perceived credibility and perceived effectiveness at reducing tobacco use of four different

Chinese HWL message sources: STMA (the regulatory arm of the state tobacco company), the China Center for Disease Control (China CDC; a government health agency actively engaged in tobacco control and disease prevention activities at the time of data collection), the WHO (a global health authority) and China's First Lady Peng Liyuan, who is a celebrity/public figure and has been the Chinese Association on Tobacco Control ambassador since 2009. Sources were selected based on prior research,^{16 17} and we included Peng Liyuan given the common health education approach of using known spokespeople to convey public health messages.^{20 21} We assessed differences in perceived credibility and effectiveness by key sociodemographic factors (sex, age, education and income) that are associated with higher smoking rates in China. Results from this study can inform the development of global and China-specific standards related to HWL source attribution.

METHODS

This study was part of a larger randomised experimental study to test the perceived impact of eight different China-specific pictorial HWL messages that varied by themes related to self-harm, harm to family, compliance with current smoke-free place regulations and anticigarette gift giving.²² Data were collected via a cross-sectional self-administered intercept survey conducted in 2017 in four cities: Shanghai, Beijing, Wuhan and Kunming. Shanghai is in the southeast of China. It is the largest city in China with a population of 22.3 million and known to be the economic, financial, trade and science and technology innovation centre of the nation. Beijing is in the north of China and is also a political, cultural and science/technology centre with a population of 11.7 million. Wuhan is in the central south region of China and characterised by a large industrial base with a population of 9.7 million. Kunming (population of 3.8 million) is in the southwest of China and serves as an important tourism and trade city and has a tobacco manufacturing industry.^{7 23} These four cities were purposively selected from different regions across China to produce a diverse sample of participants from major urban centres differentiated by culture, industry and economic development.

We recruited study participants (n=1999) from major public shopping malls across the four cities. Shopping malls are generally set up in the city centre and have a high level of foot traffic. Quotas were set to recruit an equal number of participants in each city (ie, approximately 500 participants per city). Additional quotas were set to recruit an equal number of participants based on gender, age, and smoking status, where current smokers were defined as those individuals who ever tried a cigarette and smoked on ≥ 1 day of the past 30 days. Non-smokers were those who never tried a cigarette or those who ever tried a cigarette but did not smoke in the past 30 days. Within each city, approximately 80% of the sample recruited were current smokers and 20% were

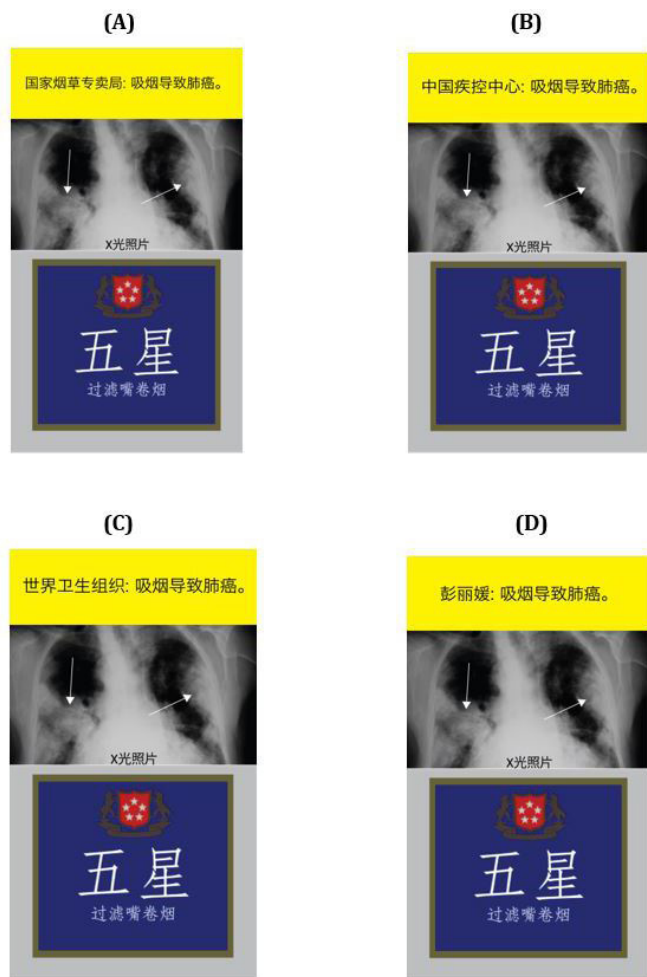


Figure 1 Study stimuli image shown to participants. Participants were required to select one of the four images in response to study questions related to message source credibility and perceived effectiveness of the message source in reducing smoking behaviour. The top yellow rectangle of the health warning label includes the following Chinese warning text '[Source]: smoking causes lung cancer'. Sources are listed in the fixed order shown to participants: (A) State Tobacco Monopoly Association, (B) the China Center for Disease Control, (C) the WHO and (D) Peng Liyuan (China's First Lady). Underneath the yellow bar is the pictorial health warning of an X-ray picture of lung cancer. The lower half of the cigarette pack includes a fake brand name and graphic to reduce brand preference bias.

non-smokers. Additional quotas were set so that 50% of smokers were at least 40 years old and 95% identified as male. For non-smokers, quotas were set so that 50% of non-smokers were at least 40 years and 50% were male.

Patient and public involvement

There was no patient or public involvement in the development and design of this study.

Study stimuli and outcomes

The HWL stimuli used in this experiment was created by the study team based on best practices in HWL design. During the survey, participants viewed a single image

(figure 1) containing a fixed order of four pictorial HWLs that differed only by the warning source. Warnings were presented in the order depicted in figure 1: (A) STMA, (B) China CDC, (C) WHO and (D) Peng Liyuan. All four HWLs covered the top 50% of the cigarette pack and contained the same picture of an abnormal chest X-ray with the following text, 'Smoking causes lung cancer' (see figure 1 for study stimuli). The bottom 50% of the cigarette pack included imagery for a faux brand called *Five Star*. This brand is not sold in China and was used to control for any brand-related bias in responses. Participants then answered the following questions: (1) 'Which warning label appears the most credible?'; (2) 'Which warning label appears the most effective at making people quit?'; and (3) 'Which warning label appears the most effective at preventing young people from starting to smoke?'. Although China only requires text-based warnings, we used a pictorial warning in this study because they are the gold standard in terms of FCTC recommendations,¹⁰ and prior research found that Chinese smokers rated pictorial HWLs as more effective at reducing smoking behaviour than the current text-based warnings.²⁴ Therefore, we were able to test a stronger policy option and adjust for the limited impact that text-only warnings may have on the study outcomes related to perceived effectiveness.

Statistical analysis

We present the frequencies and proportion of participant demographics and study outcomes. We used multinomial logistic regression to assess the relative risk (RR) ratio of selecting the HWL with the STMA, WHO or Peng Liyuan as the attribution source versus the HWL with the government agency, the China CDC (reference group) for each outcome. At the time of data collection, the China CDC was actively engaged in tobacco control and disease prevention efforts. The China CDC was selected as the reference group based on prior research and reflects the most common standard of including a national health organisation as the attribution source of tobacco-related warnings (eg, Health Canada).^{16 17 25}

First, we modelled only the outcome to produce the crude estimates of the RR or log odds of selecting the STMA, WHO or Peng Liyuan HWL versus the China CDC HWL. Next, we assessed the bivariate associations between the outcomes and the following demographic variables: geographic location (Shanghai, Beijing, Wuhan, Kunming); sex (male or female); age (18–29 years old, 30–39 years old, 40–49 years old and ≥50 years); educational achievement (<high school, high school or vocational school and >high school); annual income level (<30 000 renminbi (RMB)/year, 30 000–60 000 RMB/year and >60 000 RMB/year); and smoking status (non-smokers and current smokers). Any demographic variables associated with an outcome at $p < 0.10$ were then entered into a final adjusted model. We present results from the unadjusted and final adjusted models, where crude RR estimates and adjusted relative risk ratios (aRRRs) were considered significant at $p < 0.05$. The crude RR estimate

reflects the ‘risk’ or odds of the outcome falling into the comparison group (eg, WHO) versus the reference group (eg, China CDC) without controlling for any other predictive variables. The aRRR coefficient is a ratio of two probabilities and indicates how the ‘risk’ or odds of our outcome falling into the comparison group (eg, WHO) compared with the ‘risk’ or odds of the outcome falling into the reference group (eg, China CDC) changes with the predictive variable (eg, age) included in the model. All analyses were completed using Stata V.17 (StataCorp).

RESULTS

Table 1 presents frequencies of participant demographic characteristics and the three study outcomes. Nearly 90% of the sample identified as male, and approximately one half of the sample was 18–29 years old (25.8%) or 30–39 years (24.4%). Almost one half of participants reported more than a high school education (48.4%), and approximately 77% of respondents were current smokers.

Overall, the HWL attributed to the WHO (36.3%) was considered the most credible, followed by the China CDC (30.0%), STMA (24.4%) and Peng Liyuan (9.3%). Most participants selected the HWL attributed to the China CDC or WHO as the most effective warning label to make people quit smoking (38.3% China CDC; 34.6% WHO) or prevent youth initiation (33.9% China CDC; 35.3% WHO). A substantially smaller proportion selected the messages attributed to the STMA or Peng Liyuan as effective in preventing smoking-related behaviour (**table 1**).

Table 2 presents crude estimates of the RRs of selecting the HWL attributed to the STMA, WHO or Peng Liyuan versus the China CDC for each outcome. Compared with the China CDC HWL, the warnings attributed to the STMA and Peng Liyuan, respectively, were significantly less likely to be selected as the most credible, most effective at making people quit and most effective at preventing youth initiation. In contrast, the HWL attributed to the WHO had a significantly higher RR (RR=1.21, 95% CI 1.09 to 1.35) of being selected as the most credible versus the China CDC HWL. There were no significant differences between the WHO warning and the China CDC warning in perceived effectiveness at making people quit or preventing young people from smoking.

Results from the adjusted multivariate regression models are also presented in **table 2**. There was substantial variation in all three outcomes by geographic location. Notably, participants in Beijing versus Shanghai were significantly less likely (aRRR=0.62, 95% CI 0.45 to 0.85) to select the WHO HWL as the most credible compared with the China CDC HWL, while participants in Kunming versus Shanghai were significantly more likely to select the message attributed to Peng Liyuan as the most credible (aRRR=1.70, 95% CI 1.01 to 2.85) and the most effective at making people quit (aRRR=2.35, 95% CI 1.47 to 3.74) than the message attributed to the China CDC. In addition, participants in Wuhan and Kunming were 1.44 (95% CI 1.06 to 1.96) and 1.58 (95% CI 1.15 to 2.18)

Table 1 Participant demographics and distribution of perceived credibility, perceived effectiveness at making people quit and effectiveness at preventing young people from starting to smoke by pictorial health warning label attribution source among a national sample of Chinese adults in 2017 (n=1999)

	% (n)
Geographic location	
Shanghai	25.0 (500)
Beijing	24.9 (498)
Wuhan	25.0 (500)
Kunming	25.1 (501)
Sex	
Male	89.8 (1796)
Female	10.2 (203)
Age	
18–29 years old	25.8 (515)
30–39 years old	24.4 (487)
40–49 years old	24.5 (489)
≥50 years old	25.4 (508)
Education	
<High school	16.2 (323)
High school graduate	35.4 (708)
>High school	48.4 (968)
Annual income	
<30 000 RMB	24.9 (497)
30–60 000 RMB	43.4 (867)
>60 000 RMB	31.8 (635)
Smoking status	
Non-smokers	22.6 (452)
Current smokers	77.4 (1547)
Which warning label appears the most credible?	
State Tobacco Monopoly Administration	24.4 (488)
China Center for Disease Control	30.0 (599)
WHO	36.3 (726)
Peng Liyuan (China’s First Lady)	9.3 (186)
Which warning label appears the most effective at making people quit?	
State Tobacco Monopoly Administration	17.8 (355)
China Centre for Disease Control	38.3 (766)
WHO	34.6 (691)
Peng Liyuan (China’s First Lady)	9.3 (187)
Which warning label appears the most effective at preventing young people from starting to smoke?	
State Tobacco Monopoly Administration	17.6 (351)
China Center for Disease Control	33.9 (677)
WHO	35.3 (706)
Peng Liyuan (China’s First Lady)	13.3 (265)

Column percentages may not add to 100% due to rounding. HWL, health warning label; RMB, Chinese renminbi.

Table 2 Adjusted multinomial logistic regression models (reference group=China Center for Disease Control) of warning label credibility, effectiveness at making people quit and preventing young people from starting to smoke among a national sample of Chinese adults in 2017 (n=1999)

	Which warning label appears most credible?			Which warning label appears most effective at making people quit?			Which warning label appears most effective at making people young people from starting to smoke?		
	STMA RR (95% CI)	WHO RR (95% CI)	Peng Liyuan* RR (95% CI)	STMA RR (95% CI)	WHO RR (95% CI)	Peng Liyuan* RR (95% CI)	STMA RR (95% CI)	WHO RR (95% CI)	Peng Liyuan* RR (95% CI)
Crude estimates†	0.81 (0.72 to 0.92)	1.21 (1.09 to 1.35)	0.31 (0.26 to 0.37)	0.46 (0.41 to 0.52)	0.90 (0.81 to 1.00)	0.24 (0.21 to 0.29)	0.52 (0.45 to 0.59)	1.04 (0.94 to 1.16)	0.39 (0.34 to 0.45)
Adjusted models‡	aRRR (95% CI)	aRRR (95% CI)	aRRR (95% CI)	aRRR (95% CI)	aRRR (95% CI)	aRRR (95% CI)	aRRR (95% CI)	aRRR (95% CI)	aRRR (95% CI)
Geographic location									
Shanghai	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Beijing	0.65 (0.46 to 0.91)	0.62 (0.45 to 0.85)	1.38 (0.84 to 2.28)	1.03 (0.72 to 1.49)	1.16 (0.87 to 1.55)	1.09 (0.68 to 1.73)	0.60 (0.41 to 0.88)	0.97 (0.71 to 1.31)	0.54 (0.36m to 0.80)
Wuhan	0.95 (0.66 to 1.37)	1.16 (0.84 to 1.62)	1.20 (0.69 to 2.10)	1.28 (0.88 to 1.87)	1.44 (1.06 to 1.96)	0.98 (0.58 to 1.64)	0.78 (0.53 to 1.14)	1.18 (0.86 to 1.63)	0.33 (0.21 to 0.52)
Kunming	0.60 (0.41 to 0.87)	0.74 (0.53 to 1.04)	1.70 (1.01 to 2.85)	1.39 (0.94 to 2.06)	1.58 (1.15 to 2.18)	2.35 (1.47 to 3.74)	0.68 (0.46 to 1.00)	0.93 (0.67 to 1.30)	0.54 (0.36 to 0.82)
Sex									
Male	-	-	Ref	Ref	Ref	Ref	-	-	-
Female	-	-	-	0.60 (0.38 to 0.95)	0.69 (0.49 to 0.98)	1.40 (0.88 to 2.24)	-	-	-
Age									
18–29 years old	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
30–39 years old	1.11 (0.77 to 1.60)	1.11 (0.81 to 1.52)	0.85 (0.54 to 1.34)	0.87 (0.60 to 1.28)	0.97 (0.71 to 1.31)	0.79 (0.50 to 1.24)	0.88 (0.60 to 1.30)	1.09 (0.80 to 1.49)	0.83 (0.56 to 1.24)
40–49 years old	1.80 (1.25 to 2.60)	1.52 (1.09 to 2.11)	1.11 (0.70 to 1.75)	1.06 (0.72 to 1.54)	1.21 (0.89 to 1.65)	0.85 (0.54 to 1.35)	1.11 (0.76 to 1.63)	1.13 (0.82 to 1.56)	0.78 (0.52 to 1.17)
>50 years old	1.64 (1.14 to 2.36)	1.34 (0.97 to 1.87)	0.41 (0.24 to 0.72)	1.07 (0.73 to 1.56)	1.25 (0.91 to 1.72)	0.52 (0.31 to 0.87)	0.94 (0.64 to 1.40)	1.37 (0.99 to 1.89)	0.49 (0.31 to 0.77)
Education									
<High school	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High school graduate	0.81 (0.56 to 1.16)	1.18 (0.83 to 1.67)	0.79 (0.47 to 1.31)	0.78 (0.54 to 1.13)	1.10 (0.79 to 1.53)	1.28 (0.74 to 2.21)	0.66 (0.45 to 0.97)	0.87 (0.62 to 1.22)	0.89 (0.56 to 1.41)
>High school	1.07 (0.73 to 1.58)	1.63 (1.13 to 2.37)	0.90 (0.54 to 1.52)	0.73 (0.49 to 1.08)	1.40 (0.99 to 1.98)	1.18 (0.67 to 2.06)	0.67 (0.44 to 1.01)	1.10 (0.77 to 1.57)	0.75 (0.46 to 1.21)
Annual income									
<30 000 RMB	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
30–60 000 RMB	0.87 (0.63 to 1.19)	0.85 (0.63 to 1.14)	1.55 (0.99 to 2.42)	0.93 (0.67 to 1.30)	1.00 (0.76 to 1.32)	1.54 (0.99 to 2.41)	1.09 (0.78 to 1.53)	0.96 (0.72 to 1.28)	1.26 (0.86 to 1.86)
>60 000 RMB	0.72 (0.48 to 1.05)	1.18 (0.84 to 1.67)	1.45 (0.85 to 2.45)	0.97 (0.65 to 1.45)	1.11 (0.80 to 1.54)	1.76 (1.05 to 2.94)	0.78 (0.52 to 1.18)	1.16 (0.83 to 1.61)	0.81 (0.51 to 1.27)
Smoking status									
Non-smokers	Ref	Ref	Ref	Ref	Ref	Ref	-	-	-
Current smokers	1.01 (0.75 to 1.37)	0.91 (0.70 to 1.19)	0.67 (0.45 to 0.99)	0.99 (0.72 to 1.35)	1.03 (0.80 to 1.33)	0.57 (0.39 to 0.82)	-	-	-

Estimates in bold are significant at p<0.05; the symbol '–' signifies a variable that was not included in the final adjusted model due to its lack of significant association in the bivariate tests.

*Peng Liyuan is China's First Lady.

†Crude estimates were obtained from an empty model without any covariates. For each study outcome, this is the relative risk or log odds of selecting the warning label attributed to STMA, WHO and Peng Liyuan (China's First Lady), respectively versus the reference group China Center for Disease Control.

‡Adjusted models included all covariates significant at the p<0.10 level in bivariate analyses.

aRRR, adjusted relative risk ratio; Ref, reference group; RMB, Chinese renminbi; STMA, State Tobacco Monopoly Administration.



times more likely than participants in Shanghai, respectively, to select the WHO HWL as most effective at making people quit than the China CDC HWL.

Compared with males, females were significantly less likely to select the HWL attributed to the STMA (aRRR=0.60, 95% CI 0.38 to 0.95) and the WHO (aRRR=0.69, 95% CI 0.49 to 0.98) as the most effective at making people quit compared with the China CDC HWL. By age, the likelihood of selecting the STMA warning and the WHO warning as the most credible versus the China CDC warning, respectively, was significantly greater among adults 40–49 years old versus younger adults (18–29 years old). Across the three study outcomes, adults 50 years or older versus adults 18–29 years old had a significantly lower likelihood of selecting the HWL attributed to Peng Liyuan as the most credible and the most effective at influencing smoking behaviours versus the China CDC warning (aRRR range: 0.41–0.52, *p* values <0.02).

By socioeconomic status, those with more than a high school education versus those with less than a high education had a significantly greater likelihood (aRRR=1.63, 95% CI 1.13 to 2.37) of selecting the HWL attributed to the WHO as the most credible compared with the China CDC warning. Those with a high school education only were less likely (aRRR=0.66, 95% CI 0.45 to 0.97) than those with less than a high school education to identify the warning attributed to the STMA as the most effective at preventing youth initiation compared with the China CDC HWL. Individuals making at least 60 000 RMB per year were significantly more likely (aRRR=1.76, 95% CI 1.05 to 2.94) than individuals making less than 30 000 RMB per year to select the warning attributed to Peng Liyuan as the most effective at making people quit versus the China CDC warning.

Finally, smokers were significantly less likely than non-smokers to select the HWL attributed to Peng Liyuan as the most credible (aRRR=0.67, 95% CI 0.45 to 0.99) and the most effective at making people quit (aRRR=0.57, 95% CI 0.39 to 0.82) versus the HWL attributed to the China CDC.

DISCUSSION

Although the FCTC Article 11 implementation guidelines for pictorial HWLs recommend including an attribution statement,²⁶ limited research has investigated the credibility or effectiveness of different attribution sources, particularly in low-income and middle-income countries. In the current study, we found that most Chinese adults in our sample selected the HWLs attributed to a government health agency (China CDC) or international health organisation (WHO) as the most credible and the most effective messages to hypothetically promote smoking cessation among others or broadly prevent youth smoking initiation. In contrast, the HWLs attributed to the regulatory arm of the state tobacco company (STMA) and the First Lady Peng Liyuan were viewed as less credible and less effective at promoting potential behaviour change by

our study population, particularly when compared with the message from the China CDC. These results align with prior research in Israel,¹⁷ suggesting that health organisations (eg, Ministry of Health) are credible messengers of smoking-related health warning messages across multiple countries.

Our results also align with the broader body of literature on message credibility, which suggests the two predominant features of source credibility are perceived source expertise (ie, knowledge and skills to gather information) and perceived source trustworthiness (ie, whether the source is believed to deliver the right information).¹³ In our study, it is likely that the China CDC and WHO would meet these requirements to a greater degree given their name and association with health and disease prevention activities.

In contrast, agencies whose charge it is to regulate tobacco products—whether an independent governing body or integrated with the tobacco industry like STMA—may not be as clearly associated with health-related activities. For example, studies from the USA suggest that attributing warnings to the tobacco regulatory agency, the US Food and Drug Administration, does not increase their believability.^{16 27–29} In China, it is also possible that our study participants are aware of and view the STMA as the same organisation as CNTC given the complex national system of tobacco production and regulation,⁷ and thus, potentially rated the STMA as less credible given its tobacco industry ties.^{13 15}

Furthermore, public figures like Peng Liyuan may similarly lack the requisite expertise and trustworthiness to deliver credible messages. In this study, we found that participants overall and within certain demographic groups were generally less likely to endorse the HWL attributed to the Peng Liyuan as the most credible or effective at reducing smoking behaviour among others. While celebrities or public figures can potentially raise short-term awareness around health issues in mass media communication campaigns,^{21 30} they often rely on personal experience and are more limited in their use of scientific language and knowledge that may be needed to demonstrate credibility over the long term.^{20 21} Our results extend this understanding to warning label communications and suggest that that public figures, like regulatory agencies, may be less effective HWL attribution sources to convey smoking-related information compared with health organisations.

Among the health organisation attribution sources examined in this study, we found that participants were more likely to select the HWL attributed to the WHO as the most credible compared with the China CDC HWL, although both groups were seen as similarly effective at promoting cessation and preventing smoking initiation. Chinese culture is frequently believed to be ‘more vertical than horizontal’,^{31 32} and it is possible that participants in this study viewed the WHO as more credible among Chinese adults given its ‘higher’ position as an international authority. This might be particularly salient for

some of the older adults 40–49 years old in our sample who had a greater likelihood of endorsing the WHO as more credible than the China CDC versus younger adults (ie, 18–29 years old).

We also found that individuals with higher levels of education were more likely to select the message attributed to the WHO as more credible than the China CDC message. Because those with higher levels of education tend to have greater health literacy,^{33–35} they may be more knowledgeable about the role the WHO plays in international and regional health activities. However, individuals with lower levels of education may be more familiar with a local entity such as China CDC, given the WHO may likely have less direct interaction with individuals in China. In addition, we observed differences in perceptions by city, which may reflect unique contributions of the social, economic and cultural environment on perceptions of authority. For example, individuals in Kunming were more likely to select the HWL attributed to the First Lady as the most credible message compared with residents in Shanghai, which may reflect differences in economic development between the two cities and the heavy influence of traditional culture in Kunming. Such differences may be important when considering attribution source selection, including selecting more than one source (eg, the WHO and the China CDC), to avoid exacerbating any existing tobacco-related disparities based on socioeconomic status and to reach a broader population.

Interestingly, we saw few differences in perceptions between smokers and non-smokers. The only exception was that smokers in our study had a lower likelihood of selecting the First Lady Peng Liyuan as the most credible message source or most effective source to encourage smoking cessation among the broader population that smokes. This finding suggests that celebrities or public figures may not be taken as seriously as health organisations in cuing smokers to quit.

The study is subject to several limitations. First, participants were recruited by convenience sampling in four preselected cities in China, and no rural areas were covered. In addition, only literate adults were included in the study, and quotas were set for age, sex and smoking status. Therefore, this sample is not nationally representative, and our findings must be interpreted with this limitation in mind. Second, our experimental stimuli were shown to participants in a fixed order, which limits our ability to adjust for any ordering effects on study outcomes. In addition, due to the constraints of our experiment being nested within a larger randomised experimental survey, we were limited in our ability to test more than one HWL. It is possible that different combinations of message source and pictorial HWLs may differentially influence perceived message credibility and effectiveness. Fourth, only four HWL message sources were tested and compared in this study. Although these sources represented a range of organisations or spokespeople that are associated with tobacco control, we may not have included all relevant attribution sources in this study. Fifth, we did

not measure other factors that may influence perceived credibility and our outcomes of interest, such as people's trust in government authorities or international health organisations. Finally, we did not assess how effective the messages would be on changing a participant's own behaviour and only asked about effectiveness of changing the behaviour of others. Future research should incorporate these additional credibility and effectiveness metrics into their study design and analysis.

CONCLUSION

China has the largest population of smokers in the world, and the implementation of pictorial HWLs is a feasible measure outlined in the FCTC that could be adopted by the Chinese government to educate the public about the harms related to smoking and reduce smoking-related behaviour.⁸ Findings from this study offer initial evidence on credible and effective HWL message sources. Chinese regulatory authorities could use these findings to modify the current text-only warnings and add an attribution source or to adopt the FCTC recommended 50% coverage pictorial HWL standard that also includes an attribution source. Our results suggest that HWL messages from an international public health authority such as WHO or a domestic health authority such as China CDC were viewed as more credible and motivating than messages attributed to the STMA and Peng Liyuan. It is possible that such message could influence smoking behaviour, although future research is needed to fully understand the effectiveness of these warnings on individual behaviour change (eg, smoking cessation). Our findings also demonstrate that sociodemographic characteristics and where participants live may influence perceptions of HWL source credibility and effectiveness. Future research should further explore this variation using qualitative methods, as different attribution sources could be used to reach different populations or messages could be attributed to a combination of international and domestic health organisation to reach across subpopulations. Overall, this study provides initial evidence for selecting credible and effective HWL message sources in China and can inform the development of global standards related to HWL source attribution.

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