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## Effectiveness of Health Warnings for Waterpipe Tobacco Smoking among College Students

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### Abstract

**Objectives**—Youth have the misperception that waterpipe smoking is less harmful than cigarettes despite the evidence that it is associated with nicotine dependence and many of the diseases caused by cigarettes. There is a pressing need to identify effective health warnings that increase awareness about the harmful effects of waterpipe smoking. Our objective was to test the effectiveness of various health warning messages and their location on waterpipe devices.

**Methods**—Adult waterpipe smokers from a large U.S. university (N=367) completed an internet-based survey that tested the effect of text-only and pictorial health warning labels and their location on different parts of waterpipe smoking devices.

**Results**—Text-only messages and pictorial labels warning about harm to children were the most effective in motivating waterpipe smokers to think about quitting. In terms of warning label location, the base, mouthpiece and stem are all equally noticeable locations.

**Conclusion**—This is the first study to test waterpipe-specific warning labels and location on the waterpipe device. Placing waterpipe-specific labels on waterpipe devices may be an effective policy tool to curb waterpipe smoking.

## Keywords

waterpipe; hookah; shisha; warning labels

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## Introduction

In the past decade, waterpipe smoking has become a global phenomenon among youth, many of whom are unaware of the health risks associated with this form of tobacco consumption (Maziak et al. 2015; Salloum et al. 2014; Salloum et al. 2015b). There are currently no evidence based warning label requirements for waterpipe products, whereas warnings on cigarette packaging is a major form of communicating tobacco-related health risks to users and others exposed to their smoke (Hammond et al. 2006; O’Hegarty et al. 2006). As a result, waterpipe smokers may be misled to believe that the product is less harmful than other tobacco products that carry warning labels (Roskin and Aveyard 2009). Furthermore, existing health warnings on waterpipe tobacco products worldwide are deliberately misleading and do not conform to the guidelines set in Article 11 of the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) (Khalil et al. 2009; Nakkash and Khalil 2010). For example, one study found that existing health warning labels on waterpipe tobacco packages in a select number of countries covers only an average of 3.5% of the total surface area of packages, which is significantly less than the 30% required under the FCTC (Nakkash et al. 2011). Often, these health-warning labels refer to cigarettes or smoking in general rather than waterpipe smoking in particular (Hammond 2015; Vansickel et al. 2012).

Research on cigarette warning labels provides a good starting point for informing policies related to waterpipe smoking, as they have been shown to be an effective and inexpensive way to reduce tobacco use. Investigating the effectiveness of a similar approach with waterpipe products is critical to controlling waterpipe tobacco use. The distinctive features associated with waterpipe smoking suggest an urgent need to develop and test waterpipe-specific warning labels. The common use of fruit and candy flavors in waterpipe tobacco, and the misleading notion that waterpipe smoke is ‘filtered’ in the water, may contribute to the misperception that waterpipe smoking is less harmful than the use of cigarettes and other tobacco products (Maziak et al. 2015). Waterpipe tobacco is unique in that it is smoked at home and in cafés/restaurants, where the smoker is usually not exposed to the tobacco product packaging. However, all waterpipe smokers are exposed to the waterpipe device, on which health warning labels could be placed. One country in specific, Turkey, has extended warning labeling practices by requiring placement of warnings on both sides of the bowls of the waterpipe device to cover 65% of the surface (WHO FCTC 2014). However, the effectiveness of size and location of these warnings has not been tested. There are several components that make up a waterpipe device and studies on cigarette labels have shown that certain locations are more effective than others in capturing the attention of smokers (Hammond 2011).

Many countries that have adopted prominent pictorial warnings on cigarette packages have found that smokers are more attentive toward these warnings, and are more likely to process

such warning information (Hammond 2011). Furthermore, studies on pictorial cigarette warning labels indicate that messages with graphic imagery are more effective than symbolic imagery (Hammond et al. 2012; Thrasher et al. 2012). Other studies suggest that labels featuring harm to vulnerable others such as children attract the most attention among smokers (Healey and Hoek 2015; O'Hegarty et al. 2007). The social nature of waterpipe smoking and its distinct features from cigarettes are likely to influence smokers' responses to warning labels. But to date, there have been no studies testing the effectiveness of waterpipe-specific warning labels or their location on a waterpipe device, and this study is the first to address this issue empirically.

## Methods

### Sample

A purposive sample of students was recruited face-to-face between June and October 2014 from the University of South Carolina to participate in an Internet-based cross-sectional survey. Participants were deemed eligible if they met the following inclusion criteria: (a) at least 18 years old, (b) are currently attending or will be attending the University of South Carolina in the upcoming year, and (c) had smoked waterpipe at least once at some point in their lives, even one or two puffs. Potential participants were approached and provided with an electronic tablet to complete the Internet-based survey. Consent was obtained online prior to initiation of the survey. To incentivize participation, respondents were given \$10 upon completion of the survey. A total of 525 students were identified, of which 367 completed the survey (response rate = 69.9%). Approval for the study protocol was obtained from the Institutional Review Board of the University of South Carolina.

### Stimulus development

The questionnaire was adopted from a standard survey for university-based waterpipe users (Ward et al. 2007). The survey included questions measuring basic demographic characteristics, waterpipe use history, current use, attitudes regarding waterpipe, and health warning labels (Salloum et al. 2015a). The survey tested text-only warning messages, pictorial labels and the placement (in different locations) of health warnings on a waterpipe device. Nine text-only warning messages were adapted from the warning statements proposed for cigarette packages under the Tobacco Control Act in the US. The term 'hookah' was chosen instead of waterpipe in the health warning messages as this is the most common term used in the U.S. (Salloum et al. 2014). The text-only warning messages were presented in the following order: [1] WARNING: Hookah smoking is addictive; [2] WARNING: Hookah smoke can harm your children; [3] WARNING: Hookah smoking causes fatal lung disease; [4] WARNING: Hookah smoking causes cancer; [5] WARNING: Hookah smoking causes strokes and heart disease; [6] WARNING: Hookah smoking during pregnancy can harm your baby; [7] WARNING: Hookah smoking can kill you; [8] WARNING: Hookah smoke causes fatal lung disease in nonsmokers; and [9] WARNING: Quitting hookah smoking now greatly reduces serious risks to your health.

Four pictorial waterpipe-specific warning labels were adapted from proposed labels developed by Nakkash and Khalil (2010). The textual content from the pictorial warnings

was not matched to the text only warnings. The pictorial warning labels were presented in the following order, with the accompanying messages: [1] WARNING: The water in hookah does not prevent toxic materials from reaching your body; [2] WARNING: Hookah smoke contains rat poison; [3] WARNING: Protect your children: Don't let them be exposed to hookah smoke; and [4] WARNING: Despite its pleasant smell, hookah smoke kills. Participants were presented with all health warnings in the same order. Images were developed to represent health warning labels placed on four different locations across the waterpipe device: (i) the base of the waterpipe, (ii) the mouthpiece, (iii) the stem of the waterpipe, and (iv) the hose connecting the mouthpiece to the base.

## Measures

Participants were categorized as *current* users if they smoked waterpipe at least once in the past 30 days, even one or two puffs. The remaining participants who had smoked waterpipe at least once at some point in their lives, even one or two puffs, were classified as *ever* users. To assess responses to each health warning, participant were asked the question “to what extent do the following health warning labels motivate you to think about stopping or reducing your hookah smoking” (Chang et al. 2011; Gravely et al. 2014). Participants could choose one of the following responses: ‘not at all’, ‘somewhat’, and ‘very much’. Then participants were presented with all four options for locations of warnings on waterpipe devices and asked to indicate, “For which location would you be most likely to notice a health warning label?”

## Analysis

For each health warning, chi-square statistics tested whether the proportion of respondents who selected “very much” significantly differed between ever and current waterpipe smokers. Similarly, chi-square tests were used to determine if there was any difference in response to label location between ever and current waterpipe smokers. To test which label location on waterpipe devices was more effective, pairwise comparisons using the Bonferroni correction were made for ever and current waterpipe smokers separately. Following the Bonferroni method, a p-value less than 0.008 (0.05/6) was considered statistically significant for the comparison of label locations.

To examine the effect of text-only and pictorial health warnings, two separate mixed effects models stratified by current waterpipe use were estimated. In the first model, the dependent variable was the participant's response to the text-only health warnings, and dummy variables were used to represent each warning message. In the second model, the dependent variable was the participant's response to the pictorial health warnings, and dummy variables were used to represent each warning. To control for demographic characteristics, the two models were adjusted for age, class standing (undergraduate vs. graduate), race/ethnicity (non-Hispanic White; Black or African American; Hispanic; Asian or Pacific Islander; Native American or Alaskan Native; Mixed race), gender (female or male), and monthly spending (less than \$300 vs. \$300 or more). In cases where Type III tests for the indicator variable for health warnings were significant, multiple comparison tests using Tukey-adjusted p-values were used to identify which pairs of warnings were significantly different. To ensure that standard errors were reasonable, the variation inflation factor was

used (cutoff=5) as the criterion to assess for multicollinearity between independent variables in both models. None of the covariates included in the final models had a variation inflation factor greater than 2. All statistical analyses were conducted using SAS software (version 9.4, SAS Institute).

## Results

A total of 367 students who had previously smoked waterpipe tobacco completed the survey (Table 1), and approximately half of them were male (50.4%). Most participants identified themselves as non-Hispanic white (68.1%) and undergraduates (80.4%). A quarter of waterpipe users also smoked cigarettes, of which 13.9% were current smokers. In terms of perceptions related to waterpipe smoking, 70.6% believed cigarettes were more harmful than waterpipe, 85.0% believed cigarettes were more addictive than waterpipe, and 54.3% believed cigarettes contained more nicotine than waterpipe. A large majority (74.4%) believed that switching from cigarettes to waterpipe would reduce the health risks associated with using tobacco products.

Comparing the responses between ever and current waterpipe smokers for the text-only warnings and pictorial warnings (Table 2), a higher proportion of ever waterpipe smokers indicated that the warnings were very much motivational to quit smoking. Significant differences were found for the following text-only messages: [3] “WARNING: Hookah smoking causes fatal lung disease”; [5] “WARNING: Hookah smoking causes strokes and heart disease”; and [7] “WARNING: Hookah smoking can kill you”. For the pictorial warnings, significant differences between ever and current users were found for all the tested pictorials except for the one which has an image of an older man smoking next to a child with an asthma puffer and the message [3] “WARNING: Protect your children: Don’t let them be exposed to waterpipe smoke”. More than half of both groups agreed that this health warning will motivate them to quit. Results from the mixed models showed that the most motivational text-only message among ever and current users is message [6] which was selected significantly more than messages [1], [5], [7], [8], and [9]. There was no significant difference between message [6] and messages [2], [3], and [4] indicating that these are all equally effective. The most effective pictorial label in terms of motivating to quit among ever and current users are labels [2] and [3], which had a significantly higher response than labels [1] and [4].

Responses to the question about the best location for noticing a health-warning label are presented in Table 3. The most popular choices among ever users was the mouthpiece (41.2%) followed by the stem (36.6%). The most effective locations of health warnings among current users were the base (32.4%), followed by the mouthpiece (31.4%) and the stem (30.5%). The two groups differed significantly in terms of the base of the waterpipe where a higher proportion of current users selected this location compared to ever users. Multiple comparison tests indicate that among current users, significantly less people selected the hose of the waterpipe compared to the other three locations ( $p < 0.001$ ) and there were no significant differences between the base, mouthpiece and the stem of the waterpipe. Among ever users, the mouthpiece and the stem were selected significantly more than either

the base or the hose. There were no significant differences between the mouthpiece and the stem or between the base and the hose.

## Discussion

Our study reflects current beliefs and misperceptions about the health risks of waterpipe tobacco smoking found in prior studies (Maziak et al. 2015; Nakkash et al. 2011; Smith et al. 2007). Most waterpipe smokers believed that waterpipe smoking is less harmful, less addictive, and contains less nicotine than cigarettes, providing further evidence of the need to adopt specific regulations that increase awareness about the harms of waterpipe smoking and motivate smokers to quit. There is extensive evidence that health-warning labels on cigarette packs raise awareness of health consequences from smoking (Chopra et al. 2014; Hammond et al. 2006), which supports the need for health warnings for waterpipe tobacco. However, due to the unique nature of the waterpipe device, regulation of waterpipe-specific health warnings has to take into consideration this uniqueness. For example, mandating health warning labels only on the waterpipe tobacco packages may be ineffective in reaching the majority of smokers as most do not come into contact with the tobacco packet.

The evaluated text message in the study, “WARNING: Hookah smoking during pregnancy can harm your baby”, had the highest response compared to the other text-only warning message. The pictorial warning label with an image of a child and the message “WARNING: Protect your children: don’t let them be exposed to hookah smoke” had the highest response compared to the other pictorial labels. This suggests that young adult waterpipe tobacco smokers who are of reproductive age may be more concerned about the consequences smoking has on infants and children than their own health. Although these had the highest response, other messages also had significant positive responses indicating that multiple warnings could be used since the most impactful content is likely to vary across individuals (Kollath-Cattano et al. 2014). Furthermore, changing the content or rotating different warnings appears to renew attention and avoid “wear out” (Shanahan and Elliott 2009).

In terms of warning label location, findings suggest placing a warning label on the base, mouthpiece, or the stem of the waterpipe is likely to attract the attention of students. A prominent location provides greater repetition of warning information to the waterpipe tobacco smoker compared to a cigarette smoker (Hammond 2011; Hammond et al. 2006). For example, a cigarette smoker who smokes a pack a day will be subjected to 20 warnings a day or 7300 warnings a year. A typical waterpipe session lasts for 40 minutes during which time the waterpipe smoker, and those around him/her, would be constantly exposed to the warning label placed on the device.

One limitation of this study is that findings were drawn from a single university population in the Southeastern U.S. using purposive sampling and may not necessarily be generalizable to other populations (Kerlinger 1986). However, our findings about misperceptions and the proportion of current versus ever waterpipe smokers are similar to prior studies involving university students in other parts of the U.S. and across the world (Amin et al. 2010; Haider et al. 2015; Heinz et al. 2013; Kakodkar and Bansal 2013). Another limitation is that health warnings were presented in the same order for all subjects, which may have led to biased



results (Landon 1971). Further, our questionnaire did not extensively cover all measures of testing warning label effectiveness such as salience (i.e., attracts attention), credibility, and intention to quit waterpipe smoking. However, perceived impact of the labels was measured and results from this study can be used as a baseline for future studies. Location was tested based on the opinion of the participants, and naturalistic studies that involve more precise indicators of attention (e.g., eye tracking) may be necessary to determine optimal location.

Thus far, three countries have adopted waterpipe-specific HWLs but no evidence exists to evaluate their effectiveness (Jawad et al. 2015). The current study suggests that waterpipe-specific warning labels, if placed on the base, mouthpiece or the stem of the waterpipe, may have a strong impact in reducing current misconceptions and thus prevalence of waterpipe smoking. However, more evidence is needed, especially from countries with high prevalence rates, to provide guidance for policymakers in making waterpipe-specific regulations.

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**Table 1**  
**Characteristics and Attitudes of Waterpipe Smokers, South Carolina, USA, 2014**

| <b>Characteristics</b>                       | <b>Total<br/>(N = 367)</b> |
|--|----------------------------|
| Age, mean $\pm$ SD                           | 21.9 $\pm$ 4.03            |
| Gender, n (%)                                |                            |
| Female                                       | 182 (49.6)                 |
| Male   | 185 (50.4)                 |
| Race, n (%)                                  |                            |
| White, non-Hispanic                          | 250 (68.1)                 |
| Black or African American                    | 50 (13.6)                  |
| Hispanic                                     | 12 (3.3)                   |
| Asian or Pacific Islander                    | 36 (9.8)                   |
| Mixed race                                   | 17 (4.6)                   |
| Class standing, n (%)                        |                            |
| Undergraduate                                | 295 (80.4)                 |
| Graduate                                     | 72 (19.6)                  |
| Concurrent cigarette smoker, n (%)           |                            |
| Current smoker                               | 51 (13.9)                  |
| Ever smoker (not current)                    | 32 (8.7)                   |
| No   | 284 (77.4)                 |
| Current waterpipe smoker, n (%)              |                            |
| Yes  | 105 (28.6)                 |
| No   | 262 (71.4)                 |
| Cigarettes are more harmful than waterpipe   |                            |
| Agree / strongly agree                       | 259 (70.6)                 |
| Neither agree nor disagree                   | 52 (14.2)                  |
| Disagree / strongly disagree                 | 56 (15.2)                  |
| Cigarettes are more addictive than waterpipe |                            |
| Agree / strongly agree                       | 312 (85.0)                 |
| Neither agree nor disagree                   | 37 (10.1)                  |
| Disagree/ strongly disagree                  | 18 (4.9)                   |
| Cigarettes have more nicotine than waterpipe |                            |
| Agree / strongly agree                       | 199 (54.3)                 |
| Neither agree nor disagree                   | 117 (31.9)                 |
| Disagree / strongly disagree                 | 51 (13.9)                  |

**Table 2**  
**Responses to Tested Health Warning Labels, South Carolina, USA, 2014 (N=367)**

|  | Ever<br>Waterpipe<br>Smoker<br>(N=262) | Current<br>Waterpipe<br>Smoker<br>(N=105) | p-value |
|--|--|---|---------|
| <b>A. Text only warnings</b>   |  |   |         |
| 1. WARNING: Hookah smoking is addictive  | 17.6                                   | 14.3                                      | 0.447   |
| 2. WARNING: Hookah smoke can harm your children  | 55.3                                   | 54.3                                      | 0.854   |
| 3. WARNING: Hookah smoking causes fatal lung disease                                   | 49.6                                   | 38.1                                      | 0.045   |
| 4. WARNING: Hookah smoking causes cancer   | 48.5                                   | 41.9                                      | 0.254   |
| 5. WARNING: Hookah smoking causes strokes and heart disease                            | 46.2                                   | 31.4                                      | 0.001   |
| 6. WARNING: Hookah smoking during pregnancy can harm your baby                         | 68.7                                   | 64.8                                      | 0.466   |
| 7. WARNING: Hookah smoking can kill you  | 40.8                                   | 29.5                                      | 0.043   |
| 8. WARNING: Hookah smoke causes fatal lung disease in nonsmokers                       | 36.3                                   | 26.7                                      | 0.079   |
| 9. WARNING: Quitting hookah smoking now greatly reduces serious risks to your health   | 42.8                                   | 37.1                                      | 0.324   |
| <b>B. Pictorial warnings</b>   |  |   |         |
| 1.  | 32.8                                   | 14.3                                      | <0.001  |
| 2.  | 57.6                                   | 43.8                                      | 0.016   |
| 3.  | 53.8                                   | 52.4                                      | 0.803   |
| 4.  | 32.1                                   | 17.1                                      | 0.004   |

**Table 3**  
**Response to Placement of Health Warning Labels in Various Locations on the Waterpipe Smoking Device, South Carolina, USA, 2014**  
**(N=367)**

|                                  | Base, n (%) | Mouthpiece, n (%) | Stem, n (%) | Hose, n (%) |
|----------------------------------|-------------|-------------------|-------------|-------------|
| Ever Waterpipe Smoker (N=262)    | 54 (20.6)   | 108 (41.2)        | 96 (36.6)   | 4 (1.5)     |
| Current Waterpipe Smoker (N=105) | 34 (32.4)   | 33 (31.4)         | 32 (30.5)   | 6 (5.7)     |
| p-value                          | 0.02        | 0.08              | 0.26        | 0.04        |

