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The Global Epidemic of Waterpipe Smoking

Wasim Maziak, MD, PhD

SUMMARY

In the past decade waterpipe (WP) smoking (a.k.a. hookah, shisha, narghile) has been steadily spreading among youth around the world. The allure of this tobacco use method for youth can stem from its pleasant smooth smoke, social ambience and the perception of reduced harm. The material in this review is based on detailed Medline search for articles appearing especially in past two years that are of relevance to WP epidemiology, health and addictive effects, and WP-related tobacco control policies. It shows that WP smoking is continuing to spread among youth worldwide, and perhaps represents the second global tobacco epidemic since the cigarette. Available evidence suggests that the prevalence of current (past month) WP smoking range from 6–34% among Middle Eastern adolescents, 5%–17% among American adolescents, and that WP use is increasing globally. Studies on the health effects of WP smoking are limited by methodological quality, as well as by the novelty of WP epidemic relative to the long latency of important smoking-related health outcomes. Still, research indicates substantial harmful effects similar to those of cigarettes, as well as to the potential of providing a bridge to cigarette smoking or relapse. Developing effective interventions to curb WP use among youth requires a detailed understanding of how dependence develops in WP users, and how it is shaped by WP's unique features such as; the predominantly intermittent use with prolonged sessions, preparation time, accessibility, potent sensory cues, convivial experience of group use. It also requires assessing effective policy options such as factual and visible health warnings on all its parts, as well as youth access and indoor smoking restrictions. WP smoking is currently showing all signs of a burgeoning global epidemic with serious implications for public health and tobacco control worldwide. Investment in research and policy initiatives to understand and curb WP use needs to become a public health priority.

Keywords

waterpipe; narghile; shisha; hookah; smoking; dependence; public health; policy

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Correspondence. Wasim Maziak, MD, PhD, Professor, School of Public Health, University of Memphis, Director, Syrian Center for Tobacco Studies, Browning Hall 112, 3820 DeSoto Avenue, Memphis 38152-3340, Phone: 901.678.5018, Fax: 901.678.1715, wmaziak@memphis.edu.

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INTRODUCTION

Only some decade ago, including questions about the waterpipe (WP; a.k.a. hookah, shisha, narghile) in epidemiological studies of tobacco use among youth would have seemed unwarranted, even in the Eastern Mediterranean (EM) region considered by many as the cradle of this tobacco use method. Not including such questions nowadays, no matter where the study is conducted, will likely be a serious flaw. This reflects the dramatic changes in youth's tobacco use patterns worldwide, with non-cigarette forms, led by the WP, are becoming increasingly popular (Warren et al., 2009). In the most common form of WP used nowadays, burned charcoal pieces are placed on top of a perforated aluminum foil separating it from the flavored tobacco mixture (a.k.a. Maassel), so when the smoker draws air through the hose's mouthpiece, charcoal-heated air becomes smoke as it passes the tobacco mixture and cools as it bubbles through the water before inhalation by the smoker (Figure 1)(Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010; Gatrad, Gatrad, & Sheikh, 2007; Knishknowy & Amitai, 2005; Maziak, 2008; Maziak, Ward, Afifi Soweid, & Eissenberg, 2004; Maziak, Ward, & Eissenberg, 2007; Warren et al., 2009). These features, especially the water-passed smooth and aromatic smoke (erroneously referred to as "filtering"), underlie much of the widespread misperception about WP's "reduced" harm and addictiveness. Recent research suggests that WP smoking is addictive and is associated with considerable harm (Akl et al., 2010; Cobb et al., 2010; Gatrad et al., 2007; Knishknowy & Amitai, 2005; Maziak, 2008; Raad et al., 2010). Unfortunately, evidence-based prevention and treatment interventions are lacking, as is the knowledge base that can guide the development of such interventions (Maziak et al., 2007). In this review I want to provide an update about the global WP epidemic and the evidence about its harmful public health potential as it pertains to the development of treatment and policy interventions to curb its spread.

IS WP USE A GLOBAL PUBLIC HEALTH PROBLEM OR IS IT A PASSING FAD?

In recent years WP use has been witnessing a surge in popularity, especially among youth in the EM region. For example, results of the Global Youth Tobacco Survey (GYTS) involving data from 16 countries and the Gaza Strip in the EM suggest that current (past month) WP smoking range from 6–34% among 13–15 year olds (Warren et al., 2009). In Karachi Pakistan, ever WP use was reported by 27% of school students (n= 646; mean age 15 yrs) and 54% of university students (n=450, mean age 21 yrs), while current WP use was reported by 17% of school and 33% of university students (Anjum et al., 2008; Jawaid et al., 2008). Among Jordanian university students (n=548, mean age was 21.7 yrs), a recent study shows an amazing 42.7% prevalence of current WP smoking (Azab et al., 2010). The reduced harm perception is perhaps fueling WP use among future health professionals, as data show that current WP use was reported by 20.6% of medical students in Lebanon, 23.5 % of medical students in Syria, and 28.6% of medical students in Turkey (Almerie et al., 2008; Poyrazo lu et al., 2010; Saade et al., 2009).

Outside of the EM, where until recently tobacco surveys have rarely assessed WP use, a new picture is emerging. Ever WP use for example, has been reported by 38% of a sample of

British university students ($n=937$, mean age 20 yrs), and by 40% of a sample of French high school students ($n=920$, mean age 18 yrs)(Jackson & Aveyard, 2008; Slama et al., 2009). Studies in US universities found that current WP use ranges from 7–20% (Cobb et al., 2010). For example, among a sample of 8,745 students in eight colleges in the US, 29.5% reported ever WP use, and 7.2% reported current WP use (Primack et al., 2010). The spread of WP smoking among US college students, is reflected in the dramatic rise (400% since 1999) of hookah lounges near US campuses (Martin, 2009). These trends are not confined to small-scale surveys, but are beginning to emerge in state and national surveys. In a 2006 national survey of Estonian students ($n=13,826$; age 11–15 yrs), WP use was reported by 25% of boys and 16% of girls (Pärna, Usin, & Ringmets, 2008). Statewide youth tobacco use surveys in the US indicate that 7% of 12th graders were current WP users in Arizona, while 11% of high school students in Florida were ever users (Barnett et al., 2009; Primack et al., 2009). In Denmark, a recent report stated that more than half of Danish youth have tried WP smoking (Døssing, 2009). In Canada, the 2006 Canadian Tobacco Use Monitoring Survey shows that 8% of youth aged 15–24 years had ever used the WP (Canadian Tobacco Use Monitoring Survey (CTUMS), 2006). The available evidence from Australia comes from a telephone survey conducted in 2004 and involved 1,102 Arabic-speaking residents in south-west Sydney, where current WP smoking was reported by 11.4% of participants (Carroll et al., 2008).

But perhaps the most compelling evidence about WP's growing impact on youth's tobacco use globally comes from a recent GYTS report looking at time trends of tobacco use (1999–2008) among more than half a million youth ages 13–15 yrs (involving 209 surveys in 95 countries and 5 areas). This global surveillance effort shows that while cigarette smoking is either stable or declining, other forms of tobacco use are showing a rising trend, most notably WP smoking (Warren et al., 2009). As a result, questions about WP are becoming an essential part of tobacco use surveys worldwide (e.g., WP questions will be added to the 2010 Monitoring the Future Survey). Other noted epidemiological patterns of WP use concern its predominance among educated and affluent youth, within a social setting, and its relation to family WP use and attitude towards the WP (Azab et al., 2010; Cobb et al., 2010; Gatrad et al., 2007; Knishknowy & Amitai, 2005; Maziak, 2008; Maziak et al., 2004; Maziak et al., 2007). So what began as a Middle Eastern phenomenon in the 90s, has made it quickly to the global tobacco use arena in a way that we have not witnessed perhaps since the global cigarette epidemic (Maziak, 2010).

DOES WP SMOKING POSE AN IMPORTANT PUBLIC HEALTH PROBLEM?

WP's harmful potential

High quality studies of the long-term health effects of WP smoking are still lacking. A recent systematic review of the evidence concerning the health effects of WP smoking shows that WP smoking more than doubles the risk of lung cancer, respiratory illness, and low birth weight. WP smoking however, was not significantly associated with bladder cancer, nasopharyngeal cancer, esophageal cancer, oral dysplasia, or infertility, but the wide confidence intervals do not rule out such associations (Akl et al., 2010). This review highlights the methodological limitations of current evidence regarding WP health effects,

as well as the limitations imposed by the novelty of the WP epidemic relative to the long latency of important smoking-related health outcomes (e.g., lung cancer, cardiovascular disease). Another systematic review found that the effect WP smoking on lung function is similar to that of cigarette smoking, raising the potential of later chronic obstructive pulmonary disease (COPD) development as a result of WP use (Raad et al., 2010). A forecast on WP future morbidity and mortality can be made however, based on what we already know about WP smoking. Foremost, WP smoke contains many of the same toxicants as cigarette smoke (e.g. those associated with cardiovascular disease such as carbon monoxide, CO; lung cancer such as polycyclic aromatic hydrocarbons-PAH; addiction via nicotine), and these are delivered efficiently to the smoker (Maziak, 2010; Shihadeh, 2003; Shihadeh & Saleh, 2005). For example, analysis of smoke generated by WP users, through direct sampling during the smoking sessions, shows that users drew a mean of 119 Liter of smoke containing 150 mg of CO, 4 mg of nicotine, and 602 mg of “tar” during a single use session averaging 1 hour (Katurji et al., in press.). Measurement of users’ exposure to WP-related toxicants reveals that, relative to a single cigarette, a single WP session exposes the smoker to 3–9 times the CO and 1.7 times the nicotine (Eissenberg & Shihadeh, 2009; Maziak et al., 2009). Most of the CO in the mainstream smoke of WP is likely originating from the charcoal (Monzer et al., 2008). In fact, reports of WP-related emergency room admissions due to acute CO intoxication are beginning to emerge (Lim et al., 2009; Uyanik et al., 2009), a complication that have not come across in the cigarette smoking literature. A lot of these harmful substances moreover, are emitted to the surrounding air putting nonsmokers at risk. For example, two recent studies involving human and machine-smoked WPs showed that WP smoking generates high levels of ambient air toxicants/carcinogens (e.g. volatile organic compounds, PAH, metals, CO, NO, as well as particulate matter), that are comparable to smoking 2–10 cigarettes for a one-hour WP session (Daher et al., 2010; Fromme H, 2009). Sharing the WP, a popular practice among youth worldwide can be associated with infectious disease risks, such as TB (Steentoft J, 2006). And finally, evidence suggests that WP smoking can undermine tobacco control, as it can be used as a replacement for cigarettes among quitters, or serves as a gateway to cigarette initiation (Asfar et al., 2008; Hammal et al., 2008). A new study among 762 Danish youth (14–16 yrs) provides the first prospective evidence that WP use predicts progression to regular cigarette smoking among Danish youth (Jensen et al., 2010).

WP’s addictive potential

In 1997 Macaron et al, demonstrated nicotine exposure in WP users by measuring cotinine in their urine (Macaron C, 1997). The nicotine exposure from daily WP use is estimated to be equivalent to smoking 10 cigarettes/day (Neergaard J, 2007). Other than nicotine exposure, WP smokers report known features of dependence, such as drug-seeking behavior, use escalation with time, and inability to quit despite repeated attempts (Maziak W, 2005). For example, in a random sample of 268 WP users in Aleppo, 28% wanted to quit and 59% of these had made an unsuccessful quit attempt in the past year. Belief in one’s ability to quit was inversely related to perceived dependence (Ward et al., 2005). These observations were supported by clinical lab evidence, were abstinent WP smokers reported many of the same withdrawal/craving symptoms of cigarette smokers, and these were suppressed by subsequent WP use (Maziak et al., 2009). As dependence becomes recognized among WP

smokers, studies looking specifically into this issue are emerging. For example, a Lebanese group aimed to develop and validate an 11-item Lebanon WP Dependence Scale (LWDS-11), which included four domains; ND, negative reinforcement, psychological craving, and positive reinforcement, and correlated to WP use frequency (Salameh et al., 2008). Studies at the Syrian Center for Tobacco Studies (SCTS) have advanced a bi-dimensional concept of WP dependence; the first reflects the effects of nicotine, and the second reflects WP's unique social dimension and use features with more dependent smokers increasingly showing solitary and home-based use patterns (Maziak W, 2005). For example, it was found looking at WP use frequency -as a surrogate marker of dependence- in 268 adult WP smokers in Aleppo (Syria), that dependent smokers increasingly show solitary and home-based use patterns (Maziak et al., 2004). Case histories from WP users provide another line of evidence; "It went from something fun I did each week, to each day, to 5–6 times a day. It became an addiction" (from www.hookahforum.com), or "I think I'm addicted to the social aspect of hookah" (Francovich, 2009).

The need to understand WP dependence in order to develop evidence-based treatments

Smoking cessation among youth has been hindered by the lack of clear understanding about how youth get hooked on tobacco. Such understanding is needed to guide the timing, composition, and intensity of tobacco control interventions. While information about the initial development of tobacco dependence is beginning to emerge for cigarette smoking (e.g. DiFranza et al., 2000), knowledge to guide WP interventions continues to be lacking. A recent Cochrane review failed to identify a single WP cessation intervention (Maziak et al., 2007), the development of which will require clear understanding of salient symptoms/ domains of dependence in WP users, and how they progress in their smoking habit.

WP's unique use patterns and features (e.g. intermittent use and prolonged sessions, preparation time, accessibility, aromatic smell, and convivial experience of group use) will likely shape dependence and how it is manifested in WP smokers (Maziak W, 2005). For example, since the WP is not as portable and accessible as cigarettes, WP users may engage in more intensive behavioral adaptations to ensure access, such as carrying one's own WP to places, and selecting cafés based on WP availability (Maziak et al., 2004). Other specific features such as WP's sensory stimuli (e.g. smoke's aromatic smell) can become cues for smoking (Maziak et al., 2004). Moreover, the size of WP requires deep inhalations in order to generate smoke and keep it going (puff volume $\approx$ 500 ml, vs. $\approx$ 50 ml for cigarettes) (Breland et al., 2006; Maziak et al., 2009). This feature combined with a less irritating smoke than cigarettes can lead to higher exposure to nicotine and toxicants early on, and perhaps a faster path to dependence. As the WP is becoming the first mod of contact with tobacco for many youth, the balance between dependence and access may determine which WP users are likely to initiate cigarette smoking.

CONCLUSIONS AND POLICY RECOMMENDATIONS

Taken together, the presented data not only indicate that WP smoking has become a public health threat, but that this is perhaps the first tobacco use method since the cigarette that is showing all signs of a burgeoning global epidemic. They also indicate that the WP is

running its specific epidemiological course, and that its harmful and addictive profiles are likely to be shaped by its unique features and use patterns. Despite these alarming trends most national and international tobacco control strategies (e.g. clean indoor air policies, prohibition of advertisement and sales to minors, large or graphic warning labels, taxation), including the Framework Convention on Tobacco Control (FCTC), still do not clearly address this tobacco use method (Maziak, 2008). Furthermore, the WP is not currently regulated (e.g. by the US Food and Drug Administration, or the Canadian Food Inspection Agency), and the content and packaging of WP tobacco, or other accessories, sold on the market are not standardized (Gatrad et al., 2007; Knishknowy & Amitai, 2005; Maziak, 2008; World Health Organization, 2006). For example, new evidence shows that WP charcoal, as sold off the shelf, already contains high levels of PAH that varies systematically by brand, indicating a room for regulation (Sepetdjian et al., in press). On the other hand, in some parts of the world (e.g. US), WP venues can be benefiting from smoking bans in restaurants and bars, because they can be exempted under the “retail tobacco establishment” classification (American Lung Association, 2009; Devon, 2010; Noonan, 2010). In addition, many WP users are driven by a misperception of reduced harm/ addictiveness, which can be re-enforced by deceptive descriptors that appear on WP tobacco packages (e.g., “contains 0% tar and 0.5% nicotine”) or accessories such as the charcoal (e.g. “smokeless and odorless”, “free of chemicals”, “100% natural”) (Khalil et al., 2009; Nakkash & Khalil, 2010; Wilson et al., 2009). All these descriptors aim to create an impression of a healthy product, and should be countered by appropriate packaging and advertisement policies. In contrast, health warnings, written or graphic, need not only to follow the FCTC size requirements (e.g. at least 30% of the package), but be mindful as well of the complexity of WP as a tobacco use method. For example, WP users in the common café/restaurant social setting are not exposed to health warnings on the WP tobacco package because they are served the product already packed with tobacco. Accordingly, policy initiatives such as health warnings and bans on advertisement/deceptive descriptors should accommodate the multi-component nature of this tobacco use method as body parts, hose, charcoal, tobacco mixture, filters, mouthpieces, aluminum foil can be sold separately. Such measures moreover, need to adapt to the fact that most hookah promotion and sales, at least in western societies, are done through the internet (Cobb et al., 2010), and at times are concealed under scientific disguise (e.g. the Sacred Narghile site www.sacrednarghile.com/en/index.php).

Given WP’s global reach, its potential to hook young people on nicotine, to replace cigarettes among quitters, and to harm smokers and nonsmokers alike, WP smoking threat to global public health need not be overemphasized. Understanding the WP’s unique features and how these influence users as they progress in their smoking habit, as well as the environment that supports WP use will be essential for the development of treatment and policy interventions to curb the global WP epidemic.

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Figure 1.
Actual WP (left) and schematic (right) showing main parts⁴