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## The Waterpipe: A New Way of Hooking Youth on Tobacco

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### Abstract

**Background**—Tobacco smoking continues to be the number one preventable cause of morbidity and mortality worldwide. Several evidence-based interventions and policies have been successful in reducing cigarette smoking in developed countries. Globally, however, many beginning smokers are introduced to tobacco by means other than cigarettes. In particular, waterpipe smoking (a.k.a. hookah, narghile, shisha) has been dramatically increasing among youth worldwide.

**Methods**—In this short review, I will introduce the reader to this emerging tobacco use method and focus on its addictive properties, and how this pertains to the development of effective interventions to curb its spread.

**Results and Conclusions**—Waterpipe smoking is likely to be associated with much of the harmful effects of cigarette smoking, is addictive, and can serve as a bridge to cigarettes. Due to its unique features, waterpipe-specific interventions and policies are needed to curb the global waterpipe epidemic.

### INTRODUCTION

Tobacco smoking continues to be the number one preventable cause of morbidity and mortality, contributing to over 5 million deaths every year, a situation that is likely to worsen in the future.<sup>1</sup> While several evidence-based interventions and policies have been successful in reducing cigarette smoking in developed countries, for many youth worldwide tobacco use and addiction is initiated and maintained by means other than the cigarette. In particular, over the past decade, waterpipe smoking has dramatically become the most widespread tobacco use method among youth in the Eastern Mediterranean Region (EMR), and is rapidly spreading globally.<sup>2</sup> The waterpipe, known in many cultures under different shapes and names (eg, hookah, shisha, narghile), is a centuries-old tobacco use method that has traditionally been associated with Middle Eastern societies. Throughout the EMR, waterpipe smoking was on the decline for the most part of the 20th century, increasingly becoming confined to older males. Starting in the 1990s, however, waterpipe smoking

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Declaration of Interest

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reemerged as a trendy habit among youth in the EMR, and quickly all over the world.<sup>3</sup> Several factors may have contributed to this record widespread including; the introduction of manufactured flavored waterpipe tobacco (Maassel) and its appeal to youth; the reduced-harm perception associated with waterpipe smoking compared to cigarettes; the thriving café culture; and the communication revolution that carried this smoking habit to every corner of the world in a record time.<sup>4</sup> Recent surveys in the United States and some other Western societies show that waterpipe smoking is becoming the second most widespread tobacco use method among youth.<sup>5,6</sup> For example, a recent survey involving a large sample of college students ( $n = 105,012$ ) in 152 U.S. universities shows that 30.5% had ever used waterpipe and 8.4% currently use it, making waterpipe smoking the second most popular tobacco product (after cigarettes) in this population.<sup>5</sup> Interestingly, more than half (51.4%) of current waterpipe smokers in this study were non-cigarette smokers, which raises the issue of waterpipe smoking potentially serving as a bridge to cigarettes as I will discuss later. Such epidemiological data are more than alarming considering that they involve a tobacco use method that almost did not exist in most of Western societies some decade ago.<sup>6</sup>

In the waterpipe, charcoal-heated air passes through a perforated aluminum foil separating the charcoal from the flavored tobacco (a.k.a. Maassel) to become smoke that cools as it bubbles through the water on its way to the smoker (Fig. 1). The passage of smoke through water is thought to underlie the widespread misperception about waterpipe's "reduced" harm and addictiveness. Available evidence however, suggests that waterpipe smoking is addictive and is likely associated with smoking-related diseases such as lung cancer, respiratory disease, and low birth-weight.<sup>7</sup> The focus of this piece however, will be on waterpipe's addictive potential, and how the waterpipe can serve as a bridge to cigarette smoking.

## WATERPIPE AND ADDICTION

One of the main features of waterpipe smoking concerns its distinctive use patterns compared to cigarettes.<sup>8</sup> Among youth in particular, waterpipe smoking is frequently practiced as a group pastime in the company of friends and family. Also, the length of waterpipe smoking session taking an hour on average, combined with its limited accessibility and mobility compared to cigarettes all contribute to intermittent use being the predominant pattern for waterpipe smoking.<sup>8</sup> And if we add to that the common misperception about the filtering effect of water, it becomes clear why many waterpipe smokers claim that it is not as addictive as cigarettes.<sup>9</sup> Evidence to the contrary however, is accumulating. In 1997, Macaron et al.<sup>10</sup> first showed nicotine exposure in waterpipe smokers by measuring cotinine in their urine, a finding that has been replicated repeatedly since. For example, in a recent laboratory study conducted by our team at the Syrian Center for Tobacco Studies (SCTS), 24-hour-abstinent waterpipe smokers were invited to the clinical lab for a one session of waterpipe while their venous blood was sampled for nicotine analysis. This study showed that waterpipe smoking led to about fivefold increase in plasma nicotine levels (from  $3.07 \pm 3.05$  ng/ml pre-smoking to  $15.7 \pm 8.7$  ng/ml post-smoking,  $p < .001$ ).<sup>11</sup> In another lab study, nicotine exposure was compared between waterpipe and cigarette among dual waterpipe/cigarette smokers using a 2-condition crossover design (ie, if the 1st session was waterpipe the 2nd was cigarette and vice versa). While peak plasma

nicotine levels did not differ between the two conditions (cigarette, waterpipe), the dynamics of nicotine exposure and cumulative dose was different between waterpipe and cigarette (eg, slower rise, and more protracted and larger cumulative nicotine exposure for the waterpipe compared to cigarette, Fig. 2).<sup>12</sup>

Other than the neuropharmacological side of addiction mediated by nicotine, work by our team at SCTS elucidated behaviors akin of those indicating dependence on tobacco among waterpipe smokers, such as failed quit attempts, self-perception of being “hooked” on the waterpipe, use escalation over time, behavioral adaptations to ensure access, and abstinence-induced withdrawal that is suppressed by subsequent use.<sup>2</sup> For example, in a random sample of 268 waterpipe users in Aleppo, 28% wanted to quit and 59% had made an unsuccessful quit attempt in the past year. Belief in one’s ability to quit was inversely related to perceived dependence.<sup>13</sup> These experiences were confirmed in a standardized lab environment, as a study conducted at SCTS showed. In this study, 24-hour-abstinent waterpipe smokers were invited to SCTS’s clinical lab, where they smoked a waterpipe ad libitum, while subjective effects of withdrawal and craving were measured pre/post smoking using Hughes–Hatsukami Withdrawal Scale, Tiffany–Drobes Questionnaire on Smoking Urges, and Direct Effects of Nicotine Scale. Urge to smoke, restlessness, craving, and other abstinence symptoms were reduced significantly after smoking, while feeling dizzy, lightheaded, and other direct effects of nicotine were increased.<sup>14</sup>

On the other hand, smokers’ experiences documented through personal interviews reveal much about waterpipe’s addictiveness. For example, a qualitative study conducted by our team brought about several interesting testimonies among waterpipe smokers: “I started smoking [waterpipe] when I was young and I know its side effects and I know what it does to my lungs. I go up the stairs, I start panting. But I cannot [stop it] because I am addicted to it, I would not mind stopping it but I cannot”; “I like to dominate everything, but the narghile [waterpipe] has completely dominated me. That bothers me. My happiness is related to the narghile. It is essential for having a good time...”; “I usually smoke narghile once daily, but sometimes I smoke more. Because even when I have already smoked it, seeing or smelling narghile makes me feel that I need to smoke again, and I usually do smoke.”<sup>15</sup> These data are consistent with the notion that waterpipe smoking is associated with features of tobacco/nicotine dependence similar to those associated with cigarette smoking.

While many of the described indicators of waterpipe dependence are seen with cigarette smoking, there are strong reasons to believe that waterpipe’s unique features influence the development and manifestations of tobacco dependence. For example, waterpipe sharing, its social dimension, and limited accessibility are not covered by conventional algorithms defining tobacco dependence.<sup>8</sup> Moreover, because the waterpipe is usually used repeatedly, even the act of purchasing a waterpipe might be a more significant milestone compared to cigarettes. Still, attempts at understanding waterpipe dependence have relied so far on models and measures derived from the cigarette literature. For example, the only published measure of dependence in waterpipe smokers (Lebanon Waterpipe Dependence Scale; LWDS-11) was derived mainly from the FTND and DSM–IV criteria and without any formative work with waterpipe smokers.<sup>16</sup> As such, tobacco dependence in waterpipe

smokers has unique features that continue to be untapped by models and instruments derived from the cigarette literature.

Some of these unique features will likely influence all stages of dependence development in waterpipe smokers. So while the waterpipe-specific cues of smell and sound may attract new users as well as reinforce use among established smokers, behavioral adaptations to ensure access can signify more advanced dependence. In fact our first study to demonstrate dependence potential among waterpipe smokers showed that daily smokers who perceive themselves to be hooked on the waterpipe can engage in more intensive behavioral adaptations to ensure access, such as carrying one's own waterpipe to places, selecting cafés based on waterpipe availability.<sup>17</sup>

The role of waterpipe-specific cues in attracting new smokers and supporting use has been demonstrated in several studies. For example, a recent qualitative study conducted in Lebanon supports the contribution of features like smell, sound, and taste to young people's attachment to the waterpipe. Specifically, the taste and smell of waterpipe tobacco (Maassel) were listed as the main reasons for some to try the waterpipe, and eventually become hooked: "My parents used to sit and smoke the waterpipe... Then from its nice smell we got hooked." The smell of waterpipe even in public places was a motivator to initiate waterpipe smoking for some: "When you arrive to a café, you smell the waterpipe from the outside, you say that's it, you want to smoke it."<sup>18</sup> Furthermore, studies about attitudes and behaviors of waterpipe smokers within the EMR and beyond repeatedly indicated the influence of these unique features such as aromatic smell, smoke's smooth taste, and bubbling sound of water in shaping their waterpipe experience.<sup>2,9,19,20</sup> Accordingly, these unique features of waterpipe use and its associative cues, require a novel approach to waterpipe prevention and cessation based on evidence from research about the development and composition of dependence in waterpipe smokers and factors influencing it.

## **WATERPIPE AS A BRIDGE TO CIGARETTE SMOKING**

Another worrisome aspect of the spread of waterpipe smoking lies in its potential to serve as a gateway to cigarette smoking among youth, as well as thwart cessation attempts among adult cigarette smokers. Several lines of evidence support such potential. First, smoking cessation studies in the EMR have shown that several quitters of cigarette smoking switch to the waterpipe, perhaps to deal with their craving and withdrawal.<sup>21</sup> Applying a more rigid research design to investigate further the ability of waterpipe to replace cigarettes among abstinent cigarette smokers, we conducted a clinical lab study, where 12-hour-abstinent dual waterpipe/cigarette smokers attended SCTS's lab for two randomly ordered sessions (waterpipe or cigarette) separated by 48 hours. For both tobacco use methods, scores on measures of withdrawal and craving were high at the beginning of session (ie, before smoking) and were reduced significantly and comparably during smoking. This study was the first to show the ability of waterpipe to suppress abstinence effects comparably to cigarettes, and its potential to thwart cigarette cessation (Fig. 3).<sup>22</sup> Qualitative studies of adult smokers extend this observation to indicate that waterpipe use among cigarette quitters not only helps deal with abstinence symptoms but can lead to failed quit attempts. For example, in the earlier mentioned qualitative study done by our team among adult waterpipe

and cigarette smokers, one smoker stated, “I quit smoking [cigarettes] for more than 6 months. Then, I was invited to smoke narghile [waterpipe]. After the second puff I asked for a cigarette and I started again.”<sup>15</sup> While such observations are indicative of waterpipe’s potential to replace and act as a bridge to cigarette smoking, the gateway hypothesis is perhaps best tested using a prospective study design that follows the natural development of smoking habits among youth.

Such studies are emerging within and outside the EMR. For example, in a longitudinal study of 762 Danish youth (14–16 years), investigators found that waterpipe use at baseline predicts the progression to regular cigarette smoking among youth.<sup>23</sup> In a second study done by our team at SCTS, we followed up 1,701 students (age 13 at baseline) in Jordan for 2 years, and compared current cigarette smoking at 2-year follow-up between those who were nonsmokers (waterpipe or cigarette) and those who were current waterpipe smokers at baseline. Results showed that waterpipe-only smokers at baseline are twice as likely to become current cigarette smokers after 2 years compared to never-smokers at baseline. However, the reverse also was true; current cigarette smokers at baseline were twice as likely to become current waterpipe smokers after 2 years compared to never-smokers (Fig. 4).<sup>24</sup> Therefore, in the next step we want to reexamine this observation using 3-year follow-up, and applying comprehensive modeling techniques that account for other important factors and interactions between the two tobacco use methods. As such, available evidence from clinical, qualitative, and epidemiological studies all support the notion that tobacco smoking using a waterpipe supports tobacco dependence, can thwart smoking cessation attempts for cigarette smokers, and can serve as a gateway to cigarette smoking among youth.

## CONCLUSIONS AND FUTURE CONSIDERATIONS

Waterpipe smoking has perhaps become the most common tobacco use method among youth in the EMR, and the rest of the world is catching up quickly. This spread is fueled by misperceptions about its harmful and addictive properties, as well as the lack of product-specific interventions, policies, and regulations. Given waterpipe’s global reach, and its potential to hook young people on nicotine and to thwart prevention and cessation efforts for cigarette smokers, a timely and proportionate response to the waterpipe epidemic is urgently needed. This should include waterpipe-specific policies, cessation programs, and prevention efforts. However, all these require waterpipe-specific research to further dissect waterpipe’s unique features and how they influence users as they progress in their smoking habit, as well as a clear understanding of the environment that supports or hinders the spread of waterpipe use. For example, we cannot develop waterpipe cessation interventions without full characterization of common trajectories of tobacco dependence in waterpipe smokers, and how waterpipe and cigarettes smoking interact in hooking young people on tobacco. We also need to understand the role of policy, culture and family environment in the spread of this tobacco use method within and outside waterpipe’s natural cradle in the Middle East. In this regard, textual and graphical warning signs on the tobacco product may not be as effective in waterpipe compared to cigarettes, especially within waterpipe cafés setting, since smokers are served the waterpipe already packed with tobacco and are not exposed to the tobacco packaging. Our team and several others are taking up some of these tasks, but

given the spread and seriousness of this smoking habit, a larger involvement of researchers and resources is needed to advance evidence-based solutions to curb the global waterpipe epidemic.

## Acknowledgments

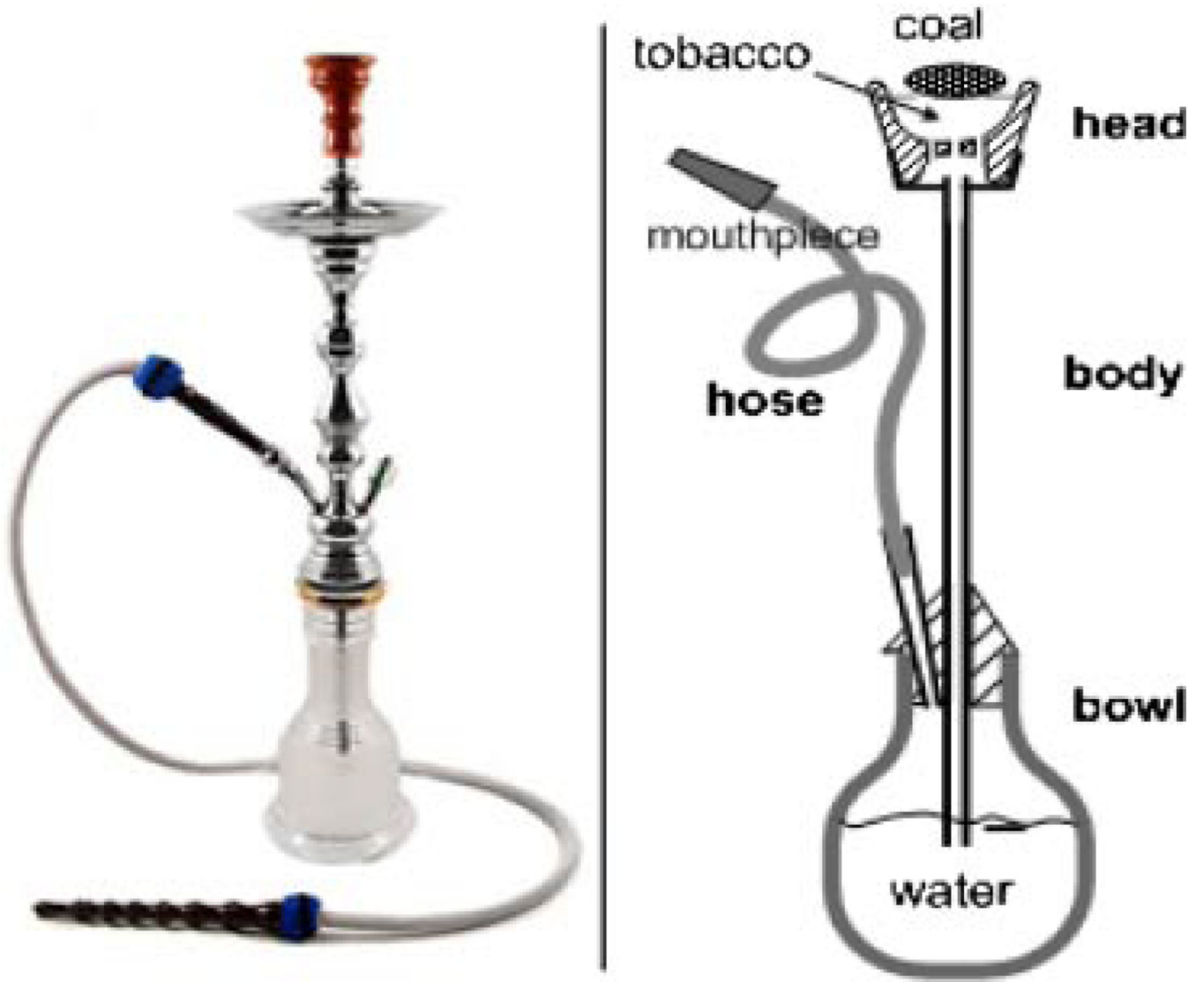
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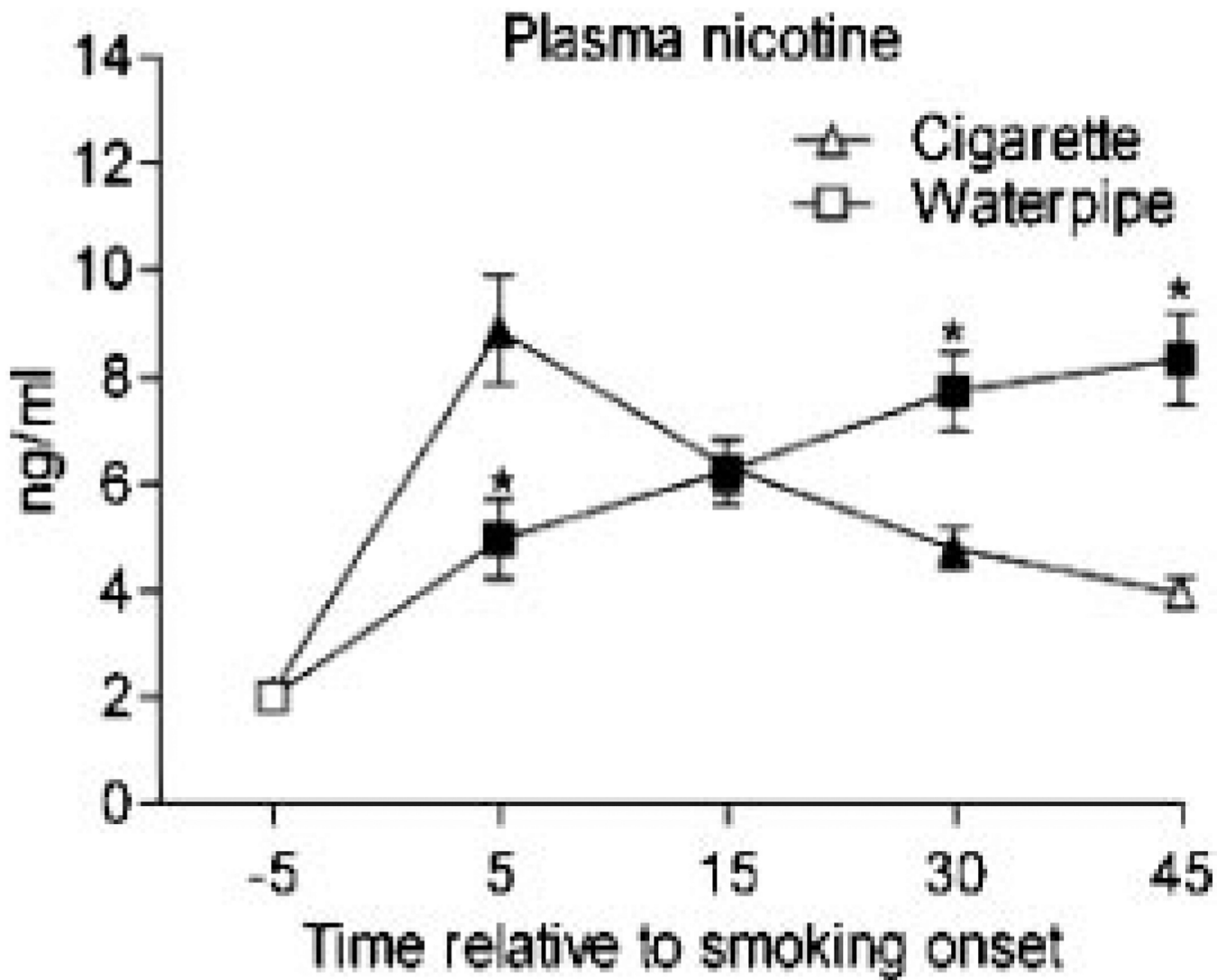
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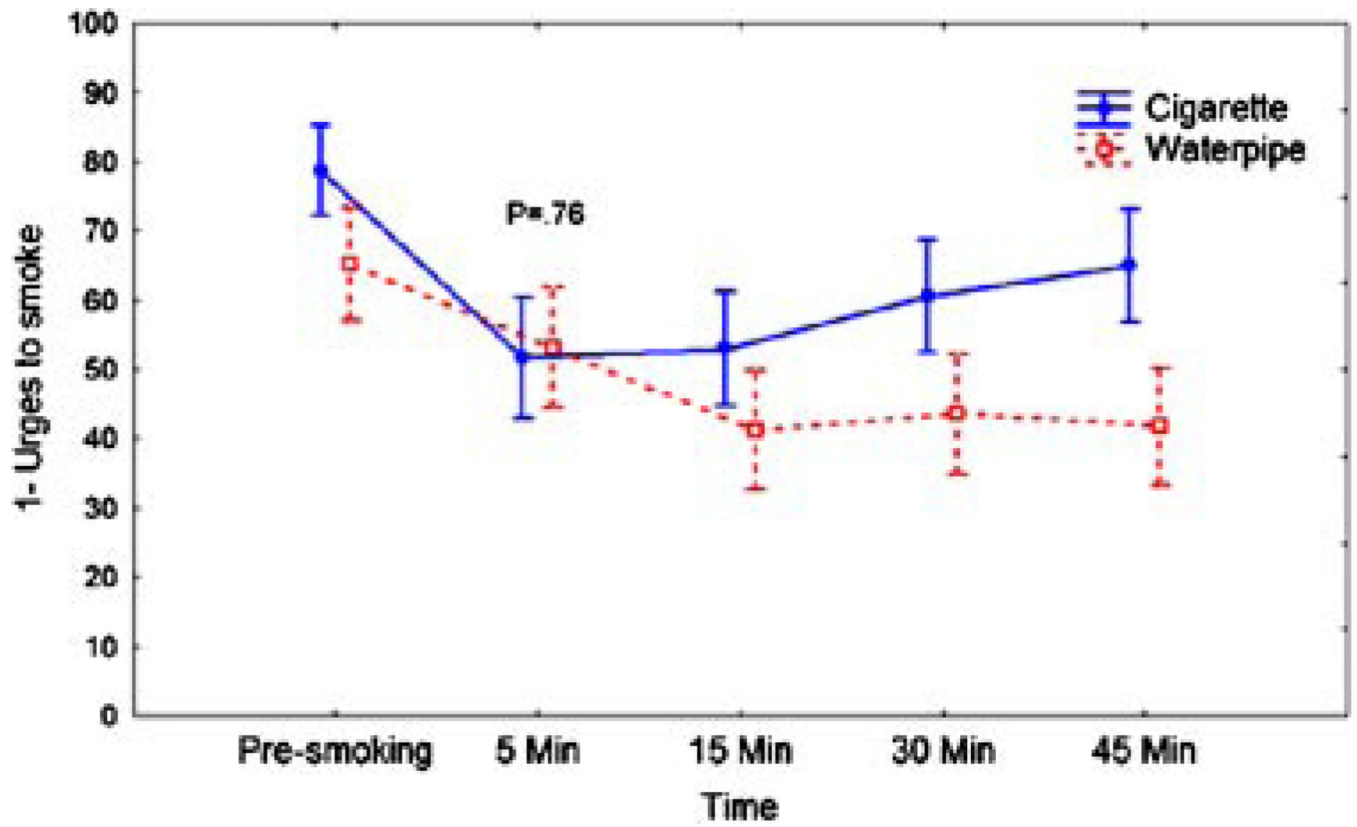


**FIGURE 1.**  
Waterpipe picture (left) and schematic showing main parts (right).

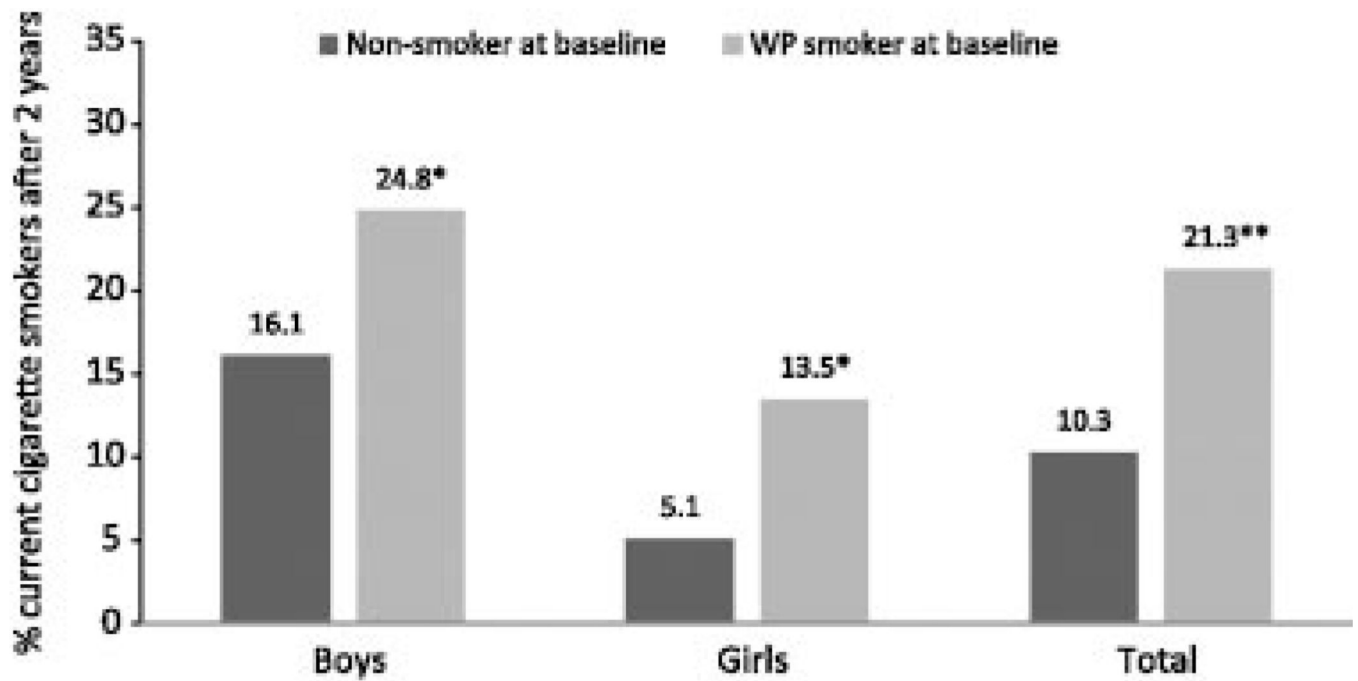




**FIGURE 2.** Mean ( $\pm 1$  SEM) plasma nicotine data from 31 participants who smoked tobacco using a waterpipe (triangles) or cigarette (squares) in a laboratory session. While both waterpipe and cigarette smoking were ad libitum, the waterpipe was available for 45 minutes while the cigarette was consumed in approximately 5 minutes. Filled symbols indicate a significant difference from baseline (time 0) and asterisks (\*) indicate a significant difference between conditions at that time point ( $p < .001$ ).<sup>12</sup>



**FIGURE 3.** Mean scores of the item “Urges to smoke” in abstinent dual cigarette/WP smokers ( $p = .8$  for comparison at 5 minutes using g repeat model ANOVA), adapted from Ref.<sup>22</sup>



**FIGURE 4.** Progression to current cigarette smoking among waterpipe smokers versus nonsmokers at baseline. \* $p < .05$ , \*\* $p < .01$ , adapted from Ref.<sup>24</sup>