

**GENERAL REVIEW ON WATERPIPE (NARGHILE)**

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**ABSTRACT**

Waterpipe (hookah, narghile, Shisha) tobacco smoking (WTS) is becoming prevalent worldwide and is one of the most popular forms of tobacco use among youth. WTS prevalence has increased dramatically among young adults and adolescents in the developed countries within the previous years, due to Lots of misconceptions as less dangerous on health and less addictive than cigarette smoking. But in reality WTS is associated with addiction, and bad health consequences such as lung cancer, chronic obstructive pulmonary disease, cardiovascular disease, bronchitis, and asthma. Much of this implication is due to the fact that a single WTS session make the smoker vulnerable to large volumes of smoke that contain toxic chemicals such as carbon monoxide, cancer –

causing polycyclic aromatic hydrocarbons, and volatile aldehydes. WTS causes spreading of infectious diseases such as hepatitis, herpes and tuberculosis. In addition to the direct risks of active WTS on health of the smokers, Its effects on the health of passive smokers are alarming. Recently there are reports discussing spreading rates and explaining causes of resurgence of this phenomena in both developed and developing countries. The purpose of this review is to describe a water pipe, the component intoxicants found in WTS, the health effects of WTS on active and passive smokers. And to advocate for regulations to include WTS, stressing on that electronic Hookah (e-Hookah, or e-shisha) is not safe, and to explore WTS cessation methods.

**KEYWORDS:** Waterpipe tobacco smoking, youth, prevalence and correlates, smoke toxicants, health effects, passive smoking.

## INTRODUCTION

Waterpipe tobacco smoking (WTS) has been considered as global threat and given the status of an epidemic by public health officials. Waterpipe, is also known as “narghileh”, “shisha” or “hookah”. WTS involves the passage of charcoal-heated air through a perforated aluminum foil and across the tobacco mixture to become smoke that bubbles through water before being inhaled by the smoker<sup>[1]</sup>, WTS has surged in popularity among young people in the United States to be around 18.2% in adults aged 18 to 24 years.<sup>[2,3]</sup> The same phenomena has been noted worldwide.<sup>[4]</sup> The Eastern Mediterranean Region has the highest prevalence of waterpipe use in the world, especially it is around 30% among young people<sup>[5]</sup>, report from Syria during crisis shows highest prevalence in male university students’ about 42.52% more than double in comparison with female 20.8%<sup>[6]</sup> this prevalence was the highest prevalence for any age category and for any tobacco product other than cigarettes smoking.<sup>[7,8]</sup> WTS is also increasingly becoming the first tobacco product that young people try<sup>[9]</sup> in various populations and subpopulations it showed alarmingly high numbers, especially among high-school and university students of Middle Eastern descent<sup>[10]</sup> According to the Global Youth Tobacco Survey, of tobacco use among 13–15-year-old children, use of tobacco products other than cigarettes increased in 34 of 100 sites surveyed, which was largely attributed to rising waterpipe use. The prevalence was 6–34% in the countries that reported data.<sup>[4]</sup> more than 15 reasons making WTS spreads increasing world widely<sup>[11]</sup> for instance, global tourism and migration flows making WTS become an inseparable part of the social image of men and women in their daily gatherings, also group smoking encourage it to be social custom event<sup>[12]</sup> this not limited on social meeting but extending to be spreading obviously through social media.<sup>[13]</sup>

The passage of smoke through water, combined with the appealing and fruity taste of the flavored tobacco, explains some of the common misconceptions around the relative safety of hookah smoking when compared with cigarettes<sup>[14]</sup> Although waterpipe smoking is perceived as less harmful compared to cigarette smoking, few relevant studies were conducted, one states that 30% of university students having fallacy thought about shisha and considering being less deleterious than cigarette<sup>[15]</sup>, that the untested idea of the narguileh being a harmless that the shisha is filtered due to the water in it seems to be one main belief justifying it being less injurious.<sup>[16]</sup>

There is a growing body of evidence suggesting that waterpipe tobacco exposes smokers to toxicants and health harms equivalent or higher to those of cigarette smoking, some difference comes from the lower ignition temperature for narguileh, liberating higher CO level.<sup>[17]</sup> In addition, the sharing of the waterpipe mouthpiece poses risks of transmission of communicable diseases including Tuberculosis and Hepatitis.<sup>[16,18]</sup>

Smokers of cigarettes and other tobacco products had higher chance of starting waterpipe tobacco smoking than other who didn't smoke other tobacco products. On the other hand, those who smokes waterpipe are more susceptible to start smoking cigarette.<sup>[19]</sup>

Young people may be attracted to waterpipe smoking because of its social allure<sup>[20,21]</sup> and the perception that it damages health less than cigarette smoking.<sup>[20]</sup> Given the limited access to and limited portability of waterpipes, nicotine-dependent smokers may turn to cigarettes. Understanding the association between waterpipe smoking and susceptibility to cigarette smoking is the first step in exploring whether the appeal of waterpipes among young people could lead to initiation of cigarette smoking. Whereas waterpipe smoking is primarily an intermittent method of using tobacco.<sup>[19,22]</sup>

### **The history of narguileh**

Waterpipes have been used to smoke tobacco and other substances, such as flowers, spices, fruits, coffee, marijuana or hashish, by the indigenous people of Africa and Asia for at least four centuries, and perhaps earlier.<sup>[23]</sup> Their origin is somewhat nebulous, but it is known that trade routes through India and China helped disseminate the practice throughout parts of Asia, the Middle East and Africa.<sup>[24]</sup> A form of waterpipe used in India in the sixteenth century was made from a coconut shell as the water reservoir, with a bamboo reed inserted through the top.<sup>[24]</sup> This type of coconut-shell hookah was used by commoners, while smokers in affluent families used brass hookahs with ornate designs.<sup>[25]</sup> According to one historical account, the waterpipe was invented in India by a physician during the reign of Emperor Akbar (who ruled from 1556 to 1605) as a purportedly less harmful method of tobacco use. The physician, Hakim Abul Fath, suggested that tobacco “smoke should be first passed through a small container of water so that it would be rendered harmless.”<sup>[25]</sup> Thus, the widespread but unsubstantiated belief held by many waterpipe users today—that the practice is relatively safe— may be as old as the waterpipe itself.<sup>[26]</sup>

**Introduction of flavoured tobacco (*maassel*)**

The definite date of the first production of sweetened flavored waterpipe tobacco, commonly called *maassel*, is unknown, but it was already in use in the Middle East in the early 1990s. Circumstantial evidence suggests a temporal link between the production of *maassel* at the beginning of the 1990s and the surge in the number of waterpipe smokers in the Middle East.<sup>[27]</sup> *Maassel* is typically manufactured by fermentation of tobacco with molasses, glycerine and fruit essence, producing a moist, pliable mixture. Before the introduction of *maassel*, most waterpipe smokers used some form of raw tobacco that they manipulated (e.g. crushed, mixed with water, squeezed and moulded before use.) This method usually produces strong, harsh smoke, unlike the smooth aromatic smoke produced from *maassel*.<sup>[4]</sup> In retrospect, the introduction of *maassel* for waterpipes was the equivalent of the Bonsack machine, which enabled mass production and marketing of cigarettes. Industrialization and commercialization of *maassel* and its increased availability and variety made it appealing to young people, paving the way for mass marketing through the Internet, and simplified waterpipe preparation.<sup>[4]</sup> Data from all over the world show that *maassel* is the preferred tobacco for use in waterpipes by most smokers, especially young ones.<sup>[27,28]</sup>

**Describe the device**

The *narguileh* is a water pipe (Figure 1) consisting of several main parts: a glass pitcher, a hose, and head or tobacco bowl (in which tobacco is placed) and mouthpiece. The glass pitcher is half filled with water; a vertical tube is dipped in the water, and the upper tip of this tube is connected to a cup containing tobacco lit with brands. The pitcher is connected with another tube that reaches to the hose through which the smoke is drawn out by a series of puffs after bubbling through the water. This needs a high suction pressure and deep inspiratory effort to overcome the resistance of this long pathway. The tobacco used is called *tombak*, and takes the form of domestic pure *tombak* in Syria, *meassel* mixed with honey or fruits, and *jurak*, which is a tobacco fruit mixture cooked to produce a dark colored paste<sup>[12,30]</sup>, *tombak* is burned with a piece of coal. The ignition temperature is 308°C.<sup>[31]</sup> Charcoal or a briquette is placed on top of the tobacco-filled head, often separated from the tobacco by a perforated aluminium foil sheet. After the head or tobacco bowl is loaded and the charcoal lit, the smoker inhales through the hose, drawing air into and around the charcoal. The resulting heated air, which also contains charcoal combustion products, then passes through the tobacco, which, as it is heated, produces the mainstream smoke aerosol inhaled by the smoker. The smoke passes through the waterpipe body, bubbles through the

water in the bowl and is carried through the hose to the smoker. During a smoking session, smokers typically replenish and adjust the charcoal to maintain the desired taste and smoke concentration. A pile of lit charcoal may be kept in a nearby firebox for this purpose, which may present an additional inhalation hazard. Smokers may opt for more convenient, easy-lighting briquettes, which can be lit directly with a portable lighter. Because of the communal nature of waterpipe smoking, with sharing of a mouthpiece.

### **Quantification of WTS smoking**

WHO Assigned a panel of experts on water-pipe to present an update instruments to measure waterpipe smoking, they started working on the development and updating of water pipe-related instruments. Therefore, the proposed items focus on main attributes relevant to 1: use patterns; 2: dependence; 3: exposure and 4: major policy/regulation (eg, flavor, labelling, promotion, access and price). The items proposed here are adapted from our previous suggested measures.<sup>[32,34]</sup>

### **Assessment of waterpipe use patterns**

The main difference between waterpipe and cigarette smoking is that waterpipe smoking is a stationary tobacco use method that requires time and a specialized apparatus. Waterpipe smokers spend on average 1 h in each session, in addition to set-up time. This time requirement influences the frequency and regularity of waterpipe use, because access is not as readily available as with cigarettes. Studies from around the world and in different age groups show that intermittent, non-daily use predominates among waterpipe smokers. The social nature of waterpipe use also contributes to its distinct and variable use patterns compared with cigarettes. This variability in use patterns occurs within the same individuals depending on the social context and availability of time.<sup>[35,36]</sup>

Recent research shows that young waterpipe smokers develop dependence earlier and at lower frequency of use compared with cigarettes (6 days/month for waterpipe vs. 13.5 days/month for cigarettes). Owing to the intermittent use patterns, length of session and the social nature of waterpipe smoking, items commonly used to measure dependence in cigarette smokers may not be appropriate. For example, items of the Fagerström test for nicotine dependence (FTND),<sup>[37]</sup> widely used for cigarette smokers have been adapted repeatedly for the waterpipe.

In fact, waterpipe is unique in the sense that the balance between dependence and access/availability can be the most important determinant of use. Owing to the limited access and portability compared with cigarettes, this balance will likely drive the more dependent waterpipe smokers to smoke cigarettes or other readily available tobacco/nicotine.<sup>[38]</sup> Subsequently, measuring average number of waterpipes/heads (the small bowl in which tobacco is contained and exposed to heat while smoking waterpipe) smoked per month might be a better indicator of waterpipe use pattern that conveys regularity that cannot be captured using shorter time frames. Another useful measure for the quick assessment of dependence in epidemiological surveys can be self-perceived dependence (being 'hooked'), which has been shown to correlate with waterpipe use frequency.<sup>[39]</sup>

Main definitions derived from the suggested items are.<sup>[39]</sup>

Ever smoker: Ever smoking or experimenting with waterpipe.

Current smoker: Smoking waterpipe at least once in the past month

Daily smoker Smoking waterpipe every day or on most days of the week

Weekly smoker Smoking waterpipe at least once a week but not every day Monthly smoker Smoking waterpipe at least once a month but less than once a week

Former smoker: Smoking waterpipe in the past, but not currently (not in the past month)

Age of initiation: Age when first started smoking waterpipe.

Waterpipe-years: Number of waterpipes smoked per month divided by 30 and multiplied by numbers of years of smoking.

Cessation: Not smoking waterpipe for at least a month in an attempt to quit.

### **Health Hazards of Waterpipe Smoking**

We will talk about toxic contents, Acute physiological and health effects, Second-hand waterpipe smoke, and Long term health effect.

#### **Toxical contents**

Similarly to cigarette smoke, waterpipe smoke contains toxins that have been implicated in lung diseases (e.g., volatile aldehydes), numerous carcinogens and toxicants have been identified, such as tobacco-specific nitrosamines, polycyclic aromatic hydrocarbons (PAH) (e.g. benzo, pyrene, anthracene), cardiovascular diseases (e.g., carbon monoxide), and addiction (i.e. Nicotine), volatile aldehydes (e.g. formaldehyde, acetaldehyde, acrolein), benzene, nitric oxide and heavy metals (arsenic, chromium, lead). The charcoal<sup>[40]</sup> contributes

to high levels of carbon monoxide (CO) and the generation of carcinogenic and risk of leukemia related to high levels of benzene exposure.<sup>[41]</sup>

Additional factors that influence the toxicant content of the waterpipe smoke aerosol are puff topography (i.e. the number of puffs drawn, the puff volume, duration of puffs and the interval between consecutive puffs) and waterpipe design and construction, and number of persons sharing the session. Waterpipes are not standardized, although some attempt has been made to standardize them, and they therefore vary in numerous ways, including the volume of the head space above the water and the porosity of those through which the user draws smoke. Differences in hose porosity can greatly influence the toxicant content, by varying dilution and combustion conditions.

### **Acute physiological and health effects of waterpipe use**

The emission of high levels of CO leads to syncope among some users due to CO intoxication secondary to the formation of carboxyhaemoglobin in blood, which compromises the transport of sufficient oxygen to body parts, including the brain.<sup>[42]</sup> Acute CO poisoning of waterpipe users has also been reported, and acute effects have been reported in several controlled clinical studies.<sup>[43-44]</sup> Some of the effects, such as elevated heart rate and blood pressure, are consistent with well-known effects of nicotine.<sup>[45]</sup> Other deleterious acute cardiovascular effects, such as impaired baroreflex control<sup>[46]</sup> and cardiac autonomic dysfunction, have also been documented and found to be independent of nicotine content<sup>[47,48]</sup> Waterpipe smoking also appears to impair lung function and exercise capacity<sup>[49]</sup> and to elicit changes in inflammation biomarkers.<sup>[50]</sup> These effects are consistent with the notion that waterpipe smoke delivers physiologically active doses of not only nicotine but also other toxicants and suggest that chronic waterpipe use may lead to disease in the long term.

### **Second-hand waterpipe smoke equally called (passive Smoke), or Environmental tobacco smoke (ETS)**

**What is ETS:** Wirth in a general review mentioned that for cigarette or narghile, Mainstream Smoke (MSS) is inhaled directly by the smoker. While the Environmental tobacco smoke (ETS) is composed first by the side stream smoke emitted directly into the atmosphere. From the burning top of the cigarette (SSS). And second by the smoke exhaled by the smoker after inhaling the MSS. This exhaled smoke is referred to as the Exhaled Mainstream Smoke (EMSS).<sup>[51]</sup>

Caouachi in a general review: reported ETS Clouds of Narguile is composed almost only by (EMSS), because the ignition temperature is low 200°-380.<sup>[52]</sup>

ETS emitted directly from waterpipe smoking into the surrounding atmosphere contains toxicants, as shown in controlled laboratory test chambers (53,54) and by measurement of airborne particulate matter in settings where waterpipes are used(54-56). Collectively, these studies show that waterpipe smoking results in significant emissions of CO, aldehydes, PAH, ultrafine particles and respirable particulate matter. Establishments in which waterpipes are smoked exclusively tend to have higher concentrations of respirable particulate matter than those in which cigarettes are smoked exclusively.<sup>[55,57]</sup> On a smoker-hour basis, waterpipe smoking results in higher emissions of CO, PAH and volatile aldehydes than cigarette smoking.<sup>[58]</sup> These studies indicate that waterpipe smoking should be included in all regulations designed to minimize exposure to second-hand smoke.

In a multicenter Global Alliance Against Chronic Respiratory Diseases-WHO survey, in Syria, ETS of Narghile or cigarette has been proved to be causal for COPD in women.<sup>[59]</sup>

And in Phase three of the International Study of Asthma and Allergies in Childhood, In utero and/or early life Exposure to passive smoking of Water-Pipe (narguileh) is associated with asthma onset in children.<sup>[60,61]</sup> Exposure to Passive smoking of narguileh or cigarette also exacerbate existing asthma.<sup>[61]</sup>

At molecular level, in adults, active smoking and (ETS) exposure have been linked to adverse changes in lipid profiles for instance increases in low-density lipoprotein cholesterol (LDL-C) and the ratio of total cholesterol to high-density lipoprotein cholesterol (HDL-C)<sup>[29]</sup> and increases in proinflammatory markers, including homocysteine markers, fibrinogen, C-reactive protein.<sup>[62-63]</sup>

ETS in general increases overall cardiac diseases especially for children and increases the chances for atherosclerosis and thrombi events especially for adults.<sup>[64-66]</sup>

The FCTC state that avoidance of ETS should be 100%, there is no safe level of exposure to tobacco smoke.<sup>[67]</sup>

We should emphasize on that there is no impact of commonly used air filters (MERV 4 and MERV 8) in eliminating the exposure to second hand smoke constituents like carbon



monoxide levels or PM 2.5<sup>[61]</sup>, The only way to protect nonsmokers especially is to not smoke around them at work, at home, or in public places and restaurants.<sup>[67]</sup>

The prohibition was in most cases progressive, and the scope of the interdictions is different among countries, generally less than corresponding laws in Western countries. Some may allow Shisha parlors while forbidding cigarette smoking in public closed places. The strict application of the anti-smoking law is also different from one country to another. For touristic concerns, smoking in restaurants is sometimes tolerated in semi-open air spaces or separate rooms.<sup>[68]</sup>

Daher N and al even reported that: Comparison of carcinogen, carbon monoxide, and ultrafine particles emission from narghile WTS and cigarette smoking, showed that it is higher in ETS of WTS.<sup>[69]</sup>

### **Long term health effect**

Addiction due to nicotine seems higher than for cigarette,<sup>[71]</sup> a systematic review of the health effects of waterpipe tobacco smoking showed significant associations between waterpipe tobacco smoking and lung cancer, periodontal disease and low birth weight.<sup>[32,71]</sup>

Evidence available as of June 2014 suggested that waterpipe tobacco smoking is probably associated with the following types of cancer: oral cancer, esophageal cancer, and lung cancer, Waterpipe tobacco smoking may also be associated with gastric carcinoma, and with urinary bladder cancer.<sup>[72-80]</sup>

Significant evidence has become available for an association between waterpipe tobacco smoking and respiratory disease, mainly chronic bronchitis, asthma and COPD.<sup>[81-84]</sup>

In addition, cigarette smoking and waterpipe smoking have a synergistic effect on chronic obstructive pulmonary disease onset and severity as showed by Lung Functions.

In terms of cardiovascular disease, in a study of 1210 patients in four hospitals in Lebanon, those who had smoked waterpipes for > 40 years had three time the odds for severe atherosclerosis (> 70%) than non-smokers.<sup>[84]</sup> Another large prospective study, in Bangladesh, suggested that waterpipe tobacco smoking was associated with a 20% increase in mortality from ischemic heart disease and stroke in men.<sup>[85]</sup> A cross-sectional study in the Islamic Republic of Iran provided less conclusive evidence on the association between

waterpipe tobacco smoking and self-reported heart disease but showed a dose effect relation (i.e. a higher risk with higher exposure), making the association more likely.<sup>[86]</sup>

Waterpipe tobacco smoking has been associated with a variety of other outcomes. Two retrospective cohort studies conducted in Lebanon and one case control study in the Islamic Republic of Iran found an association between waterpipe tobacco smoking and low birth weight, with an odds ratio of about 2.<sup>[87,88]</sup> One cohort study in Egypt and four cross-sectional studies in Saudi Arabia consistently showed statistically significant associations with periodontal disease.<sup>[89,90]</sup> Studies found an association between waterpipe smoking and perennial rhinitis.<sup>[91]</sup>

Large cross-sectional study in the Islamic Republic of Iran suggested an association with gastro-esophageal reflux disease and (88) a national survey of university students in the USA found a moderate, statistically significant association between waterpipe smoking and poorer mental health.<sup>[92]</sup>

### **Suggested actions for awareness, advocacy and regulations**

The information described above which strongly links water pipe active and passive smoking to cancer, cardiac, asthma and COPD and others. Should lead to reinforce awareness and advocacy in the community and at government and policy makers' level beside cigarette smoking campaigns. Unfortunately, Despite waterpipe's alarming trends, its genotoxic and carcinogenic risks, there is a failure of policies and regulations to address this emerging global public health threat,<sup>[93]</sup> and for that we suggest to make significant drop by implement tax measures on tobacco products and Waterpipes themselves, as well as parts and accessories restrict or prohibit importation and sale of duty-free tobacco and waterpipe products.

Indoor waterpipe smoking in public areas should be prohibited and smoking allowed only outside. Waterpipe venues should not be allowed within large shopping areas, such as indoor malls. Waterpipe tobacco and waterpipe smoke should be tested by the same stringent standards that are applied to cigarette tobacco. Comprehensive education and public awareness programmes on the dangers of waterpipe smoking should be implemented. Programmes should specifically address the fallacy that waterpipe smoking is safer or healthier than smoking cigarettes. Education and programmes for and about the benefits of cessation should be widely available. Training on and awareness of the dangers of waterpipe

smoking should be provided for health workers, community workers, social workers, media professionals, educators, decision-makers, administrators and all those who are pivotal in tobacco control and health care.

We should act in respect to the WHO- Framework Convention on Tobacco Control (FCTC) program MPOWER that contains six effective tobacco control policies, which concern all patterns of tobacco smoking as stated in the WHO Global Reports on Tobacco control.<sup>[67]</sup>

Report 2017 and website MPOWER stands for

1. Monitor tobacco use and prevention policies.
2. Protect people from tobacco smoke
3. Offer help to quit tobacco use
4. Warn about the dangers of tobacco
5. Enforce bans on tobacco advertising, Promotion and sponsorship
6. Raise taxes on tobacco

Fortunately The Convention Secretariat has worked to establish a network of six knowledge hubs within academic institutions of the Parties. Each of these hubs specializes in a given area, such as taxation, water pipe and smokeless tobacco use, or research and surveillance, and assists Parties in their implementation work, not least through analyzing and disseminating information. Overall, You can see Water pipe and smokeless tobacco use is one of the six Hubs.<sup>[67]</sup>

### **Cessation**

People who received either behavioral treatment or behavioral treatment plus bupropion were more likely to quit waterpipe smoking at six months follow-up than those who received usual care.<sup>[93]</sup> Men smoking waterpipe were more likely to have quit at one year follow-up in the intervention.<sup>[93-95]</sup> For Primary school students partook in activities to prevent the initiation of tobacco use through its deglamorisation and teaching of health effects. Preparatory and secondary school students were taught social skills to handle peer pressure to smoke.

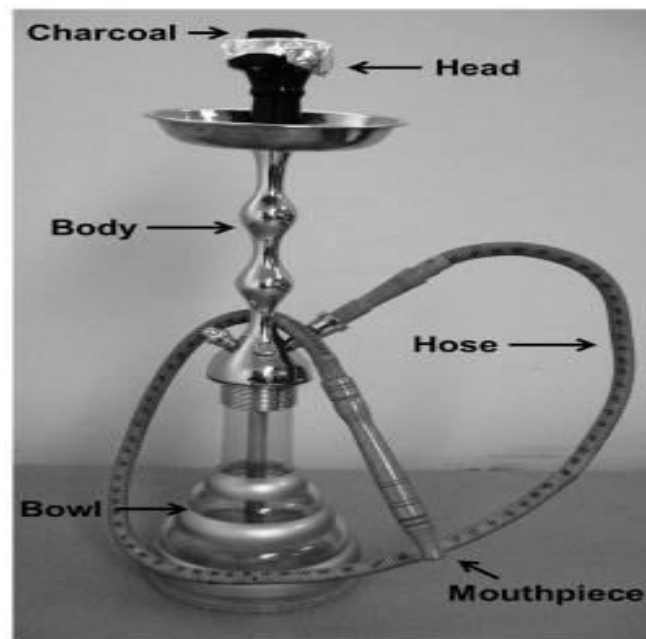
Religious communities were informed of the health effects of tobacco use/secondhand smoke, and the sinful nature of smoking. Adult women at home were taught about the health effects of tobacco use/secondhand smoke and how to protect themselves and their children from it in a culture-specific way.

Expired breath CO, which is good for the detection of smoking in the past 24 hours only, may not accurately verify abstinence in intermittent waterpipe smokers, but can be used as a 'bogus pipeline'.

We suggest that waterpipe smokers may be more likely to stop smoking successfully when using a smoking cessation intervention combined by usual behavioral care.

We should stress on that: e-shisha are not proved to be safe. And could not be advised as alternative for narghile cessation.<sup>[70]</sup>

We also urge the FCTC and all policy makers, to deliver clear legislations and tools to protect children at home from exposure to ETS of Cigarette or Narguileh.<sup>[61]</sup>



## CONCLUSION

Waterpipe tobacco smoking is becoming increasingly popular, particularly among young adults and adolescents. Multiple studies suggest that WTS is associated with high incidence of dependence and long-term negative health consequences similar to those of cigarette smoking. Recently reports about passive WTS effects have explained their negative outcomes and consider as public health dilemma that needs strict instructions to limit spreading of this phenomena in both developed and developing countries. Electronic -shisha does not help, and filters do not protect against indoor ETS. For the future, we need a meta-analysis on health effects of water-pipe

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