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Interventions for waterpipe smoking cessation (Review)

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[Intervention Review]

Interventions for waterpipe smoking cessation

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ABSTRACT

Background

While cigarette smoking has declined globally, waterpipe smoking is rising, especially among youth. The impact of this rise is amplified by mounting evidence of its addictive and harmful nature. Waterpipe smoking is influenced by multiple factors, including appealing flavors, marketing, use in social settings, and misperceptions that waterpipe is less harmful or addictive than cigarettes. People who use waterpipes are interested in quitting, but are often unsuccessful at doing so on their own. Therefore, developing and testing waterpipe cessation interventions to help people quit was identified as a priority for global tobacco control efforts.

Objectives

To evaluate the effectiveness of tobacco cessation interventions for people who smoke waterpipes.

Search methods

We searched the Cochrane Tobacco Addiction Review Group Specialized Register from database inception to 29 July 2022, using variant terms and spellings ('waterpipe' or 'narghile' or 'arghile' or 'shisha' or 'goza' or 'narkeela' or 'hookah' or 'hubble bubble'). We searched for trials, published or unpublished, in any language.

Selection criteria

We sought randomized controlled trials (RCTs), quasi-RCTs, or cluster-RCTs of any smoking cessation interventions for people who use waterpipes, of any age or gender. In order to be included, studies had to measure waterpipe abstinence at a three-month follow-up or longer.

Data collection and analysis

We used standard Cochrane methods. Our primary outcome was abstinence from waterpipe use at least three months after baseline. We also collected data on adverse events. Individual study effects and pooled effects were summarized as risk ratios (RR) and 95% confidence intervals (95% CI), using Mantel-Haenszel random-effects models to combine studies, where appropriate. We assessed statistical heterogeneity with the I^2 statistic. We summarized secondary outcomes narratively. We used the five GRADE considerations (risk of bias, inconsistency of effect, imprecision, indirectness, and publication bias) to assess the certainty of the body of evidence for our primary outcome in four categories high, moderate, low, or very low.

Main results

This review included nine studies, involving 2841 participants. All studies were conducted in adults, and were carried out in Iran, Vietnam, Syria, Lebanon, Egypt, Pakistan, and the USA. Studies were conducted in several settings, including colleges/universities, community healthcare centers, tuberculosis hospitals, and cancer treatment centers, while two studies tested e-health interventions (online web-based educational intervention, text message intervention). Overall, we judged three studies to be at low risk of bias, and six studies at high risk of bias.

We pooled data from five studies (1030 participants) that tested intensive face-to-face behavioral interventions compared with brief behavioral intervention (e.g. one behavioral counseling session), usual care (e.g. self-help materials), or no intervention. In our meta-analysis, we included people who used waterpipe exclusively, or with another form of tobacco. Overall, we found low-certainty evidence of a benefit of behavioral support for waterpipe abstinence (RR 3.19 95% CI 2.17 to 4.69; $I^2 = 41\%$; 5 studies, N = 1030). We downgraded the evidence because of imprecision and risk of bias.

We pooled data from two studies (N = 662 participants) that tested varenicline combined with behavioral intervention compared with placebo combined with behavioral intervention. Although the point estimate favored varenicline, 95% CIs were imprecise, and incorporated the potential for no difference and lower quit rates in the varenicline groups, as well as a benefit as large as that found in cigarette smoking cessation (RR 1.24, 95% CI 0.69 to 2.24; $I^2 = 0\%$; 2 studies, N = 662; low-certainty evidence). We downgraded the evidence because of imprecision. We found no clear evidence of a difference in the number of participants experiencing adverse events (RR 0.98, 95% CI 0.67 to 1.44; $I^2 = 31\%$; 2 studies, N = 662). The studies did not report serious adverse events.

One study tested the efficacy of seven weeks of bupropion therapy combined with behavioral intervention. There was no clear evidence of benefit for waterpipe cessation when compared with behavioral support alone (RR 0.77, 95% CI 0.42 to 1.41; 1 study, N = 121; very low-certainty evidence), or with self-help (RR 1.94, 95% CI 0.94 to 4.00; 1 study, N = 86; very low-certainty evidence).

Two studies tested e-health interventions. One study reported higher waterpipe quit rates among participants randomized to either a tailored mobile phone or untailored mobile phone intervention compared with those randomized to no intervention (RR 1.48, 95% CI 1.07 to 2.05; 2 studies, N = 319; very low-certainty evidence). Another study reported higher waterpipe abstinence rates following an intensive online educational intervention compared with a brief online educational intervention (RR 1.86, 95% CI 1.08 to 3.21; 1 study, N = 70; very low-certainty evidence).

Authors' conclusions

We found low-certainty evidence that behavioral waterpipe cessation interventions can increase waterpipe quit rates among waterpipe smokers. We found insufficient evidence to assess whether varenicline or bupropion increased waterpipe abstinence; available evidence is compatible with effect sizes similar to those seen for cigarette smoking cessation.

Given e-health interventions' potential reach and effectiveness for waterpipe cessation, trials with large samples and long follow-up periods are needed. Future studies should use biochemical validation of abstinence to prevent the risk of detection bias. Finally, there has been limited attention given to high-risk groups for waterpipe smoking, such as youth, young adults, pregnant women, and dual or poly tobacco users. These groups would benefit from targeted studies.

PLAIN LANGUAGE SUMMARY

Can users of waterpipes be helped to quit through smoking cessation interventions?

Key messages

- Limited evidence showed that behavioral support might be helpful for quitting waterpipe use.
- There was not enough evidence to evaluate the effect of varenicline, bupropion, or e-health interventions for quitting waterpipe use.
- In all cases, further studies may change our conclusions. Further large and well-designed trials on behavioral and pharmacological waterpipe cessation interventions are needed.
- Given the potential reach and effectiveness of e-health interventions to help quit waterpipe smoking, trials with large samples and long follow-up periods are needed.
- Reporting more details about the behavioral strategies used in study interventions would help identify vital components in waterpipe interventions.

What is a waterpipe?

Waterpipes are devices used for smoking tobacco. As used today, the waterpipe (also known as hookah, shisha, or narghile) consists of a head (where tobacco is placed), a body, a water base, and a hose that ends with a mouthpiece. Burning charcoal pieces are usually placed on top of a pierced aluminum foil that covers the tobacco-filled head, which allows the charcoal-heated air to pass through the tobacco, while the holes in the bottom of the head allow the smoke to pass down through the waterpipe stem. The lower part of the stem is underwater, causing smoke to bubble through, on its way via the hose and mouth tip to the smoker. The mouth tip is usually covered with a disposable mouthpiece for individual users.

How is waterpipe addiction treated?

Forms of support to help people quit waterpipe smoking are similar to those that target other forms of tobacco use. These include behavioral support, quit-smoking medicines, and combinations of the two.

Why did we do this Cochrane Review?

Waterpipe smoking has increased dramatically, becoming a global public health problem, especially among young people. Current evidence suggests that waterpipe smoking is as addictive as cigarettes, and that users will experience similar risks to their health as cigarette smokers. Therefore, developing and testing waterpipe-specific quitting interventions is important.

What did we do?

We included trials of any interventions to help waterpipe smokers quit smoking. They could be of any age or gender. We measured whether participants had stopped using a waterpipe at three months after the intervention or longer. We included interventions that were directed at individuals or groups of people.

What did we find?

We found nine studies that tested interventions to help waterpipe smokers to quit. Among these, five studies tested behavioral support; two studies tested a quit-smoking medicine, called varenicline; one study tested a quit-smoking medicine called bupropion; and two studies tested e-health support delivered over the internet or mobile phone.

What are the main results of our review?

We have low-quality evidence that face-to-face behavioral support helps more people quit waterpipe smoking than no support. We are uncertain about the effect of bupropion, varenicline, and e-health interventions because of the limited evidence.

What are the limitations of the evidence?

Results are based on data from just a few studies. Six of the nine studies had design issues that may affect how much we trust the results. In addition, the included behavioral interventions differed from one another, and were not always well described. This means that our results may change when more studies become available.

How up-to-date is this evidence?

This search for evidence was performed in July 2022.

SUMMARY OF FINDINGS

Summary of findings 1. Interventions for waterpipe smoking cessation

Patients or population: people who use waterpipe

Settings: clinics/communities/college campuses

Intervention: behavioral support and pharmacotherapy

Comparison: usual care/brief intervention/placebo

Outcome	Anticipated absolute effects (95% CI)		Relative effect (Random effect)	Number of participants (number of studies)	Certainty of the evidence (GRADE)
	Risk without intervention, usual care	Risk with Interventions			
Face-to-face behavioral intervention vs minimal or no support <i>(Measured 3 to 6 months with CO-validated prolonged and continuous abstinence, and self-reported abstinence)</i>	112 per 1000	297 per 1000 (187 to 472)	RR 2.64 (1.66 to 4.20)	851 (5 cluster-RCTs)	⊕⊕○○ Low a, b
Varenicline plus behavioral intervention vs placebo plus behavioral intervention - <i>(repeated point prevalence abstinence (not even a puff/chew/session in the last 7 days) at each of weeks 5, 12, and 25 (combined), verified by CO cutoff < 10 ppm)</i>	56 per 1000	70 per 1000 (39 to 126)	RR 1.24 (0.69 to 2.24)	662 (2 RCT)	⊕⊕○○ Low ^c
Bupropion therapy plus behavioral intervention vs behavioral intervention alone <i>(continuous waterpipe smoking abstinence, defined as an expired CO of 9 ppm or less at the 6-month postintervention follow-up visits)</i>	449 per 1000	364 per 1000 (189 to 633)	RR 0.77 (0.42 to 1.41)	121 (1 cluster-RCT)	⊕○○○ Very low a, c

Bupropion therapy plus behavioral support versus self-help <i>(continuous waterpipe smoking abstinence, defined as an expired CO of 9 ppm or less at the 6-month postintervention follow-up visits)</i>	194 per 1000 375 per 1000 (182 to 774)	RR 1.94 (0.94 to 4.00)	86 (1 cluster-RCT)	⊕⊕⊕⊕ Very low ^{a, c}
	Impact	Number of participants (number of studies)	Certainty of the evidence (GRADE)	
E-health interventions	Due to the variation in the studies, we did not pool the results. Quit rates were higher among participants randomized to receive either the tailored or untailored intervention groups compared with those in the no intervention control group (RR 1.48, 95% CI 1.07 to 2.05; 1 study, N = 319). Smoking abstinence rates were higher among those randomized to receive a 20-slide presentation compared with those randomized to receive an 8-slide presentation (RR 1.86, 95% CI 1.08 to 3.21; 1 study, N = 70).	389 (2 RCTs)	⊕⊕⊕⊕ Very low ^{a, c}	

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

Moderate certainty: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

Low certainty: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.

Very low certainty: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect

CI: confidence interval; CO: carbon monoxide; ppm: parts per million; RCT: randomized controlled trial; RR: risk ratio

^a Downgraded one level for risk of bias: no studies were at low risk of bias

^b Downgraded one level because of imprecision: fewer than 300 events

^c Downgraded two levels because of imprecision: fewer than 150 events

BACKGROUND

Description of the condition

Waterpipe smoking (aka hookah, shisha, narghile) has become a global public health problem (Maziak 2015c). Despite the substantial success in reducing cigarette smoking in some parts of the world, multiple surveillance data from around the globe have shown that waterpipe smoking has increased dramatically, and become one of the leading tobacco use methods (Akl 2011; Akl 2015; Jawad 2018; Maziak 2015a; Maziak 2015b; Maziak 2015c). For example cigarette smoking rates have decreased by approximately 33% in the USA, while waterpipe smoking has taken the opposite course, with a 123% increase among young adults in the USA (Arrazola 2015; Johnston 2016). A 2018 systematic review, which included 68 countries in the World Health Organization's (WHO) six regions, indicated that waterpipe smoking among adults was highest in the Eastern Mediterranean (EMR), followed by Europe, and is predominantly popular among young people (Jawad 2018). For example, waterpipe use was the highest among young Lebanese adults (ages 18 to 24; 65.3%); current waterpipe use (past 30-day use) was the highest among Lebanese youth (ages 12 to 17; 37.2%); and daily use was the highest among Egyptian youth (10.4%). A similar surge was documented in western countries. For example, based on data from the third wave (2016) of the *Population Assessment of Tobacco and Health (PATH)* study in the USA, young adults (ages 18 to 24) had a higher prevalence of ever used (47.5%), past 12-month use (25.8%), and current (past 30-day) waterpipe use (9.2%) than youth, aged 12 to 17 (ever used [5.2%], past 12-month use [2.9%], and current use [0.7%]); or adults 25+ (15.5% ever used, 3.5% used within past 12 months, 1.2% current use [Sharma 2020]). A similar profile was documented in Germany. Using data from the *German Health Interview and Examination Survey for Children and Adolescents* during 2014 to 2017 (N = 6599), the prevalence of ever used was 25.8%, use in the last 12 months was 19.7%, and current waterpipe use was 8.5% (Klosterhalfen 2020).

The impact of the dramatic rise of waterpipe smoking globally is amplified by the mounting evidence of its dependence-inducing and harmful nature (Gathuru 2015; Sutfin 2018). Evidence suggests that waterpipe smoking is addictive (Aboaziza 2015). A typical waterpipe smoking session delivers 1.7 times the nicotine dose of a single cigarette (Eissenberg 2009), and even intermittent waterpipe use can produce symptoms of nicotine dependence (Bahelah 2017; Ebrahimi 2021). Several laboratory studies have indicated that regular and long-term waterpipe smokers experience withdrawal symptoms while abstaining (Maziak 2009; Rastam 2011). In terms of the health effects of waterpipe smoking, evidence suggests that compared with non-smokers, waterpipe smokers have an increased risk of respiratory disease (odds ratio (OR) 3.18; 95% confidence interval (CI) 1.25 to 8.08), oral cancer (OR 2.12, 95% CI 1.32 to 3.42), lung cancer (OR 6.0, 95% CI 1.78 to 20.26), and cardiovascular disease (OR 2.4, 95% CI 1.20 to 2.80 [Asfar 2020; Bhatnagar 2019; El-Zaatari 2015; Jawad 2013; Waziry 2017]). Using charcoal to heat the tobacco in the waterpipe results in additional exposure to toxins and cancer-causing chemicals (Al-Faham 2018; Monzer 2008; Nguyen 2013). Sharing the same waterpipe can also expose users to communicable disease risks (e.g. tuberculosis, herpes [Al-Faham 2018; Martin 2009]). Furthermore, there is evidence that waterpipe smoking can roll back successes achieved

in tobacco control by providing a gateway to cigarette smoking among youth (Jaber 2015; Soneji 2015). For example in Soneji 2015, waterpipe smoking among adolescents was associated with cigarette smoking initiation (adjusted odds ratio (AOR) 2.56, 95% CI 1.46 to 4.47), current cigarette smoking (AOR 2.48, 95% CI 1.01 to 6.06), and higher intensity of cigarette smoking (AOR 2.55, 95% CI 1.48 to 4.38). Hence, waterpipe smoking cessation interventions are a high priority.

Description of the intervention

Interventions to help people quit smoking waterpipes may take similar forms to interventions targeting other forms of tobacco use (Livingstone-Banks 2022; Rigotti 2022). These include treatments available for people wanting to quit, such as behavioral support (Hartmann-Boyce 2021), pharmacotherapy (Cahill 2013), and combinations of the two (Hartmann-Boyce 2019; Stead 2016); and interventions targeting users to induce quit attempts, such as brief advice from a health professional (Stead 2013). Behavioral support can include counseling (Lancaster 2017; Stead 2017), providing self-help materials (Livingstone-Banks 2019), and incentives (Notley 2019). Pharmacotherapies include nicotine replacement therapy (Hartmann-Boyce 2018; Lindson 2019), bupropion (Hajizadeh 2023), and varenicline (Livingstone-Banks 2023). Interventions can be delivered via different media (Matkin 2019; Taylor 2017; Tzelepis 2019; Whittaker 2019), and by various healthcare professionals, including nurses (Rice 2017), dentists (Holliday 2021), and pharmacists (Carson-Chahhoud 2019).

How the intervention might work

Different smoking cessation treatments incorporate different mechanisms, but the underpinning principles are to mitigate the craving and withdrawal symptoms often associated with a quit attempt; reduce the reward derived from smoking, by indirectly disrupting dopamine release or by desensitizing receptors; and delivering positive reinforcement through means other than smoking (Adams, 2020; Chang, 2020).

Why it is important to do this review

In response to the increase in waterpipe use, the WHO released two advisory notes in 2005 and 2015 about the risks of waterpipe smoking and ways to address them (WHO 2015a; WHO 2015). One of the main WHO recommendations was based on Article 14 of the Framework Convention on Tobacco Control (FCTC), highlighting the need to develop waterpipe-specific smoking cessation programs (WHO 2015), which take into account the emerging evidence about the unique aspects of waterpipe smoking that contribute to dependence among smokers (Ward 2015). For example the social aspect of waterpipe smoking and the prominent role of waterpipe venues (e.g. hookah cafés, restaurants) in shaping waterpipe experience and dependence need to be addressed (Ebrahimi 2020). Yet, unlike cigarettes, guidelines for waterpipe-specific treatments have not been established, and waterpipe cessation services are still not well-developed. One of the main barriers to developing such cessation guidelines and evidence-based cessation programs lies in the scarcity of studies that have tested waterpipe-specific cessation interventions. When such studies exist, their quality and suitability to guide waterpipe cessation services are not evaluated. Therefore, this Cochrane

Review aims to assess the emerging literature in this area ([Maziak 2007](#); [Maziak 2015a](#)).

The previous version of this Cochrane Review, published in 2015, found only three published randomized controlled trials (RCTs) for waterpipe cessation interventions ([Maziak 2015a](#)). For this review version, we expanded our inclusion criteria to increase the value of the evaluation. The current review includes studies that (1) measured abstinence at three-month follow-up or more, rather than six months or more; (2) used any definition of waterpipe smoking rather than past-month use only; and (3) reported cessation in dual users (waterpipe and any other tobacco product), as well as in people who exclusively smoked waterpipes.

OBJECTIVES

To evaluate the effectiveness and safety of tobacco cessation interventions for people who use waterpipes.

METHODS

Criteria for considering studies for this review

Types of studies

- Randomized controlled trials (RCTs)
- Cluster-randomized controlled trials (cluster-RCTs)
- Quasi-randomized controlled trials (quasi-RCTs)

Types of participants

People of any age and gender who smoke waterpipes, including people who use waterpipes (daily or occasionally) alongside e-cigarettes or other tobacco products (e.g. people who use a combination of waterpipes and cigarettes or smokeless tobacco).

Types of interventions

We included any interventions aimed at helping people quit waterpipe smoking (or the dual use of tobacco products, including waterpipes). Therefore, eligible interventions could consist of brief advice to quit, provision of self-help materials, brief or intensive behavioral counseling interventions, pharmacotherapies (e.g. nicotine replacement therapy, varenicline, bupropion), referral to other sources of support, and any combination of the above.

Comparators

We set out to include trials that compared waterpipe cessation interventions with any of the following comparators:

- No intervention;
- Wait-list controls;
- Usual care, including brief advice interventions;
- Other active interventions (as defined above).

Types of outcome measures

Primary outcomes

The primary outcome was abstinence from waterpipe use. To be eligible, studies had to report abstinence rates from waterpipe use at least three months from baseline. We excluded trials that did not investigate waterpipe-use outcomes, or did not have a sufficiently long follow-up. In trials with more than one measure of abstinence, we selected the measure with the longest follow-up and the

strictest definition, in line with the Russell Standard ([West 2005](#)), and the SRNT Treatment Research Network guidance ([Piper 2006](#)). Therefore, we preferred biochemically validated over self-reported abstinence, and prolonged or continuous abstinence over point prevalence abstinence. Abstinence rates were based on intention-to-treat analyses, with dropouts and losses to follow-up assumed to be continuing or relapsed waterpipe users.

Secondary outcomes

Secondary outcomes were the number of people who experienced adverse events, and the number of people who experienced serious adverse events, as reported by the authors.

Search methods for identification of studies

Electronic searches

We updated searches of the Cochrane Tobacco Addiction Group Specialised Register via the Cochrane Register of Studies (CRS-Web) from database inception to 29 July 2022, using the terms 'waterpipe' or 'narghile' or 'arghile' or 'shisha' or 'goza' or 'narkeela' or 'hookah' or 'hubble bubble'. We searched for these terms in the title, the abstract, or as keywords. At the time of the search, the Register included the results of searches of the following databases from inception: the Cochrane Central Register of Controlled Trials (CENTRAL, which includes records from both the US National Library of Medicine's clinicaltrials.gov trial registry, and the WHO International Clinical Trials Registry Platform [ICTRP; www.who.int/ictip/], Issue 6, 2022; MEDLINE OVID to update 15 July 2022; Embase OVID to 29 July 2022; PsycINFO OVID to 11 July 2022. For further details of the searches used to populate the Cochrane Tobacco Addiction Group Specialised Register, see tobacco.cochrane.org/resources/cochrane-tag-specialised-register. Our search strategy can be found in [Appendix 1](#).

Searching other resources

We also used our existing bibliography, compiled from earlier exhaustive reviews of the literature on waterpipe smoking ([Ak1 2015](#); [Asfar 2016](#); [Jawad 2016](#); [Jawad 2018](#); [Maziak 2015a](#); [Ward 2015](#)).

Data collection and analysis

Selection of studies

Two review authors (TG and OO) independently prescreened titles and abstracts of articles identified in the search, using a screening checklist based on our eligibility criteria. We resolved disagreements through discussion, or referral to a third review author (TA). We conducted screening using Covidence software ([Covidence](#)).

Two review authors (TG and OO) independently screened the full text of articles that passed prescreening. We consulted a third review author (TA) to resolve any disagreements that were not resolved through discussion.

Data extraction and management

Two review authors (TG and OO) independently extracted data from each included study, using a standardized electronic data collection form. Review authors then cross-checked this information between themselves, and resolved disagreements through discussion. If the current review team authors were also the authors of an included

study, we ensured that other review authors or other researchers did the data extraction and risk of bias assessment. We extracted the following information about each study, where possible, which is presented in the [Characteristics of included studies](#) tables.

- *Methods*: study design; study location (i.e. country); study setting (e.g. hospital, university, community); and study recruitment procedure
- *Participants*: number of participants (N); if this was a specialist population (e.g. people with tuberculosis); if participants were selected based on motivation to quit; and participant characteristics (including gender, age, baseline average cigarettes/day, nicotine dependence, baseline motivation to quit, and baseline self-efficacy/confidence in quitting)
- *Interventions*: comparator (control) and intervention details, including modality of support; details of provider training; overall contact time; the number of sessions; and use of pharmacotherapy
- *Outcomes*: definition of waterpipe abstinence; longest follow-up time; use of biochemical validation; and adverse events
- *Study funding sources*
- *Author conflicts of interest*

Assessment of risk of bias in included studies

We assessed and reported the risk of bias in the [Characteristics of included studies](#) tables for each eligible study, following the guidelines in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2017), and the risk of bias guidance developed by the Cochrane Tobacco Addiction Group (Higgins 2011). The latter states that performance bias (relating to blinding participants and providers) should not be assessed for behavioral interventions, as it is impossible to blind people to these types of interventions. Therefore, we reported on the following individual domains:

- Random sequence generation;
- Allocation concealment;
- Blinding of participants and personnel (performance bias) for studies testing pharmacotherapy interventions only;
- Blinding of outcome assessment (detection bias);
- Incomplete outcome data (attrition bias);
- Selective reporting (reporting bias);
- Other bias.

Two review authors (TG and OO) independently assessed the risk of bias for each included study, with any disagreements resolved by discussion and inclusion of a third review author (TA). A summary risk of bias judgment was derived for each study by applying an algorithm suggested in Section 8.7 of the *Cochrane Handbook* (Higgins 2017). Specifically, if the judgment for at least one of the domains was judged to be high risk of bias, we determined the summary risk of bias to be high. If there were no judgments of high risk, but the judgment in at least one domain was at unclear risk of bias, then we determined the summary risk of bias to be unclear. The summary risk of bias was deemed low if our judgments in all domains were low risk of bias.

Measures of treatment effect

For waterpipe use abstinence, we calculated a risk ratio (RR) and associated 95% confidence interval (CI) for each trial included

in the meta-analyses. We calculated RRs as follows: (number of participants abstinent from waterpipe in the intervention group/number of participants in the intervention group)/(number of participants abstinent from waterpipe in the control group/number of participants in the control group). We would have used the same methods to calculate the RRs, and 95% CI for the numbers of participants experiencing adverse events and serious adverse events for each study were the relevant data presented.

Unit of analysis issues

The unit of analysis was the individual. Where we deemed it possible and appropriate to the structure of the analysis, we combined all relevant experimental intervention groups of a given multiple-arm study into a single intervention group, and all relevant controls of that study into a single control group. When extracting data from cluster-RCTs, we considered whether study authors had made allowances for clustering in the data analysis reported, and when available, used data adjusted for clustering effects. When studies reported analyses that accounted for the clustered study design, we estimated the effect on this basis. When this was not possible, and the information was unavailable from the authors, we carried out an approximately correct analysis (Higgins 2022). We imputed estimates of the intra-cluster correlation coefficient (ICC), as reported in the study, using estimates derived from similar studies, or using general recommendations from empirical research.

Dealing with missing data

We calculated quit rates on an intention-to-treat basis, and assumed that participants lost to follow-up were still smoking. However, we excluded deaths from the denominators of studies. Where abstinence data were missing, we contacted study authors for further information or clarifications.

Assessment of heterogeneity

We assessed the characteristics of included studies to identify any clinical or methodological heterogeneity before pooling studies and conducting meta-analyses. Where we deemed studies homogeneous enough to be meaningfully combined, we conducted a meta-analysis and assessed statistical heterogeneity, using the I^2 statistic. We conducted subgroup and sensitivity analyses to investigate potential causes of the observed heterogeneity.

Assessment of reporting biases

If we had been able to meta-analyze abstinence rates from at least ten studies, we planned to assess reporting bias using funnel plots. Funnel plots illustrate the relationship between the effect estimates from individual studies against their size or precision. The greater the degree of asymmetry, the greater the risk of reporting bias.

Data synthesis

We conducted our analyses in Review Manager 5.4 (Review Manager 2020). We pooled studies for our waterpipe abstinence outcome using Mantel-Haenszel random-effects methods to generate pooled RRs with 95% CIs. We used a random-effects model to accommodate anticipated variations across included studies in the interventions and comparators administered to participants. An RR greater than one indicated that people were more likely to quit in the intervention group than in the control group.

Subgroup analysis and investigation of heterogeneity

We conducted subgroup analyses to account for clinical heterogeneity among studies.

We grouped studies by:

1. Type of tobacco use (exclusive waterpipe users; dual waterpipe users)
2. Level of participant motivation (recruited based on being motivated to quit; recruited regardless of motivation)

Sensitivity analysis

We conducted a sensitivity analysis removing studies deemed to be at an overall high risk of bias.

Summary of findings and assessment of the certainty of the evidence

Following standard Cochrane methodology, we used the five GRADE considerations (risk of bias, inconsistency of effect, imprecision, indirectness, and publication bias) to assess the certainty of the body of evidence for our primary outcome (Schünemann 2022; Schünemann 2022a). Depending on our assessment of these considerations in each intervention

comparison, we judged the certainty of the evidence for this outcome to be high, moderate, low, or very low. To present these judgments, we used GRADEpro GDT to create a summary of findings table with the following intervention comparisons: behavioral interventions, pharmacotherapy interventions, and e-health interventions (GRADEpro GDT).

RESULTS

Description of studies

See [Characteristics of included studies](#); Characteristics of ongoing studies; and [Characteristics of excluded studies](#) for specific details.

Results of the search

The new searches for this update of the review retrieved 153 unique records. We also included two out of three studies from the previous review, and one previously excluded study, which was now eligible due to changes in our eligibility criteria, documented in the [Differences between protocol and review](#) (reported abstinence at three-month follow-up). After title and abstract screening, we classified 23 studies as potentially eligible for inclusion. After full-text screening, we identified nine studies that met inclusion criteria. The flow of studies through the systematic review process for this update is shown in [Figure 1](#).

Figure 1. Study selection PRISMA flow chart

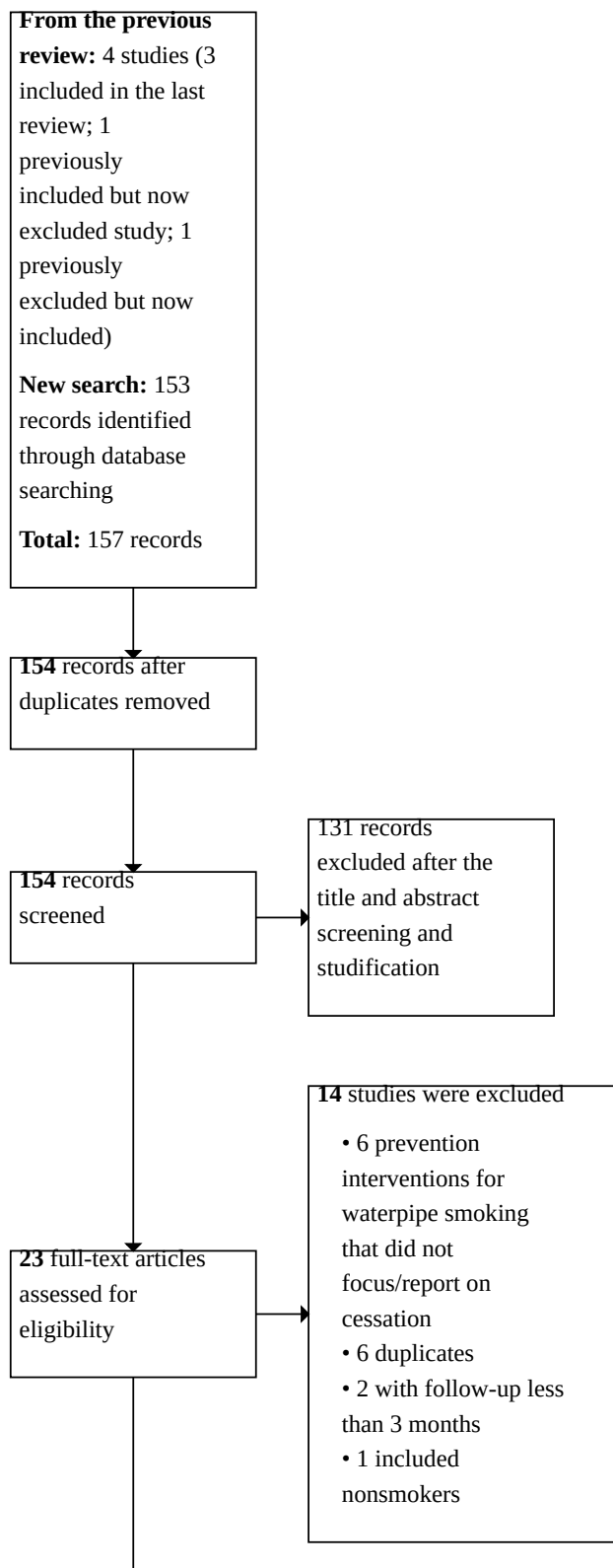
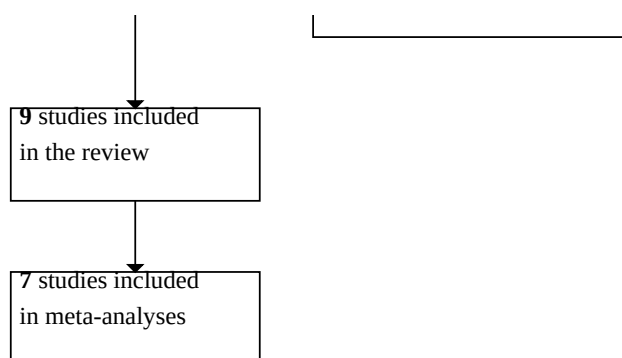


Figure 1. (Continued)



Included studies

This review included nine studies, involving 2841 participants. We identified six new studies in the current update (Chami 2022; Dadipoor 2022; Dogar 2018; Jiang 2019; Joveini 2020; Mays 2021), in addition to two studies included in the previous review (Dogar 2014; Lipkus 2011). We excluded one previously included study because it also recruited participants who did not smoke a waterpipe (Mohlman 2013), and included one study that was previously excluded but is now eligible as it reported abstinence at three months follow-up (Asfar 2014).

Types of studies

Five studies were randomized controlled trials (RCT), in which the individual participant was the unit of randomization (Asfar 2014; Chami 2022; Dogar 2018; Lipkus 2011; Mays 2021). Among these, four studies were two-arm RCTs (Asfar 2014; Chami 2022; Dogar 2018; Lipkus 2011), and one was a two-site, three-arm, parallel-group RCT (Mays 2021). Three studies were quasi-experimental studies, using community health centers or colleges as the unit of randomization (Dadipoor 2022; Jiang 2019; Joveini 2020). Another study was a cluster-RCT, using tuberculosis health centers as the unit of randomization (Dogar 2014). Six studies were funded by government agencies (the American National Cancer Institute, National Institute on Drug Abuse, and Fogarty International Center, and the Canadian International Development Research Centre [Asfar 2014; Dadipoor 2022; Dogar 2014; Jiang 2019; Lipkus 2011; Mays 2021]), two studies were funded by a pharmaceutical company (Pfizer [Chami 2022; Dogar 2018]), and one study was funded by a university (Tehran University of Medical Sciences, Iran [Joveini 2020]).

Type of settings and participants

Studies were carried out in Iran (Dadipoor 2022; Joveini 2020), Vietnam (Jiang 2019), Syria (Asfar 2014), Pakistan (Dogar 2014; Dogar 2018), Lebanon (Chami 2022), and the USA (Lipkus 2011; Mays 2021). Studies were conducted in a range of settings, including colleges/universities (Chami 2022; Joveini 2020), community healthcare centers (Dadipoor 2022), tuberculosis healthcare centers (Dogar 2014), cancer treatment centers (Asfar 2014), rural health centers (Jiang 2019), and hospitals (Dogar 2018). One study tested an online web-based intervention (Lipkus 2011), and another tested a text messages intervention (Mays 2021). Eight studies were conducted on adults (Asfar 2014; Chami 2022; Dogar

2014; Dogar 2018; Jiang 2019; Joveini 2020; Lipkus 2011; Mays 2021), and one study was conducted among women aged 15 years and older (Dadipoor 2022). Four studies recruited participants from specific population groups, including people with suspected tuberculosis (Dogar 2014), and college students (Joveini 2020; Lipkus 2011; Mays 2021).

Studies varied regarding participants' smoking status and motivation to quit using the waterpipe. Seven studies targeted people who exclusively smoked a waterpipe (Asfar 2014; Chami 2022; Dadipoor 2022; Dogar 2018; Joveini 2020; Lipkus 2011; Mays 2021), and two studies targeted people smoking combustible cigarettes, waterpipe, or both (Dogar 2014; Jiang 2019). Abstinence outcomes for the three types of participants were reported separately in Jiang 2019 and Dogar 2014. We use waterpipe cessation specifically for our analyses. The waterpipe smoking status definition used to determine eligibility differed across studies. Participants in Mays 2021 and Joveini 2020 smoked a waterpipe at least once a month, participants in Jiang 2019 smoked cigarettes and a waterpipe some days or every day, participants in Dogar 2018 smoked a waterpipe daily, participants in Dogar 2014 smoked a local form of unflavored waterpipe tobacco ten times a day on average, participants in Asfar 2014 smoked a waterpipe at least three times a week in the previous year, participants in Chami 2022 smoked a waterpipe five to seven times a week, participants in Dadipoor 2022 smoked waterpipe four times a week for at least six months, and participants in Lipkus 2011 smoked a waterpipe at least once a month. Only four studies only selected participants based on their motivation (or readiness) to quit waterpipe (Asfar 2014; Chami 2022), or all forms of tobacco (Dogar 2018; Jiang 2019). The other studies did not specify this criterion in their eligibility criteria (e.g. the participant is willing to participate in the study, but is not required to be ready to quit waterpipe). No studies focussed on inducing quit attempts among people not seeking support.

Types of interventions

Eight studies tested individual-level interventions (Asfar 2014; Chami 2022; Dogar 2014; Dogar 2018; Jiang 2019; Joveini 2020; Lipkus 2011; Mays 2021), and one tested group-based interventions at the community level (Dadipoor 2022). Five studies tested behavioral interventions at different intensities (Asfar 2014; Dadipoor 2022; Dogar 2014; Jiang 2019; Joveini 2020). Three of those interventions were based on the 5 As model theoretical

framework for cigarette smoking (Asfar 2014; Dogar 2014; Jiang 2019). Three studies tested pharmacological interventions (Chami 2022; Dogar 2014; Dogar 2018). Two tested varenicline compared to placebo (Chami 2022; Dogar 2018), and one tested bupropion combined with behavioral support compared to behavioral support alone, or self-help materials alone (Dogar 2014). Two studies tested e-health interventions (Lipkus 2011; Mays 2021). One study tested a 6-week tailored mobile messaging intervention conveying the risks of waterpipe tobacco and strategies to enhance motivation and support quitting (Mays 2021). The frequency and duration of the messages were tailored, based on participants' waterpipe tobacco smoking patterns. The second study tested brief versus intensive online educational interventions targeting college students in the USA (Lipkus 2011).

Types of outcome measures

A wide range of waterpipe abstinence definitions were used. Four studies used seven-day point prevalence abstinence (Chami 2022; Dogar 2018; Jiang 2019; Mays 2021), three studies used self-reported waterpipe abstinence (Dadipoor 2022; Joveini 2020; Lipkus 2011), one study used continuous abstinence (Dogar 2014), and one study used prolonged abstinence (Asfar 2014). Five studies out of the nine included studies reported biochemically validated waterpipe abstinence, using exhaled carbon monoxide (CO) levels of < 10 ppm (Asfar 2014; Chami 2022; Dogar 2014; Dogar 2018; Jiang 2019). In six studies, participants were followed for a maximum

of six months (Dogar 2014; Dogar 2018; Jiang 2019; Lipkus 2011; Mays 2021, Dadipoor 2022), and in one for twelve months (Joveini 2020). In two studies, the final follow-up was three months after the intervention (Asfar 2014; Chami 2022).

Two of the three pharmacologic studies reported adverse events (Chami 2022; Dogar 2018).

Excluded studies

We listed nine studies from our searches as potentially relevant studies that did not meet all inclusion criteria. We listed these studies with reasons for exclusion in the [Characteristics of excluded studies](#) table. Six studies tested prevention interventions for waterpipe smoking and did not consider waterpipe cessation as an outcome (Leavens 2018; Mohammadi 2019; Mojahed 2018; Nakkash 2018; Shelley 2021; Thomas 2015), one recruited non-waterpipe smokers (Mohlman 2013), and two followed participants for less than three months (Alzyoud 2018; Shishani 2018).

Risk of bias in included studies

A summary of the risk of bias assessments for the included studies can be found in [Figure 2](#). Overall, we considered three studies at low risk of bias (Asfar 2014; Chami 2022; Dogar 2018), and six at high risk of bias (Dadipoor 2022; Dogar 2014; Jiang 2019; Joveini 2020; Lipkus 2011; Mays 2021).

Figure 2. Risk of bias summary: review authors' judgments about each risk of bias item for each included study + Low risk, - High risk and? Unclear risk

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias): All outcomes	Blinding of outcome assessment (detection bias): All outcomes	Incomplete outcome data (attrition bias): All outcomes	Selective reporting (reporting bias)	Other bias
Asfar 2014	+	?		+	+	+	
Chami 2022	+	+	+	+	+	+	
Dadipoor 2022	-	-		-	+	+	
Dogar 2014	+	+	-	+	+	+	-
Dogar 2018	+	+	+	+	+	+	
Jiang 2019	-	-		+	+	?	
Joveini 2020	-	-		-	?	?	
Lipkus 2011	+	?		-	+	?	
Mays 2021	+	?		-	+	?	

Allocation

We judged six studies at low risk for random sequence generation bias, as they adequately described the randomization process (Asfar 2014; Chami 2022; Dogar 2014; Dogar 2018; Lipkus 2011; Mays 2021), while three studies were at high risk (Dadipoor 2022; Jiang 2019; Joveini 2020).

For allocation concealment, we considered three studies at low risk of bias (Chami 2022; Dogar 2014; Dogar 2018), and three at high risk of bias, because the participants were recruited after the clusters were randomized, which could have influenced recruitment (Dadipoor 2022; Jiang 2019), or because the study was only quasi-randomized (Joveini 2020). We considered the remaining three studies as unclear risk of allocation concealment due to a lack of information (Asfar 2014; Lipkus 2011; Mays 2021).

Blinding

We assessed performance bias in only three studies (Chami 2022; Dogar 2014; Dogar 2018) because the remaining six studies tested behavioral interventions alone (as specified in the methods). We judged Dogar 2018 and Chami 2022 at low risk of bias as they used a placebo to facilitate blinding, whereas Dogar 2014 was considered at high risk due to lack of a placebo.

We rated five studies at low risk of detection bias (Asfar 2014; Chami 2022; Dogar 2014; Dogar 2018; Jiang 2019), while the remaining four studies were judged at high risk of bias because they did not biochemically verify abstinence, and the intervention and control arms did not receive similar amounts of contact.

Incomplete outcome data

We rated eight studies at low risk of attrition bias (Asfar 2014; Chami 2022; Dadipoor 2022; Dogar 2014; Dogar 2018; Jiang 2019; Lipkus 2011; Mays 2021). Missing data ranged from 7% in Dogar 2014 to 41% in Chami 2022. We judged one study at unclear risk for incomplete outcome data because attrition rates were not reported.

Selective reporting

We judged five studies at low risk for selective reporting (Asfar 2014; Chami 2022; Dadipoor 2022; Dogar 2014; Dogar 2018) because

reported outcomes were consistent with the methods sections of protocols or trial registry entries. We could not find prespecified methods in the form of protocols or trial registry entries for the remaining studies, so we judged them at unclear risk.

Other potential sources of bias

Baseline characteristics were unbalanced between treatment groups in one cluster-randomized study, and therefore, we deemed this study at high risk (Dogar 2014).

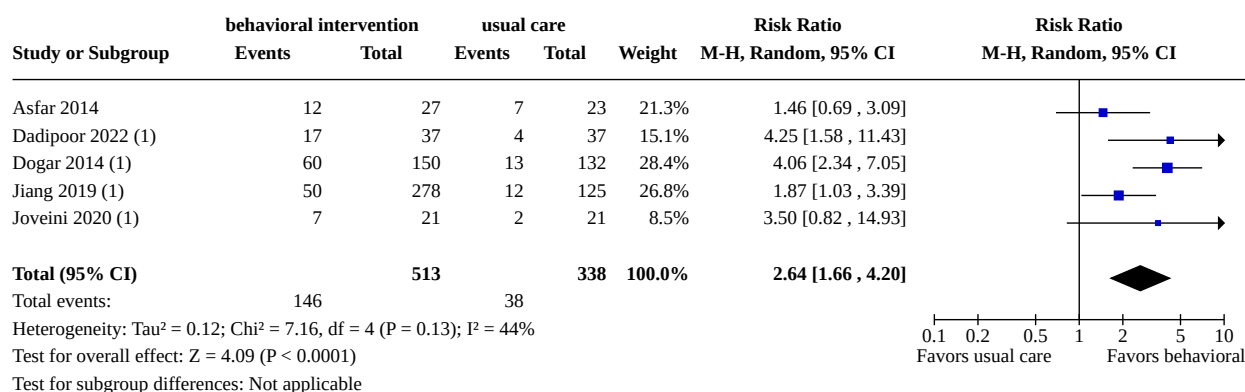
Effects of interventions

See: **Summary of findings 1 Interventions for waterpipe smoking cessation**

Face-to-face behavioral support

After adjusting for cluster randomization in Dadipoor 2022; Dogar 2014; Jiang 2019, and Joveini 2020, we pooled the five studies on this intervention ($N = 851$ effective participants sample size) in our meta-analysis (Asfar 2014; Dadipoor 2022; Dogar 2014; Jiang 2019; Joveini 2020). See Figure 3. These studies tested more than one session of face-to-face behavioral interventions compared with self-help, brief advice, or no intervention. Three studies included only exclusive waterpipe users (Asfar 2014; Dadipoor 2022; Joveini 2020); the other two studies included exclusive waterpipe users, exclusive cigarette users, and dual waterpipe and cigarette users. We included only exclusive waterpipe users and dual users from these studies in our meta-analysis. Dogar 2014 was a three-arm cluster-RCT testing a self-help intervention versus a behavioral support combined with bupropion medication. We included only the self-help and behavioral intervention alone study arms in this meta-analysis. We used an assumed intracluster correlation coefficient (ICC) of 0.036 to adjust for the cluster-randomized designs, ending with these estimated design effects for Dadipoor 2022 (2.872), Dogar 2014 (1.792), Jiang 2019 (1.832), and Joveini 2020 (3.664). Therefore, the effective samples for the intervention and comparison arms were 37 versus 37 (Dadipoor 2022), 150 versus 132 (Dogar 2014), 278 versus 125 (Jiang 2019), and 21 versus 21 (Joveini 2020), using the *Cochrane Handbook* (Higgins 2022). We used these adjusted numbers for the meta-analysis.

Figure 3.



Footnotes

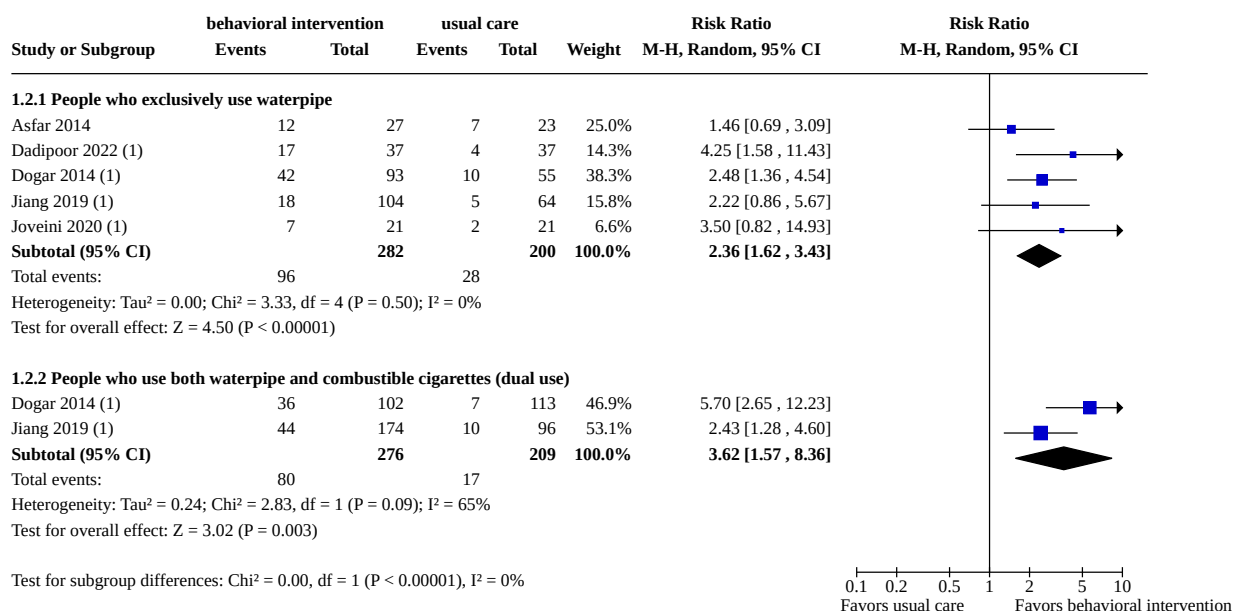
(1) Cluster randomization was adjusted for with intraclass correlation coefficient (ICC) of 0.036

Overall, we found evidence of benefit from behavioral support (risk ratio (RR) 2.64, 95% confidence interval (CI) 1.66 to 4.20; $I^2 = 44\%$; 5 studies, $N = 851$; [Analysis 1.1](#); [Figure 3](#); low-certainty evidence).

We conducted two subgroup analyses. First, we divided studies by whether they included exclusive waterpipe users or dual users. We used data from five studies in the exclusive waterpipe users subgroup ([Asfar 2014](#); [Dadipoor 2022](#); [Dogar 2014](#); [Jiang 2019](#); [Joveini 2020](#)), and two studies in the dual users subgroup ([Dogar 2014](#); [Jiang 2019](#)). We found no evidence of subgroup difference ($P = 0.36$; $I^2 = 0\%$; [Analysis 1.2](#); [Figure 4](#)). Second, we divided studies by participants' selection based on their motivation to quit, as indicated by the method of recruitment. Two studies

recruited participants who were motivated to quit ([Asfar 2014](#); [Jiang 2019](#)), and three studies recruited participants regardless of their motivation status ([Dadipoor 2022](#); [Dogar 2014](#); [Joveini 2020](#)). We did not find clear evidence of a difference in how effects should be interpreted across subgroups ($P = 0.17$; $I^2 = 47.9\%$; [Analysis 1.3](#); [Figure 5](#)). In both cases, the subgroup effect estimates favored the intervention. We could not conduct our planned sensitivity analysis because only one study was not at high risk of bias ([Asfar 2014](#)). The point estimate for [Asfar 2014](#) demonstrated a benefit of more intensive behavioral intervention; however, the CI incorporated the possibility of no difference and a benefit of brief intervention, as well as a potential benefit of more intensive intervention (RR 1.46, 95% CI 0.69 to 3.09; $N = 50$; [Analysis 1.3](#)).

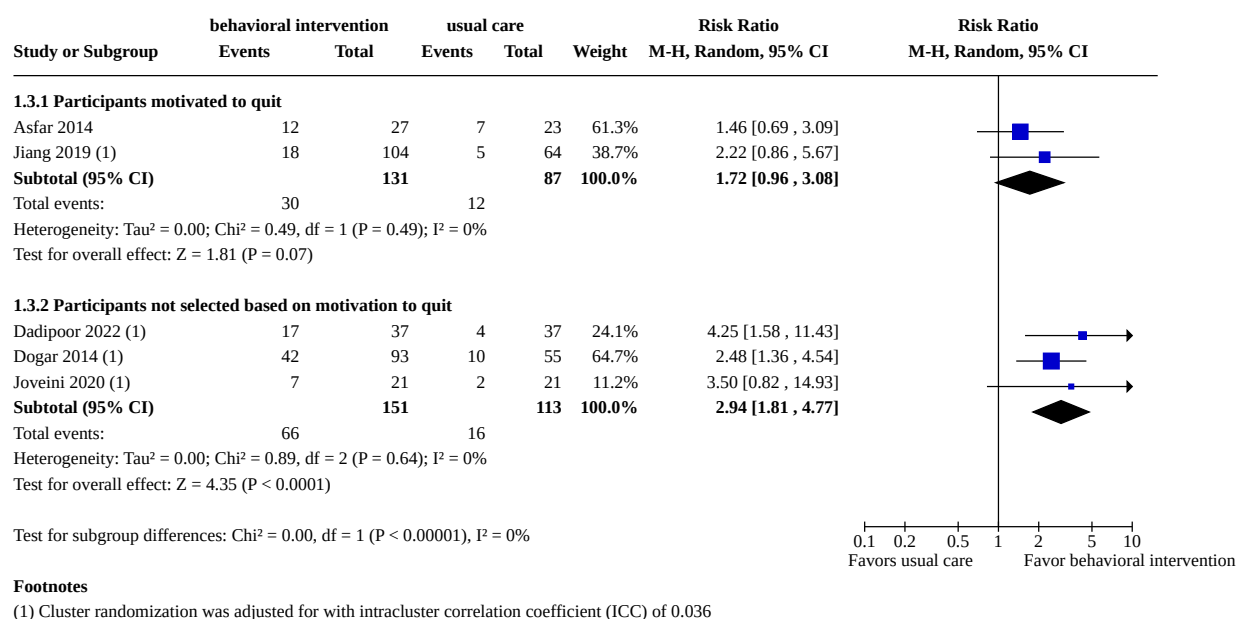
Figure 4.



Footnotes

(1) Cluster randomization was adjusted for with intraclass correlation coefficient (ICC) of 0.036

Figure 5.

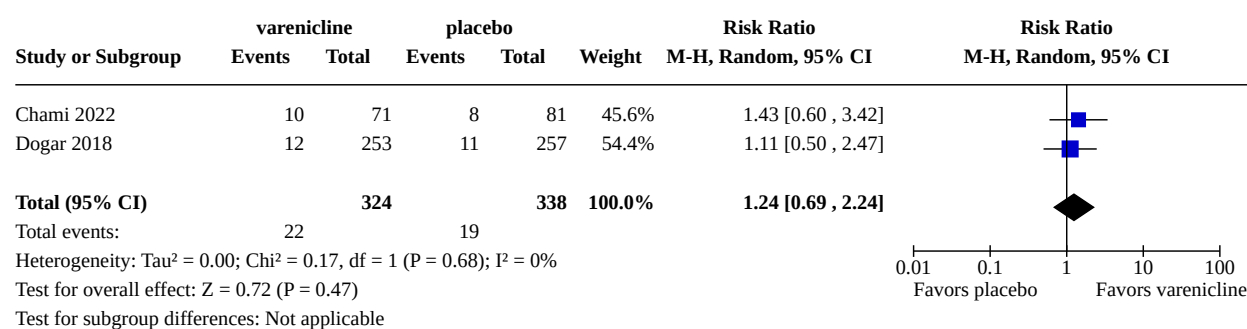


Varenicline

We pooled two studies ($N = 662$ participants) in our meta-analysis (Chami 2022; Dogar 2018). The two studies tested varenicline plus brief behavioral intervention versus placebo plus brief behavioral intervention among exclusive waterpipe smokers. The point

estimate showed more people randomized to receive varenicline quit waterpipe smoking (RR 1.24, 95% CI 0.69 to 2.24; 2 studies, $N = 662$; Analysis 2.1, Figure 6; low-certainty evidence). However, the results were limited by imprecision, with CIs incorporating the potential for harm, as well as benefit.

Figure 6.



Dogar 2018 reported 34 adverse events in 27 participants (11 in the varenicline arm and 16 in the placebo arm), while Chami 2022 reported 410 adverse events in 103 participants (50 in the varenicline arm and 53 in the placebo arm). When pooled, we did not find clear evidence of a difference between arms (RR 0.98, 95% CI 0.67 to 1.44; $I^2 = 31\%$; 2 studies, 662 participants; Analysis 2.2), although there was substantial imprecision. None of the events were deemed serious in either study (Analysis 2.3). Reported adverse events included respiratory disorders, gastrointestinal disorders, general disorders, immune system disorders, renal and urinary disorders, nervous system disorders, psychiatric disorders, headache, sleep disturbance, fatigue, skin reaction, change in appetite, and ear, nose, and throat symptoms.

Bupropion

Dogar 2014 was a three-arm cluster-RCT that tested self-help materials versus brief behavioral intervention, and versus brief behavioral intervention plus bupropion among cigarette or waterpipe smokers. We considered the data provided by waterpipe smokers only. Compared to the behavioral support alone group, behavioral support plus bupropion did not provide clear evidence of increased quitting at the 25-week follow-up (RR 0.77, 95% CI 0.42 to 1.41; 1 study, $N = 121$; Analysis 3.1; very low-certainty evidence). Dogar 2014 also tested a combined pharmacotherapy and behavioural support intervention. Compared to the self-help materials group, behavioral support plus bupropion resulted in higher quit rates at 25 weeks of follow-up. However, this was inconclusive due to imprecision and risk of bias (RR 1.94, 95%

CI 0.94 to 4.00; 1 study, N = 86; [Analysis 4.1](#); very low-certainty evidence).

[Dogar 2014](#) did not report on adverse events.

E-health interventions

Two studies tested e-health interventions for waterpipe use ([Lipkus 2011](#); [Mays 2021](#)). Due to the variation in the studies, we did not pool the results of these studies using meta-analysis. [Mays 2021](#) tested a tailored mobile phone messaging waterpipe intervention compared with an untailored intervention or no intervention in young adults in the USA. Quit rates were higher among participants randomized to either the tailored or untailored intervention groups compared with those in the no intervention control group (RR 1.41, 95% CI 1.01 to 1.97; 1 study, N = 349; [Analysis 5.1](#)), but we did not detect a clear difference in quit rates between those receiving tailored messages and those receiving untailored messages (RR 1.24, 95% CI 0.89 to 1.71; 1 study, N = 130; [Analysis 5.1](#)). [Lipkus 2011](#) tested an online educational intervention targeting college students in the USA, comparing the effect of an intensive twenty-slide presentation with a brief eight-slide presentation. Smoking abstinence rates were higher in the more intensive intervention group (RR 1.91, 95% CI 1.06 to 3.43; 1 study, N = 88; [Analysis 5.1](#)). Overall, we deemed this body of evidence as very low certainty.

DISCUSSION

Summary of main results

We conducted two meta-analyses for the primary outcome of waterpipe abstinence at three months or longer. The first analysis included five studies (N = 1030 participants) that tested face-to-face behavioral interventions with different intensities (2 to 7 counseling sessions) in comparison to lower intensity interventions (brief advice, self-help materials, no support). The interventions were based on best practice cessation interventions for people who smoke combustible cigarettes in three studies, and adapted to people who used waterpipes in one study. Overall, we found low-certainty evidence that behavioral interventions increase the chances of achieving waterpipe smoking abstinence. Our subgroup analyses tested the differences between exclusive waterpipe users and dual users, and between those selected based on their motivation to quit and those not selected based on their motivation, and found no clear evidence of subgroup differences.

We also found low-certainty evidence with a point estimate showing higher waterpipe quit rates in response to varenicline; however, confidence intervals included the potential for no difference or lower quit rates as well as benefit. Adverse events in the two studies were reported, but there was no clear evidence of a difference between study arms, and none of the events reported were severe. In addition, data on the effectiveness of bupropion on waterpipe smoking cessation were inconclusive. We found only one study that tested the effect of bupropion. This study showed evidence of benefit from a combined intervention of bupropion and behavioral support compared with self-help materials, but not compared with behavioral support alone. These results do not match the well-established effect of varenicline and bupropion in cigarette smoking cessation ([Hajizadeh 2023](#); [Livingstone-Banks 2023](#); [Stead 2016](#)). They should be treated with caution due to the limitations of the evidence, including imprecision and risk of bias, so we cannot rule out that varenicline and bupropion work as

well in waterpipe users as in cigarette smokers. On the other hand, the profound differences between cigarette and waterpipe smoking behaviors and addiction patterns could mean a difference in how well these interventions work among waterpipe users. Waterpipe smoking has a solid social dependence dimension ([Ward 2015](#)). While cigarette smoking can be a solitary behavior, waterpipes are more often shared and smoked in socially enjoyable settings ([Akl 2015](#); [Alam 2020](#)). In addition, the local sociocultural norms favoring waterpipe smoking and the lack of waterpipe control policies and regulations (e.g. taxation, enforcement of waterpipe smoking ban in public places, and applying health warning labels on waterpipe devices and tobacco) may contribute to lower waterpipe smoking cessation rates. Mass media campaigns and community outreach interventions that consider waterpipe-specific social cues have the potential to challenge current waterpipe social norms and encourage cessation ([Maziak 2019](#); [Salloum 2016](#)).

Two studies tested e-health interventions for waterpipe use. Due to the variation in the studies, we did not pool the results of the studies using a meta-analysis. The first study tested a brief versus intensive online educational intervention among college students. Smoking abstinence rates were higher in the intensive intervention compared with the brief intervention. The second study tested a tailored mobile text-messaging intervention compared with either an untailored or no intervention. Quit rates were higher among participants in the tailored and untailored intervention groups compared with those in the no intervention control group. While we judged this evidence to be of very low certainty, e-health is a promising strategy for waterpipe smoking cessation interventions. E-health interventions might have a high reach because most waterpipe smokers are young adults who are receptive to e-health interventions ([Villanti 2017](#)). In addition, e-health interventions are highly scalable, with the potential to be available at a low cost at the population level. Therefore, further research is needed to explore the effectiveness of this setting.

Overall completeness and applicability of evidence

Given the strong cultural component in waterpipe use, which can vary substantially by country, there are potential limitations for the generalizability of our results. Studies were carried out in Iran, Vietnam, Syria, Lebanon, Pakistan, Egypt, and the USA. These countries have significant differences in culture, healthcare systems, and socioeconomic status, which should be taken into account when interpreting these results. In addition, although most studies described how the interventions were delivered (e.g. text messaging, in-person, number of sessions, etc.), details about the content and specific behavior change techniques were often lacking. Future trials should include comprehensive descriptions of the interventions delivered. Finally, the studies were not comparable in terms of participants' smoking status at baseline. For example, several studies recruited exclusive regular waterpipe smokers but used different definitions, such as smoked waterpipe at least once monthly, smoked waterpipe daily, or smoked waterpipe at least three times a week. Other studies recruited dual waterpipe users, defined as current dual users (smoked cigarettes and waterpipe in the past seven days) or daily dual users (smoked cigarettes and waterpipe more than once a day). Adopting standard definitions and assessments of waterpipe use and dependence would facilitate comparing waterpipe cessation interventions in the future ([Maziak 2015b](#)).

Quality of the evidence

We judged three studies to be at low risk of bias and six studies to be at high risk of bias. The most common reason was high risk of detection bias, because waterpipe-use status was self-reported, and there was differential face-to-face contact with investigators across study arms. For the primary abstinence outcome, we assessed the certainty of the evidence for our analysis using the GRADE system (Schünemann 2022). In the face-to-face behavioral intervention comparison, the certainty was downgraded one level due to imprecision (i.e. fewer than 300 events in the analysis), and another level because none of the included studies were at low risk of bias. In addition, the included behavioral interventions were heterogeneous and not always well described, and the trials used inconsistent definitions of baseline waterpipe smoking status. In the varenicline comparison, the certainty was downgraded by two levels due to imprecision (i.e. fewer than 150 events in the analysis). We downgraded the comparisons testing bupropion and e-health interventions one level each, because of high risk of bias, and by two levels due to imprecision.

Potential biases in the review process

Cochrane's methods are designed to minimize reviewer bias where possible. For example, at least two review authors independently conducted study selection, data extraction, and risk of bias assessments. A potential key limitation of the review is that we may have failed to identify all relevant research for inclusion in the review. However, given the nature of the Cochrane methods, we are confident that any failures in the identification of studies for inclusion will not be systematic, and therefore, should not have a significant impact on the validity of our results.

We did not find enough studies to conduct a formal assessment of the risk of publication bias. However, this risk cannot be ruled out, and the possibility of publication bias should be taken into account when interpreting the results of this review.

Agreements and disagreements with other studies or reviews

Three other reviews have explored the effects of waterpipe smoking cessation interventions (Babaie 2021; Jawad 2016; Kader 2019). None of these reviews included meta-analyses. The main objective of Jawad 2016 was to systematically review the literature for interventions targeting the prevention and cessation of waterpipe tobacco smoking, including legislative interventions. This review considered a broader range of study designs (randomized controlled trials (RCT), non-RCT, observational studies, qualitative studies). Four of our included studies were reported descriptively in this review. They concluded that few studies showed promising results, but that small sample sizes and high risk of bias meant that better designed and larger trials were required for firmer conclusions. Kader 2019 attempted to systematically review interventions aimed at reducing waterpipe use with a focus on the RE-AIM framework (reach, efficacy, adoption, implementation, maintenance). Five of our included studies were reported descriptively in this review. In line with our findings, they concluded that despite limited evidence on interventions for reducing waterpipe use, counseling and educational support appeared the most promising. Babaie 2021 aimed to identify the types of interventions used for preventing and controlling waterpipe smoking. This review identified 27 interventions that

were categorized into four main themes, including preventive interventions, control interventions (policies and regulations), and actual enactment, and implementation of legislation and policies.

Prior research identified several high-risk groups for waterpipe smoking. As evident from several epidemiological studies worldwide, waterpipe use has increased the most among youth and young adults (Maziak 2015b). Our search identified several potential studies targeting these high-risk groups; however, most of these studies were not eligible for our review for several reasons. Most of these studies were uncontrolled pre-post studies (Alzyoud 2018), had a focus on prevention outcomes (e.g. knowledge, harm perception, initiation, intention to quit [Leavens 2018; Mays 2016]), or a focus on reducing craving (Pourmohammad 2016), or the studies only reported short-term (less than three months) abstinence (Alzyoud 2018; Johnson 2019; Nakkash 2018; Shishani 2018).

Another high-risk group for waterpipe smoking is pregnant women. Waterpipe smoking during pregnancy increases the risk of spontaneous miscarriage, premature birth, and low birth weight (Al-Sheyab 2016; Khabour 2016; Nematollahi 2018; Tamim 2008). Waterpipe smoking prevalence is relatively high among women in the Eastern Mediterranean region, ranging from 6% to 18%, due to the social acceptability of waterpipe smoking among women in that region compared with cigarettes (Azab 2013; Baheiraei 2012; Mirahmadizadeh 2008). We found only one study that was conducted in 2017, among 140 suburban pregnant women, who were identified as waterpipe users during their visit to receive prenatal care in healthcare centers in the outskirts of Zahedan, Iran (Mojahed 2018). The study was a quasi-experimental study that involved a control group and a pre-post-test design, and assessed a behavioral intervention aimed at reducing waterpipe craving and dependence. Participants were assigned to either the intervention or control group. The intervention group received five motivational group interview sessions about waterpipe smoking withdrawal. The control group was given the usual care (brief advice) to quit the waterpipe. A notable reduction in waterpipe craving and dependence was observed between the two groups at two-month follow-up. However, the study did not measure quitting.

A growing high-risk group that should be the focus of waterpipe smoking cessation efforts is dual users. Data from the first three waves (2013 to 2016) of the Population Assessment of Tobacco and Health Study, a nationally representative, longitudinal cohort study of adults and youth in the USA, indicated that most waterpipe poly tobacco users used cigarettes (youth: 49.4%, young adults: 59.4%, adults 25+: 63.2%), and had lower rates of quitting all tobacco than exclusive hookah users or hookah poly tobacco users who did not use cigarettes (Sharma 2020). In a study in Jordan, the prevalence of dual cigarette and waterpipe users among adolescents (age 11 to 17 years) was 30%, which was greater than waterpipe alone (21.1%), or cigarettes alone (6.7% [Alomari 2018]). Compared with exclusive waterpipe users, dual users have higher nicotine dependence, are less interested in quitting, and are less likely to make a quit attempt (Abbadi 2020; Shelley 2017). This group seems to be receiving increasing attention among researchers, as three of the included studies in our review enrolled waterpipe dual users. Our subgroup analysis testing the difference in the intervention effects between exclusive and dual waterpipe users showed no clear difference. However, only two studies were included in the

dual users group and the study designs were heterogeneous, so the results must be interpreted cautiously.

AUTHORS' CONCLUSIONS

Implications for practice

- There is low-certainty evidence that behavioral waterpipe cessation interventions can increase quit rates among waterpipe smokers.
- There is insufficient evidence with which to evaluate the effect of pharmacotherapy in combination with behavioral intervention for waterpipe smoking cessation.
- There is insufficient evidence with which to evaluate the effect of e-health interventions for waterpipe smoking cessation.

Implications for research

- Further large and well-designed randomized controlled trials (RCT) on behavioral waterpipe cessation interventions are needed.
- The limited number of studies evaluating pharmacological interventions suggests that future studies should explore this further, ensuring that behavioral co-interventions are matched between study arms.
- Given the potential reach and effectiveness of m-health interventions for waterpipe smoking cessations, trials with large samples and long follow-up periods of six months or more are needed.

- Future studies should use biochemical validation of abstinence to mitigate the risk of detection bias.
- There has been limited attention to high-risk groups for waterpipe smoking, such as youth, young adults, pregnant women, and dual or poly tobacco users. More research is needed in these groups.
- Further research should test whether waterpipe-specific cessation interventions that address waterpipe-specific social cues have the potential to challenge current waterpipe social norms and improve cessation outcomes.

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REFERENCES

References to studies included in this review

Asfar 2014 {published data only}

Asfar T, Al Ali R, Rastam S, Maziak W, Ward KD. Behavioral cessation treatment of waterpipe smoking: the first pilot randomized controlled trial. *Addictive Behaviors* 2014;**39**(6):1066-74.

NCT01135173. Waterpipe Cessation Intervention Study. clinicaltrials.gov/ct2/show/NCT01135173 (first posted 2 June 2010).

Chami 2022 {published data only}

Chami HA, Zaouk N, Makki M, Tamim H, Shaya M, Talih F. Varenicline treatment for waterpipe smoking cessation. *Nicotine and Tobacco Research* 2023;**25**(1):111-9.

NCT02575183. Varenicline (Chantix) Treatment for Waterpipe Smoking Cessation. clinicaltrials.gov/ct2/show/NCT02575183 (first posted 14 October 2015).

Dadipoor 2022 {published data only}

Dadipoor S, Heyrani A, Mirzaei-Alavijeh M, Aghamolaei T, Ghaffari M, Ghanbarnejad A. Using intervention mapping for hookah smoking cessation: a quasi-experimental evaluation. *Addiction Science & Clinical Practice* 2022;**17**(1):18.

IRCT20190126042494N1. Design, implementation and evaluation of a hookah smoking quitting program among women in Bandar Abbas with an intervention mapping approach. en.irct.ir/trial/37129 (first registered 03 March 2019).

Dogar 2014 {published data only}

* Dogar O, Jawad M, Shah SK, Newell JN, Kanaan M, Khan MA, et al. Effect of cessation interventions on hookah smoking: post-hoc analysis of a cluster-randomized controlled trial. *Nicotine & Tobacco Research* 2014;**16**(6):682-8.

Elsei H, Dogar O, Ahluwalia J, Siddiqi K. Predictors of cessation in smokers suspected of TB: secondary analysis of data from a cluster randomized controlled trial. *Drug and Alcohol Dependence* 2015;**155**:128-33.

ISRCTN08829879. An intervention to stop tobacco use among patients suspected of tuberculosis (TB). www.isrctn.com/ISRCTN08829879 (submitted 5 December 2008).

Siddiqi K, Khan A, Ahmad M, Dogar O, Kanaan M, Newell JN, et al. Action to stop smoking in suspected tuberculosis (ASSIST) in Pakistan: a cluster randomized, controlled trial. *Annals of Internal Medicine* 2013;**158**(9):667-75.

Dogar 2018 {published data only}

* Dogar O, Zahid R, Mansoor S, Kanaan M, Ahluwalia JS, Jawad M, et al. Varenicline versus placebo for waterpipe smoking cessation: a double-blind randomized controlled trial. *Addiction* 2018;**113**(12):2290-9.

ISRCTN94103375. Hookah trial: the efficacy of varenicline in achieving abstinence among hookah smokers. isrctn.com/ISRCTN94103375 (first submitted 20 November 2015).

Kanaan M, Dogar O, Zahid R, Mansoor S, Jawad M, Ahluwalia JS, et al. Dependence and withdrawal symptoms among waterpipe tobacco smokers enrolled in a double-blind, placebo-controlled, randomised trial. *Tobacco Induced Diseases* 2018;**16**(1):341.

Shtaiwi A, Siddiqui F, Kanaan M, Siddiqi K. What factors are associated with waterpipe smoking cessation? A secondary data analysis. *Nicotine and Tobacco Research* 2022;**24**(4):581-9.

Zahid R, Dogar O, Mansoor S, Khan A, Kanaan M, Jawad M, et al. The efficacy of varenicline in achieving abstinence among waterpipe tobacco smokers - study protocol for a randomized controlled trial. *Trials* 2017;**18**(1):14.

Jiang 2019 {published data only}

Jiang N, Siman N, Cleland CM, Van Devanter N, Nguyen T, Nguyen N, et al. Effectiveness of village health worker-delivered smoking cessation counseling in Vietnam. *Nicotine & Tobacco Research* 2019;**21**(11):1524-30.

Joveini 2020 {published data only}

* Joveini H, Rohban A, Eftekhari AH, Dehdari T, Maheri M, Hashemian M. The effects of an education program on hookah smoking cessation in university students: an application of the Health Action Process Approach (HAPA). *Journal of Substance Use* 2020;**25**(1):62-9.

Lipkus 2011 {published and unpublished data}

Lipkus IM, Eissenberg T, Schwartz-Bloom RD, Prokhorov AV, Levy J. Affecting perceptions of harm and addiction among college waterpipe tobacco smokers. *Nicotine & Tobacco Research* 2011;**13**(7):599-610.

Mays 2021 {published data only}

Mays D, Johnson AC, Phan L, Sanders C, Shoben A, Tercyak KP, et al. Tailored mobile messaging intervention for waterpipe tobacco cessation in young adults: a randomized trial. *American Journal of Public Health* 2021;**111**(9):1686-95.

References to studies excluded from this review

Alzyoud 2018 {published data only}

Alzyoud S, Sreenivas V, Pbert L. Effectiveness of waterpipe smoking cessation intervention with youth. *Tobacco Induced Diseases* 2018;**16**(1):339-40.

Leavens 2018 {published data only}

Leavens ELS, Meier E, Tackett AP, Miller MB, Tahirkheli NN, Brett EI, et al. The impact of a brief cessation induction intervention for waterpipe tobacco smoking: a pilot randomized clinical trial. *Addictive Behaviors* 2018;**78**:94-100.

Mohammadi 2019 {published data only}

Mohammadi M, Ghaleiha A, Rahnama R. Effectiveness of a peer-led behavioral intervention program on tobacco use-related knowledge, attitude, normative beliefs, and intention to smoke among adolescents at Iranian public high schools. *International Journal of Preventive Medicine* 2019;**10**:111.

Mohlman 2013 {published data only}

Mohlman MK, Boulos DN, El Setouhy M, Radwan G, Makambi K, Jillson I, et al. A randomized, controlled community-wide intervention to reduce environmental tobacco smoke exposure. *Nicotine & Tobacco Research* 2013;**15**(8):1372-81.

Mojahed 2018 {published data only}

IRCT20160924029954N5. Impact of motivational interview on reducing hookah consumption. www.irct.ir/trial/23951 (first registered 22 January 2018).

* Mojahed K, Navidian A. The effect of motivational interviewing on craving and dependence on hookah in suburban pregnant women in South East of Iran. *Issues in Mental Health Nursing* 2018;**39**(8):693-9.

Nakkash 2018 {published data only}

Nakkash R, Lotfi T, Bteddini D, Haddad P, Najm H, Jbara L, et al. A randomized controlled trial of a theory-informed school-based intervention to prevent waterpipe tobacco smoking: changes in knowledge, attitude, and behaviors in 6th and 7th graders in Lebanon. *International Journal of Environmental Research and Public Health* 2018;**15**(9):1839.

Shelley 2021 {published data only}

Nguyen NT, Nguyen T, Abroms LC, Doan HT, Shelley DR. Feasibility, acceptability, and preliminary effectiveness of a text messaging intervention for smoking cessation in Vietnam. *Tobacco Induced Diseases* 2021;**19**(1):A284. [DOI: [10.18332/tid/141608](https://doi.org/10.18332/tid/141608)]

Shelley D, Jiang N, Cleland C, Nguyen T, Abroms L, Nguyen N. Adaptation and assessment of a text message cessation intervention for tobacco users in Vietnam. *Cancer Epidemiology, Biomarkers & Prevention* 2021;**30**(7 [Suppl]):17.

Shishani 2018 {published data only}

Shishani K, Odom-Maryon T, Roll J. The role of behavioral therapy in treating waterpipe addiction. *Tobacco Induced Diseases* 2018;**16**(1):197.

* Shishani K, Odom-Maryon T, Roll JM. A randomized clinical trial to evaluate the efficacy of contingency management for treatment of waterpipe tobacco addiction. *The American Journal on Addictions* 2018;**27**(3):202-9.

Thomas 2015 {published data only}

Thomas JL, Bengtson JE, Wang Q, Luo X, Marigi E, Ghidei W, et al. Abstinence rates among college cigarette smokers enrolled in a randomized clinical trial evaluating Quit and Win contests: the impact of concurrent hookah use. *Preventive Medicine* 2015;**76**:20-5.

Additional references
Abbadi 2020

Abbadi A, Alnahr J, Zoghoul S, Bsoul A, Alarood S, Al-Mistarehi AH, et al. Waterpipe nicotine dependence and depressive symptoms among adolescent waterpipe and dual users. *Journal of Environmental and Public Health* 2020;**N/A**:2364571.

Aboaziza 2015

Aboaziza E, Eissenberg T. Waterpipe tobacco smoking: what is the evidence that it supports nicotine/tobacco dependence? *Tobacco Control* 2015;**24**(Suppl 1):i44-i53.

Ahn 2012

Ahn S, Myers ND, Jin Y. Use of the estimated intraclass correlation for correcting differences in effect size by level. *Behavior Research Methods* 2012;**44**(2):490-502.

Akl 2011

Akl EA, Gunukula SK, Aleem S, Obeid R, Jaoude PA, Honeine R, et al. The prevalence of waterpipe tobacco smoking among the general and specific populations: a systematic review. *BMC Public Health* 2011;**11**:244.

Akl 2015

Akl EA, Ward KD, Bteddini D, Khaliel R, Alexander AC, Lotfi T, et al. The allure of the waterpipe: a narrative review of factors affecting the epidemic rise in waterpipe smoking among young persons globally. *Tobacco Control* 2015;**24** (Suppl 1):i13-i21.

Al-Faham 2018

Al-Faham Z, LeBouf RF, Nett RJ. Tobacco and other occupational exposures among hookah bar workers. *American Journal of Industrial Medicine* 2018;**61**(6):543-4. [DOI: [10.1002/ajim.22829](https://doi.org/10.1002/ajim.22829)]

Al-Sheyab 2016

Al-Sheyab NA, Al-Fuqha RA, Kheirallah KA, Khabour OF, Alzoubi KH. Anthropometric measurements of newborns of women who smoke waterpipe during pregnancy: a comparative retrospective design. *Inhalation Toxicology* 2016;**28**(13):629-5.

Alam 2020

Alam MM, Ward KD, Bahelah R, Kalan ME, Asfar T, Eissenberg T, et al. The Syrian Center for Tobacco Studies-13 (SCTS-13): psychometric evaluation of a waterpipe-specific nicotine dependence instrument. *Drug and Alcohol Dependence* 2020;**215**:108192. [DOI: [10.1016/j.drugalcdep.2020.108192](https://doi.org/10.1016/j.drugalcdep.2020.108192)]

Alomari 2018

Alomari MA, Al-sheyab NA. Dual tobacco smoking is the new trend among adolescents: update from the Irbid-TRY. *Journal of Substance Use* 2018;**23**(1):92-8.

Arrazola 2015

Arrazola RA, Singh T, Corey CG, Husten CG, Neff LJ, Apelberg BJ, et al. Tobacco use among middle and high school students - United States, 2011-2014. *CDC Morbidity and Mortality Weekly Report* 2015;**64**(14):381-5. [PMCID: PMC5779546] [PMID: 25879896]

Asfar 2016

Asfar T, Ward K D, Al-Ali R, Maziak W. Building evidence-based tobacco treatment in the eastern mediterranean region: lessons learned by the Syrian Center for Tobacco Studies. *Journal of Smoking Cessation* 2016;**11**(2):116-23.

Asfar 2020

Asfar T, Schmidt M, Ebrahimi Kalan M, Wu W, Ward KD, Nakkash RT, et al. Delphi study among international

expert panel to develop waterpipe-specific health warning labels. *Tobacco Control* 2020;**29**(2):159–67. [DOI: [10.1136/tobaccocontrol-2018-054718](https://doi.org/10.1136/tobaccocontrol-2018-054718)]

Azab 2013

Azab M, Khabour OF, Alzoubi KH, Anabtawi MM, Quttina M, Khader Y, et al. Exposure of pregnant women to waterpipe and cigarette smoke. *Nicotine & Tobacco Research* 2013;**15**(1):231–7.

Babaie 2021

Babaie J, Ahmadi A, Abdollahi G, Doshmangir L. Preventing and controlling water pipe smoking: a systematic review of management interventions. *BMC Public Health* 2021;**21**(1):344.

Baheiraei 2012

Baheiraei A, Mirghafourvand M, Nedjat S, Mohammadi E, Mohammad-Alizadeh Charandabi S. Prevalence of water pipe use and its correlates in Iranian women of reproductive age in Tehran: a population-based study. *Medical Principles and Practice* 2012;**21**(4):340–4.

Bahelah 2017

Bahelah R, DiFranza JR, Ward K D, Eissenberg T, Fouad FM, Taleb ZB, et al. Waterpipe smoking patterns and symptoms of nicotine dependence: The Waterpipe Dependence in Lebanese Youth Study. *Addictive Behaviors* 2017;**74**:127–33.

Bhatnagar 2019

Bhatnagar A, Maziak W, Eissenberg T, Ward KD, Thurston G, King BA, et al. Water pipe (hookah) smoking and cardiovascular disease risk: a scientific statement from the American Heart Association. *Circulation* 2019;**139**(19):e917–36.

Cahill 2013

Cahill K, Stevens S, Perera R, Lancaster T. Pharmacological interventions for smoking cessation: an overview and network meta-analysis. *Cochrane Database of Systematic Reviews* 2013, Issue 5. Art. No: CD009329. [DOI: [10.1002/14651858.CD009329.pub2](https://doi.org/10.1002/14651858.CD009329.pub2)]

Carson-Chahhoud 2019

Carson-Chahhoud KV, Livingstone-Banks J, Sharrad KJ, Kopsaftis Z, Brinn MP, To-A-Nan R, et al. Community pharmacy personnel interventions for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 10. Art. No: CD003698. [DOI: [10.1002/14651858.CD003698.pub3](https://doi.org/10.1002/14651858.CD003698.pub3)]

Covidence [Computer program]

Covidence. Version accessed July 2022. Melbourne, Australia: Veritas Health Innovation. Available at covidence.org.

Ebrahimi 2020

Ebrahimi KM, Bahelah R, Bursac Z, Ben TZ, DiFranza JR, Tleis M, et al. Predictors of nicotine dependence among adolescent waterpipe and cigarette smokers: A 6-year longitudinal analysis. *Drug and Alcohol Dependence* 2020;**217**:108346.

Ebrahimi 2021

Ebrahimi KM, Bahelah R, Bursac Z, Ward KD, Ben TZ, Tleis M, et al. A group-based modeling approach to identify developmental trajectories of nicotine dependence among Lebanese

adolescents waterpipe smokers. *Nicotine & Tobacco Research* 2021;**23**(12):2056–64.

Eissenberg 2009

Eissenberg T, Shihadeh A. Waterpipe tobacco and cigarette smoking: direct comparison of toxicant exposure. *American Journal of Preventive Medicine* 2009;**37**(6):518–23.

El-Zaatari 2015

El-Zaatari ZM, Chami HA, Zaatari GS. Health effects associated with waterpipe smoking. *Tobacco Control* 2015;**24**(Suppl 1):i31–43.

Gathuru 2015

Gathuru IM, Tarter RE, Klein-Fedyshin M. Review of hookah tobacco smoking among college students: policy implications and research recommendations. *American Journal of Drug and Alcohol Abuse* 2015;**41**(4):272–80.

GRADEpro GDT [Computer program]

GRADEpro GDT. Version accessed 2023. Hamilton (ON): McMaster University (developed by Evidence Prime). Available from [gradepro.org](https://www.gradepro.org).

Hajizadeh 2023

Hajizadeh A, Howes S, Theodoulou A, Klemperer E, Hartmann-Boyce J, Livingstone-Banks J, et al. Antidepressants for smoking cessation. *Cochrane Database of Systematic Reviews* 2023, Issue 5. Art. No: CD000031. [DOI: [10.1002/14651858.CD000031.pub6](https://doi.org/10.1002/14651858.CD000031.pub6)]

Hartmann-Boyce 2018

Hartmann-Boyce J, Chepkin SC, Ye W, Bullen C, Lancaster T. Nicotine replacement therapy versus control for smoking cessation. *Cochrane Database of Systematic Reviews* 2018, Issue 5. Art. No: CD000146. [DOI: [10.1002/14651858.CD000146.pub5](https://doi.org/10.1002/14651858.CD000146.pub5)]

Hartmann-Boyce 2019

Hartmann-Boyce J, Hong B, Livingstone-Banks J, Wheat H, Fanshawe TR. Additional behavioural support as an adjunct to pharmacotherapy for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 6. Art. No: CD009670. [DOI: [10.1002/14651858.CD009670.pub4](https://doi.org/10.1002/14651858.CD009670.pub4)]

Hartmann-Boyce 2021

Hartmann-Boyce J, Livingstone-Banks J, Ordonez-Mena JM, Fanshawe TR, Lindson N, Freeman SC, et al. Behavioural interventions for smoking cessation: an overview and network meta-analysis. *Cochrane Database of Systematic Reviews* 2021, Issue 1. Art. No: CD013229. [DOI: [10.1002/14651858.CD013229.pub2](https://doi.org/10.1002/14651858.CD013229.pub2)]

Higgins 2011

Higgins JP, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman A, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ* 2011;**343**:d5928.

Higgins 2017

Higgins JPT, Altman DG, Sterne JAC, editor(s). Chapter 8: Assessing risk of bias in included studies. In: Higgins JPT, Churchill R, Chandler J, Cumpston MS, editor(s), *Cochrane Handbook for Systematic Reviews of Interventions* Version

5.2.0 (updated June 2017), Cochrane, 2017. Available from www.training.cochrane.org/handbook.

Higgins 2022

Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al, editor(s). Cochrane Handbook for Systematic Reviews of Interventions Version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Holliday 2021

Holliday R, Hong BS, McColl E, Livingstone-Banks J, Preshaw PM. Interventions for tobacco cessation delivered by dental professionals Review. *Cochrane Database of Systematic Reviews* 2021, Issue 2. Art. No: CD005084. [DOI: [10.1002/14651858.CD005084.pub4](https://doi.org/10.1002/14651858.CD005084.pub4)]

Jaber 2015

Jaber R, Madhivanan P, Veledar E, Khader Y, Mzayek F, Maziak W. Waterpipe a gateway to cigarette smoking initiation among adolescents in Irbid, Jordan: a longitudinal study. *The International Journal of Tuberculosis and Lung Disease* 2015;**19**(4):481-7.

Jawad 2013

Jawad M, McEwen A, McNeill A, Shahab L. To what extent should waterpipe tobacco smoking become a public health priority? *Addiction* 2013;**108**(11):1873-84.

Jawad 2016

Jawad M, Jawad S, Waziry RK, Ballout RA, Akl EA. Interventions for waterpipe tobacco smoking prevention and cessation: a systematic review. *Scientific Reports* 2016;**6**:25872.

Jawad 2018

Jawad M, Charide R, Waziry R, Darzi A, Ballout RA, Akl EA. The prevalence and trends of waterpipe tobacco smoking: a systematic review. *PLoS One* 2018;**13**(2):e0192191.

Johnson 2019

Johnson AC, Lipkus I, Tercyak KP, Luta G, Rehberg K, Phan L, et al. Development and pretesting of risk-based mobile multimedia message content for young adult hookah use. *Health Education & Behavior* 2019;**46**(2 [Suppl]):97-105.

Johnston 2016

Johnston LD, O'Malley PM, Miech RA, Bachman JG, Schulenberg JE. Monitoring the future national survey results on drug use, 1975-2015: overview, key findings on adolescent drug use. Available at eric.ed.gov/?id=ED578539 2016:1-204.

Kader 2019

Kader Z, Roman NV, Crutzen R. Systematic review of interventions aimed at reducing hookah pipe use: implications for practitioners and clinicians. *South African Medical Journal* 2019;**109**(6):392-406.

Khabour 2016

Khabour OF, Alzoubi KH, Al-Sheyab N, Shihadeh A, Eissenberg T. Investigating the effects of exposure to waterpipe smoke on pregnancy outcomes using an animal model. *Nicotine & Tobacco Research* 2016;**18**(5):585-9.

Klosterhalfen 2020

Klosterhalfen S, Kotz D, Kuntz B, Zeiher J, Starker A. Waterpipe use among adolescents in Germany: prevalence, associated consumer characteristics, and trends (German Health Interview and Examination Survey for Children and Adolescents, KiGGS). *International Journal of Environmental Research and Public Health* 2020;**17**(21):7740.

Lancaster 2017

Lancaster T, Stead L F. Individual behavioural counselling for smoking cessation. *Cochrane Database of Systematic Reviews* 2017, Issue 3. Art. No: CD001292. [DOI: [10.1002/14651858.CD001292.pub3](https://doi.org/10.1002/14651858.CD001292.pub3)]

Lindson 2019

Lindson N, Chepkin SC, Ye W, Fanshawe TR, Bullen C, Hartmann-Boyce J. Different doses, durations and modes of delivery of nicotine replacement therapy for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 4. Art. No: CD013308. [DOI: [10.1002/14651858.CD013308](https://doi.org/10.1002/14651858.CD013308)]

Livingstone-Banks 2019

Livingstone-Banks J, Ordonez-Mena JM, Hartmann-Boyce J. Print-based self-help interventions for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 1. Art. No: CD001118. [DOI: [10.1002/14651858.CD001118.pub4](https://doi.org/10.1002/14651858.CD001118.pub4)]

Livingstone-Banks 2022

Livingstone-Banks J, Lindson N, Hartmann-Boyce J, Aveyard P. Effects of interventions to combat tobacco addiction: Cochrane update of 2019 and 2020. *Addiction* 2022;**117**:1573-88. [DOI: [org/10.1111/add.15769](https://doi.org/10.1111/add.15769)]

Livingstone-Banks 2023

Livingstone-Banks J, Fanshawe TR, Thomas KH, Theodoulou A, Hajizadeh A, Hartman L, et al. Nicotine receptor partial agonists for smoking cessation. *Cochrane Database of Systematic Reviews* 2023, Issue 5. Art. No: CD006103. [DOI: [10.1002/14651858.CD006103.pub8](https://doi.org/10.1002/14651858.CD006103.pub8)]

Martin 2009

Martin J. Booming hookah biz links China, Iran, Egypt - and Texas. CNNMoney. First published: 26 August 2009: 5:17 AM ET. Available at money.cnn.com/2009/08/26/smallbusiness/hookah_entrepreneur.fsb/index.htm.

Matkin 2019

Matkin W, Ordonez-Mena JM, Hartmann-Boyce J. Telephone counselling for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 5. Art. No: CD002850. [DOI: [10.1002/14651858.CD002850.pub4](https://doi.org/10.1002/14651858.CD002850.pub4)]

Mays 2016

Mays D, Tercyak KP, Lipkus IM. The effects of brief waterpipe tobacco use harm and addiction education messages among young adult waterpipe tobacco users. *Nicotine & Tobacco Research* 2016;**18**(5):777-84.

Maziak 2009

Maziak W, Rastam S, Ibrahim I, Ward KD, Shihadeh A, Eissenberg T. CO exposure, puff topography, and subjective

effects in waterpipe tobacco smokers. *Nicotine & Tobacco Research* 2009;**11**(7):806-11.

Maziak 2015b

Maziak W, Taleb ZB, Bahelah R, Islam F, Jaber R, Auf R, et al. The global epidemiology of waterpipe smoking. *Tobacco Control* 2015;**24**(Suppl 1):i3-12.

Maziak 2015c

Maziak W. Rise of waterpipe smoking. *BMJ* 2015;**350**:h1991.

Maziak 2019

Maziak W, Osibogun O, Asfar T. Waterpipe smoking: the pressing need for risk communication. *Expert Review of Respiratory Medicine* 2019;**13**(11):1109-19. [DOI: [10.1080/17476348.2019.1668271](https://doi.org/10.1080/17476348.2019.1668271)]

Mirahmadizadeh 2008

Mirahmadizadeh A, Nakhaee N. Prevalence of waterpipe smoking among rural pregnant women in Southern Iran. *Medical Principles and Practice* 2008;**17**(6):435-9.

Monzer 2008

Monzer B, Sepetdjian E, Saliba N, Shihadeh A. Charcoal emissions as a source of CO and carcinogenic PAH in mainstream narghile waterpipe smoke. *Food and Chemical Toxicology* 2008;**46**(9):2991-5.

Nematollahi 2018

Nematollahi S, Mansournia MA, Foroushani AR, Mahmoodi M, Alavi A, Shekari M, et al. The effects of water-pipe smoking on birth weight: a population-based prospective cohort study in southern Iran. *Epidemiology and Health* 2018;**40**:e2018008.

Nguyen 2013

Nguyen T, Hlangothi D, Martinez RA 3rd, Jacob D, Anthony K, Nance H, et al. Charcoal burning as a source of polyaromatic hydrocarbons in waterpipe smoking. *Journal of Environmental Science and Health - Part B* 2013;**48**(12):1097-102.

Notley 2019

Notley C, Gentry S, Livingstone-Banks J, Bauld L, Perera R, Hartmann-Boyce J. Incentives for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 7. Art. No: CD004307. [DOI: [10.1002/14651858.CD004307.pub6](https://doi.org/10.1002/14651858.CD004307.pub6)]

Parker 2005

Parker DR, Evangelou E, Eaton CB. Intraclass correlation coefficients for cluster randomized trials in primary care: the cholesterol education and research trial (CEART). *Contemporary Clinical Trials* 2005;**26**(2):260-7. [DOI: [10.1016/j.cct.2005.01.002](https://doi.org/10.1016/j.cct.2005.01.002)]

Piper 2006

Piper ME, McCarthy DE, Baker TB. Assessing tobacco dependence: a guide to measure evaluation and selection. *Nicotine & Tobacco Research* 2006;**8**(3):339-51.

Pourmohammad 2016

Pourmohammad Shandiz Zahra, Ghanaei CHamanabad Ali, Mashhadi Ali. Effectiveness of transcranial direct current

stimulation (tDCS) on reducing craving among hookah smokers. *Research Journal of Medical Sciences* 2016;**10**(3):139-46.

Rastam 2011

Rastam S, Eissenberg T, Ibrahim I, Ward KD, Khalil R, Maziak W. Comparative analysis of waterpipe and cigarette suppression of abstinence and craving symptoms. *Addictive Behaviors* 2011;**36**(5):555-9.

Review Manager 2020 [Computer program]

Review Manager 5 (RevMan 5). Version 5.4. The Cochrane Collaboration, 2020.

Rice 2017

Rice VH, Heath L, Livingstone-Banks J, Hartmann-Boyce J. Nursing interventions for smoking cessation. *Cochrane Database of Systematic Reviews* 2017, Issue 12. Art. No: CD001188. [DOI: [10.1002/14651858.CD001188.pub5](https://doi.org/10.1002/14651858.CD001188.pub5)]

Rigotti 2022

Rigotti NA, Kruse GR, Livingstone-Banks J, Hartmann-Boyce J. Treatment of tobacco smoking: a review. *JAMA* 2022;**327**(6):566-77. [DOI: [10.1001/jama.2022.0395](https://doi.org/10.1001/jama.2022.0395)]

Salloum 2016

Salloum RG, Asfar T, Maziak W. Toward a regulatory framework for the waterpipe. *American Journal of Public Health* 2016;**106**(10):1773-7. [DOI: [10.2105/AJPH.2016.303322](https://doi.org/10.2105/AJPH.2016.303322)]

Schünemann 2022

Schünemann HJ, Higgins JPT, Vist GE, Glasziou P, Akl EA, Skoetz N, et al. Chapter 14: Completing 'Summary of findings' tables and grading the certainty of the evidence. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al, editor(s). *Cochrane Handbook for Systematic Reviews of Interventions* Version 6.3 (updated February 2022). Cochrane, 2022. Available from training.cochrane.org/handbook.

Schünemann 2022a

Schünemann HJ, Brennan S, Davoli M, Mustafa RA, Akl EA, Meerpohl JJ, et al. Strong and high-quality evidence synthesis needs Cochrane: a statement of support by the GRADE Guidance Group. *Journal of Clinical Epidemiology* 2022 [Epub 2022 Oct 9];**152**:285-7. [DOI: [10.1016/j.jclinepi.2022.10.001](https://doi.org/10.1016/j.jclinepi.2022.10.001)]

Sharma 2020

Sharma E, Bansal-Travers M, Edwards KC, Halenar MJ, Taylor KA, Kasza KA, et al. Longitudinal pathways of exclusive and polytobacco hookah use among youth, young adults and adults in the USA: findings from the PATH Study Waves 1-3 (2013-2016). *Tobacco Control* 2020;**29**(Suppl 3):s155-62.

Shelley 2017

Shelley D, Kumar P, Lee L, Nguyen L, Nguyen TT, VanDevanter N, et al. Health care providers' adherence to tobacco treatment for waterpipe, cigarette and dual users in Vietnam. *Addictive Behaviors* 2017;**64**:49-53.

Siddiqi 2013

Siddiqi K, Khan A, Ahmad M, Dogar O, Kanaan M, Newell JN, et al. Action to stop smoking in suspected tuberculosis

(ASSIST) in Pakistan: a cluster randomized, controlled trial. *Annals of Internal Medicine* 2013;**158**(9):667-5. [DOI: [10.7326/0003-4819-158-9-201305070-00006](https://doi.org/10.7326/0003-4819-158-9-201305070-00006)]

Soneji 2015

Soneji S, Sargent JD, Tanski SE, Primack BA. Associations between initial water pipe tobacco smoking and snus use and subsequent cigarette smoking: results from a longitudinal study of US adolescents and young adults. *JAMA Pediatrics* 2015;**169**(2):129-36.

Stead 2013

Stead LF, Buitrago D, Preciado N, Sanchez G, Hartmann-Boyce J, Lancaster T. Physician advice for smoking cessation. *Cochrane Database of Systematic Reviews* 2013, Issue 5. Art. No: CD001007. [DOI: [10.1002/14651858.CD001007.pub3](https://doi.org/10.1002/14651858.CD001007.pub3)]

Stead 2016

Stead LF, Koilpillai P, Fanshawe TR, Lancaster T. Combined pharmacotherapy and behavioural interventions for smoking cessation. *Cochrane Database of Systematic Reviews* 2016, Issue 3. Art. No: CD008286. [DOI: [10.1002/14651858.CD008286.pub3](https://doi.org/10.1002/14651858.CD008286.pub3)]

Stead 2017

Stead LF, Carroll AJ, Lancaster T. Group behaviour therapy programmes for smoking cessation. *Cochrane Database of Systematic Reviews* 2017, Issue 3. Art. No: CD001007. [DOI: [10.1002/14651858.CD001007.pub3](https://doi.org/10.1002/14651858.CD001007.pub3)]

Sutfin 2018

Sutfin EL, Soule EK, McKelvey K, Jenson D. Implications and challenges for implementation of the FDA's final deeming rule for waterpipe tobacco. *Tobacco Control* 2018;**27**(3):347-51.

Tamim 2008

Tamim H, Yunis KA, Chemaitelly H, Alameh M, Nassar AH. Effect of narghile and cigarette smoking on newborn birthweight. *BJOG* 2008;**115**(1):91-7.

Taylor 2017

Taylor GMJ, Dalili MN, Semwal M, Civiljak M, Sheikh A, Car J. Internet-based interventions for smoking cessation. *Cochrane Database of Systematic Reviews* 2017, Issue 9. Art. No: CD007078. [DOI: [10.1002/14651858.CD007078.pub5](https://doi.org/10.1002/14651858.CD007078.pub5)]

Tzelepis 2019

Tzelepis F, Paul CL, Williams CM, Gilligan C, Regan T, Daly J, et al. Real-time video counselling for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 10. Art. No: CD012659. [DOI: [10.1002/14651858.CD012659.pub2](https://doi.org/10.1002/14651858.CD012659.pub2)]

Villanti 2017

Villanti AC, Johnson AL, Ilakkuvan V, Jacobs MA, Graham AL, Rath JM. Social media use and access to digital technology in US young adults in 2016. *Journal of Medical Internet Research* 2017;**19**(6):e196.

Ward 2015

Ward KD, Siddiqi K, Ahluwalia JS, Alexander AC, Asfar T. Waterpipe tobacco smoking: the critical need for cessation treatment. *Drug and Alcohol Dependence* 2015;**153**:14-21.

Waziry 2017

Waziry R, Jawad M, Ballout RA, Al Akel M, Akl EA. The effects of waterpipe tobacco smoking on health outcomes: an updated systematic review and meta-analysis. *International Journal of Epidemiology* 2017;**46**(1):32-43.

West 2005

West R, Hajek P, Stead L, Stapleton J. Outcome criteria in smoking cessation trials: proposal for a common standard. *Addiction* 2005;**100**(3):299-303.

Whittaker 2019

Whittaker R, McRobbie H, Bullen C, Rodgers A, Gu Y, Dobson R. Mobile phone text messaging and app-based interventions for smoking cessation. *Cochrane Database of Systematic Reviews* 2019, Issue 10. Art. No: CD006611. [DOI: [10.1002/14651858.CD006611.pub5](https://doi.org/10.1002/14651858.CD006611.pub5)]

WHO 2015

World Health Organization. Waterpipe Tobacco Smoking and Health. apps.who.int/iris/bitstream/handle/10665/179523/WHO_NMH_PND_15.4_eng.pdf (Accessed July 2022).

WHO 2015a

World Health Organization (WHO). Advisory note: waterpipe tobacco smoking: health effects, research needs and recommended actions by regulators. Available from www.who.int/publications/i/item/advisory-note-waterpipe-tobacco-smoking-health-effects-research-needs-and-recommended-actions-by-regulators-2nd-ed (Accessed July 2022).

References to other published versions of this review

Maziak 2005

Maziak W, Ward KD, Eissenberg TE. Interventions for waterpipe smoking cessation. *Cochrane Database of Systematic Reviews* 2005, Issue 4. Art. No: CD005549. [DOI: [10.1002/14651858.CD005549](https://doi.org/10.1002/14651858.CD005549)]

Maziak 2007

Maziak W, Ward KD, Eissenberg T. Interventions for waterpipe smoking cessation. *Cochrane Database of Systematic Reviews* 2007, Issue 4. Art. No: CD005549. [DOI: [10.1002/14651858.CD005549.pub2](https://doi.org/10.1002/14651858.CD005549.pub2)]

Maziak 2015a

Maziak W, Jawad M, Jawad S, Ward KD, Eissenberg T, Asfar T. Interventions for waterpipe smoking cessation. *Cochrane Database of Systematic Reviews* 2015, Issue 7. Art. No: CD005549. [DOI: [10.1002/14651858.CD005549.pub3](https://doi.org/10.1002/14651858.CD005549.pub3)]

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Asfar 2014

Study characteristics

Methods	<ul style="list-style-type: none"> Year(s) of study: 2007 to 2008 Study design: two-arm, parallel group randomized control trial Country: Syria Region: Aleppo Setting: outpatient clinic in cancer center treatment (Syrian Center for Tobacco Studies) Theoretical framework: the behavioral intervention was developed based on best practice cessation interventions for cigarette smokers and the scientific literature, and was adapted for the Syrian context
Participants	<ul style="list-style-type: none"> Inclusion criteria: adults who were ≥ 18 years of age, had smoked waterpipe ≥ 3 times per week in the last year, did not use cigarettes, and were interested in quitting waterpipe Exclusion criteria: the inability to understand the study and consent procedures Recruitment method: recruited by flyers, ads, and word of mouth Sample size: 50 participants; mean age 29.7 ± 9.3 years Definition of smoking status: smoked waterpipe ≥ 3 times per week in the last year
Interventions	<ul style="list-style-type: none"> Focus of intervention: waterpipe users Type of intervention: behavioral (intensive versus brief) Description of intervention group(s): <ul style="list-style-type: none"> The brief intervention (control group): participants received educational self-help materials, single 45-minute counseling session, and 3 follow-up phone calls (1 day before quit day, 1 day after, and 7 days after) The intensive intervention: participants received educational self-help materials, 3 in-person sessions, and five brief (10 min) phone calls (one day before the quit day, and 1, 10, 21, and 30 days after the quit day) Intervention delivered by: trained physician
Outcomes	<ul style="list-style-type: none"> Length of follow-up: 3 months The primary efficacy outcome was self-reported prolonged abstinence (defined as complete abstinence after a two-week grace period following the quit day from waterpipe at three months post-cessation, assessed by self-report and an expired carbon monoxide level of < 10 ppm) Biochemical validation: CO < 10 ppm
Notes	<ul style="list-style-type: none"> Funding: a start-up grant (SUG) for tobacco related research from the Initiative for Cardiovascular Health Research in the Developing Countries (IC-Health). The National Institute on Drug Abuse (NIDA) grants R01 DA024876 and R01 DA035160. Conflict of interest: all authors declare that they have no conflicts of interest

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants then were randomly allocated to one of two treatment arms based on a simple randomization method, which was computerized to be used as an automatic function within a software program created by the SCTS information technology manager for data collection.
Allocation concealment (selection bias)	Unclear risk	Allocation concealment was not reported

Interventions for waterpipe smoking cessation (Review)

Asfar 2014 (Continued)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Abstinence was biochemically validated (CO verified < 10ppm)
Incomplete outcome data (attrition bias) All outcomes	Low risk	Retention rates were high (78% in the intensive arm, and 83% in the brief arm completed the 3-month follow-up)
Selective reporting (reporting bias)	Low risk	The study was registered at clinicaltrials.gov (NCT01135173). The outcomes prespecified in that registry match those reported in the study report.

Chami 2022

Study characteristics

Methods	<ul style="list-style-type: none"> Year(s) of study: 2016 to 2021 Study design: 2-arm, randomized double-blind placebo-controlled trial. Participants were randomly assigned to receive varenicline and behavioral support (N = 71; treatment group) or placebo and behavioral support (N = 81; control group) Country: Lebanon Region: Beirut <p>Setting: In-person visit</p>
Participants	<ul style="list-style-type: none"> Inclusion criteria: exclusive waterpipe smokers, age 18 years or older, who smoke waterpipe 5 to 7 times per week, and are willing to quit waterpipe Exclusion criteria: cigarette and cigars smokers and individuals who used other forms of tobacco were excluded, as well as pregnant women and individuals with renal failure, cardiovascular disease, and active malignancy Recruitment method: participants were recruited directly in cafés and university campuses and through media advertisement, social media, phone messages, word-of-mouth, and flyers distributed in cafés, health centers, pharmacies, specialty clinics, and at the American University of Beirut smoking cessation clinic. Sample size: 152 participants (control group: N = 81, 41% females, mean age = 38; treatment group: N = 71, 37% females, mean age = 38) Definition of smoking status: smoke waterpipe 5 to 7 times per week
Interventions	<ul style="list-style-type: none"> Focus of intervention: waterpipe smoking Type of intervention: varenicline + behavioral support Description of the intervention: <ul style="list-style-type: none"> Varenicline – participants received 12 weeks of varenicline, starting 1 week before the quit date as suggested by the manufacturer: 0.5 mg orally once a day on days 1–3, 0.5 mg twice a day on days 4–7, then 1 mg twice a day on days 8–77. To assess compliance, participants were instructed to return all unused pills and empty pillboxes at the end of treatment. Behavioral support – all participants received three 30-minute one-on-one behavioral interventions for smoking cessation using a cognitive behavioral therapy approach with motivational interviewing derived from the trans-theoretical model. Description of control group: <ul style="list-style-type: none"> Placebo – participants received 12 weeks of a placebo, starting 1 week before the quit date as suggested by the manufacturer: 0.5 mg orally once a day on days 1 to 3, 0.5 mg twice a day on days 4 to 7, then 1 mg twice a day on days 8 to 77. To assess compliance, participants were instructed to return all unused pills and empty pillboxes at the end of treatment.

Chami 2022 (Continued)

- Behavioral support – all participants received three 30-minute one-on-one behavioral interventions for smoking cessation using a cognitive behavioral therapy approach with motivational interviewing derived from the trans-theoretical model.
- Intervention delivered by:
 - Drug intervention provided through pills to be taken for 12 weeks
 - Behavioral support was provided by two clinical psychologists following a manual to minimize variability in how psychologists interacted with participants

Outcomes	<ul style="list-style-type: none"> • Length of follow-up: 2 weeks, 3 weeks, and 12 weeks • Repeat point prevalence abstinence <ul style="list-style-type: none"> ◦ Self-reported ◦ Self-reported + exhaled carbon monoxide < 10 ppm ◦ Self-reported + exhaled carbon monoxide < 10 ppm + cotinine < 10 ng/ml • Self-reported 7 days abstinence at 2 weeks, 3 weeks, and 12 weeks • Self-reported 7 days abstinence verified by exhaled carbon monoxide < 10 ppm at 2 weeks, 3 weeks, and 12 weeks
Notes	<ul style="list-style-type: none"> • Funding: this project was funded by Pfizer Inc. award number: WI195422 GRAND 2014 • Conflict of interest: authors declare no conflict of interests

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	“Participants were randomly allocated to receive varenicline or placebo following a random computer-generated sequence within each stratum using www.randomization.com . Participants were sequentially assigned a computer-generated study ID based on their stratum and were provided identical drug bottles containing either varenicline or placebo”
Allocation concealment (selection bias)	Low risk	“These bottles were pre-labeled with the participant’s ID by the research pharmacy following the computer-generated random treatment allocation sequence for each ID”
Blinding of participants and personnel (performance bias) All outcomes	Low risk	“All participants, study personnel, and investigators were unaware of the treatment assigned to each ID and were blinded by using identical study drug containers and matching placebo pills until data were analyzed”
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Personnel assessing the outcome were blinded to treatment allocation until data were analyzed.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Loss to follow up reported, 41% in varenicline compared to 52% in placebo group, with overall loss to follow-up of 46.7%.
Selective reporting (reporting bias)	Low risk	Reported outcomes were consistent with the methods section and study protocol on clinicaltrials.gov

Dadipoor 2022

Study characteristics

Methods	<ul style="list-style-type: none"> • Year(s) of study: 2018 to 2020
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Interventions for waterpipe smoking cessation (Review)

Dadipoor 2022 (Continued)

- Study design: a cluster quasi-experimental study
 - Four healthcare centers were selected randomly from 20 centers, two were assigned to the control group and the other two to the intervention group
 - Eligible women from each healthcare received the control (N =106) or intervention (N = 106)
- Country: Iran
- Region: Bandar Abbas
- Setting: in-person visit

Participants

- Inclusion criteria: women over 15 years of age who have smoked exclusively waterpipe four times a week for at least six months, no prior experience of a psychological disorder or cardiovascular disease, being local to Bandar Abbas City or residing in the city for at least ten years (for cultural adjustment) and signing an informed consent to take part in the research
- Exclusion criteria: person who simultaneously smokes cigarettes, tobacco products, or drugs, attempts to cease waterpipe smoking at the outset of the study or just before the study, using nicotine alternative therapy, currently participating in any other cessation program, absence from more than two training sessions, and unavailability in the post-test
- Recruitment method: participants were identified from four healthcare centers' records and were contacted by phone to determine their eligibility to participate in the study
- Sample size: 212 participants (control N = 106; intervention N = 106); mean age 37.7 (13.8)
- Definition of smoking status: smoking waterpipe four times a week for at least six months

Interventions

- Focus of intervention: waterpipe smoking
- Type of intervention: behavioral (mainly educational)
- Description of the intervention: the intervention was a participatory education and training course designed at the personal and interpersonal levels. In the treatment group, the intervention included 14 group-based counseling sessions at the personal level. At the interpersonal level, extra three sessions were provided for participants who had been introduced by the participating women in the intervention group as their supporters. The entire course took four months, from September 2019 to January 2020.
- Description of control group: the control group attended a one-hour group-based counseling session of instructions on the detriments of waterpipe smoking
- Intervention delivered by: four people presented the course. An expert in health education and promotion with a good knowledge of waterpipe smoking behavior guided nine sessions. A physician and a clinical psychologist, both experienced in managing the physical and psychological consequences of tobacco cessation, conducted the other five sessions. A competent woman who had successfully stopped waterpipe smoking acted in all sessions as a role model. She improved women's self-confidence and self-efficacy and shared her experience in hookah cessation.

Outcomes

- Length of follow-up: after the training, and at 3 months and 6 months
- Self-reported waterpipe smoking abstinence after training, at 3 months and 6 months

Notes

- Funding: this study was funded by a research grant from the National Institute for Medical Research (#983514)
- Conflict of interest: the authors had no competing interests to declare

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	"Four healthcare centers were selected randomly from 20 centers serving Bandar Abbas." "One of the women was then selected randomly. We called her on the phone to determine study eligibility. If she was found to be ineligible, the next woman on the list was contacted. This process continued until an eligible participant was identified. The next eligible participants were searched for by

Dadipoor 2022 (Continued)

		adding 53 to the row number of the previously selected woman and proceeding on the above-mentioned process.”
Allocation concealment (selection bias)	High risk	Participants were assigned to control and intervention groups based on the hospital record IDs. When a participant was determined to be eligible, the person responsible for the assignment could determine the next participant by adding 53 to the row number of the previously selected participant.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Self-reported abstinence; participants in the intervention arm attended 14 sessions compared to a 1-hour session of instructions for participants in the control arm
Incomplete outcome data (attrition bias) All outcomes	Low risk	Loss to follow-up reported and minimal, 3 participants in control group and 2 in intervention group
Selective reporting (reporting bias)	Low risk	Reported outcomes were consistent with trial registry entry IRC-T20190126042494N1.

Dogar 2014
Study characteristics

Methods	<ul style="list-style-type: none"> • Year(s) of study: 2010 to 2011 • Study design: 3-arm cluster-randomized controlled non-inferiority trial • Country: Pakistan • Region: Jhang and Sarghoda districts • Setting: 33 primary and secondary health centers • Theoretical framework: based on the World Health Organization’s ‘5As Approach’
Participants	<ul style="list-style-type: none"> • Inclusion criteria: adults aged over 18 years, with suspected (cough \geq 3 weeks, of unknown cause), and regular tobacco smokers (>1 cigarette/hookah session a day) • Exclusion criteria: those requiring hospitalization or urgent medical attention • Recruitment method: patients attending primary and secondary healthcare centers registered as diagnostic centers by a tuberculosis program in 2 Pakistani districts 33 clusters • Sample size: 2369 total adult participants: 215 hookah smokers with mean age of 51.5 (SD 13.8), median household income USD 81.4 (IQR 69.8), 21% women; 485 dual hookah and cigarette smokers with mean age of 45.4 (13.3), median household income USD 93.0 (81.4) and 5% women; and 1255 cigarette smokers with mean age of 37.4 (11.5), median household income USD 81.4 (58.1), 1.7% women • Definition of smoking status: used waterpipe \geq 1 a day (daily waterpipe use)
Interventions	<ul style="list-style-type: none"> • Focus of intervention: any regular tobacco users (cigarette, waterpipe). Focused on individuals • Type of intervention: behavioral & pharmacological (bupropion) • Description of the intervention group(s): <ul style="list-style-type: none"> ◦ Group (1): control group/usual care. Participants were given a leaflet with standard health messages about the harms of tobacco ◦ Group (2): 2 brief behavioral support cessations based on 5 as approach (1st visit 30 mins, 2nd on quit day 10 mins). The initial 30-minute consultation assisted smokers who were willing to set aside a quit day. The 10-minute, second consultation coincided with the patient’s quit date, and provided an opportunity for follow-up and review of patient’s progress ◦ Group (3): 2 brief behavioral support cessations (as above) plus bupropion for 7 weeks (75 mg/day for 1st week, 150 mg/day for next 6 weeks)

Dogar 2014 (Continued)

- Intervention delivered by: tuberculosis DOTS (directly observed treatment, short course) paramedics (nurses or auxiliary nurses), who received one full-day training on intervention protocol and delivery tools

Outcomes	<ul style="list-style-type: none"> Length of follow-up: 6 months The primary outcome was continuous smoking abstinence, defined as an expired CO measurement of 9 ppm or less at the 6-month follow-up Biochemical validation: CO verified ≤ 9 ppm
Notes	<ul style="list-style-type: none"> Differential effects post-intervention: none reported Adverse effects of intervention: none reported Funding: the study was funded by the International Development Research Centre, Canada Conflict of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Those who consented to participate were randomized to three conditions. Computer-generated sequence
Allocation concealment (selection bias)	Low risk	QUOTE: "a researcher who was blinded to centre identity used computer-generated random-number lists to generate allocation sequence."
Blinding of participants and personnel (performance bias) All outcomes	High risk	QUOTE: "The lack of blinding also meant that a degree of observer bias was possible."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome was biochemically verified with a carbon monoxide measurement of 9 ppm or less
Incomplete outcome data (attrition bias) All outcomes	Low risk	<p>Primary outcome data missing for 7.0% of waterpipe-only smokers. Reasons for missing data unlikely to be related to true outcome.</p> <p>There was no differential loss to follow-up or intervention completion among the three subgroups.</p>
Selective reporting (reporting bias)	Low risk	Reported outcomes are consistent with trial registry entry ISRCTN08829879.
Other bias	High risk	<p>There was imbalance in baseline characteristics among the three subgroups at enrollment.</p> <p>QUOTE: "Compared to cigarette-only smokers, hookah-only smokers were older, with more females, higher CO readings, lower nicotine dependency score, and longer duration of smoking."</p> <p>It was not stated if statistical adjustments were made for the clustering.</p>

Dogar 2018
Study characteristics

Methods	<ul style="list-style-type: none"> Year(s) of study: 2016 to 2018
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Interventions for waterpipe smoking cessation (Review)

Dogar 2018 (Continued)

	<ul style="list-style-type: none"> Study design: two-arm, parallel group, placebo-controlled, double-blind, multi-center (N = 4), individually randomized trial with follow-up to 25 weeks Country: Pakistan Region: Punjab Setting: 3 district hospitals (Cahkwal, Khushab, Mandi Bahauddin districts) and a teaching hospital (Rawalpindi district) Theoretical framework: testing the efficacy of varenicline in achieving 6-month abstinence from all forms of tobacco among waterpipe smokers who are willing to quit
Participants	<ul style="list-style-type: none"> Inclusion criteria: adults (18 years of age and older) who smoked waterpipe on a daily basis (≥ 25 days in a month) for at least 6 months and were motivated to quit all forms of smoking Exclusion criteria: had used any smoking cessation medications in the last 30 days; were pregnant, lactating or planning to become pregnant; required hospitalization; had an allergic reaction to varenicline in the past; or had unstable angina, untreated cardiac arrhythmia, myocardial infarction, cardiac procedure (in last three months), uncontrolled hypertension, stroke, chronic kidney disease, epilepsy or severe mental illnesses. Individuals who chewed smokeless tobacco and/or those with substances (including alcohol) misuse were also excluded Recruitment method: potential participants were recruited from hospitals' outpatient departments or from their catchment areas within community settings Sample size: 510 participants. The mean age was 49 years ([sd] = 15.2) Definition of smoking status: smoked waterpipe on a daily basis (≥ 25 days in a month) for at least 6 months
Interventions	<ul style="list-style-type: none"> Focus of intervention: waterpipe smokers Type of intervention: behavioral and pharmacological (varenicline) Description of the intervention group(s): <ul style="list-style-type: none"> Intervention group: participants received varenicline + 2 sessions behavioral support Control group: participants received varenicline placebo + 2 sessions behavioral support Behavioral intervention included: 1) a 30-minute session designed to: raise awareness about the harms of smoking (including waterpipe) and the advantages of quitting, address common misperceptions specific to waterpipe smoking, assist in planning a quit date, gain social support and remove environmental cues, and identify common triggers and withdrawal symptoms and suggest culturally appropriate coping strategies; and 2) a 10-minute follow-up session a week later to review progress and offer further support Intervention delivered by: trained researchers
Outcomes	<ul style="list-style-type: none"> Length of follow-up: 6 months The primary outcome was 7-day self-reported point prevalence abstinence from all forms of tobacco (not even a puff/chew/session in the previous 7 days) as verified by CO cutoff < 10 ppm at each of 5-, 12- and 25-week follow-ups Biochemical validation: CO verified (< 10 ppm)
Notes	<ul style="list-style-type: none"> Most trial participants were men (84.1%) and approximately half smoked both waterpipe and cigarettes (51.2%) Adverse events: 34 adverse events were reported in 27 participants (15 in varenicline and 19 in placebo); none were serious. Adverse events included respiratory disorders, gastrointestinal disorders, general disorders, immune system disorders, renal and urinary disorders, nervous system disorders, and psychiatric disorders Funding: this study was funded by pharmaceutical company (Pfizer – GRAND 2014 - WI194558) Conflict of interest: the funder (Pfizer) declared that they had no role in the study design, data collection, data analysis, data interpretation or writing of the report
Risk of bias	
Bias	Authors' judgement Support for judgement

Dogar 2018 (Continued)

Random sequence generation (selection bias)	Low risk	QUOTE: "Using software R software to generate a permuted block randomization list for each study site, with stratification factors including district, sex and concomitant cigarette smoking."
Allocation concealment (selection bias)	Low risk	QUOTE: "The central research office generated a trial ID by running a prespecified code (for each random block). Research team at the study sites and at the central office were unaware of the treatment condition associated with each trial ID."
Blinding of participants and personnel (performance bias) All outcomes	Low risk	QUOTE: "All investigators, researchers and participants remained blinded to the allocation until the trial data were analyzed. To ensure double blinding, investigators used identical medication packs for both placebo and varenicline, which were labeled with a unique trial ID."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All investigators, researchers and participants remained blinded to the allocation until the trial data were analyzed. Abstinence was biochemically validated (CO verified < 10ppm)
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rates were very low at 6-month follow-up (9% in the active treatment arm and 5% in the placebo arm)
Selective reporting (reporting bias)	Low risk	The trial was registered at the ISRCTN registry: ISRCTN94103375; and reported outcomes were consistent with the methods section.

Jiang 2019
Study characteristics

Methods	<ul style="list-style-type: none"> • Year(s) of study: 2014 to 2018 • Study design: quasi-experimental imbedded in a larger two-arm cluster-randomized controlled trial conducted in 26 community health centers in Vietnam. The purpose of this study was to compare the effectiveness of healthcare provider advice and cessation assistance (brief cessation counseling and educational materials) vs the same intervention plus referral to village health worker-led 3-session in-person cessation counseling • Country: Vietnam • Region: Thai Ngyuen province • Setting: 26 CHCs in Vietnam • Theoretical framework: intervention components were based on USA Public Health Services and WHO guidelines for treating tobacco use and growing literature that supports the effectiveness of integrating lay health workers to the healthcare team
Participants	<ul style="list-style-type: none"> • Inclusion criteria: CHC site criteria include having at least one physician, ≥ 4 allied healthcare professional staff, ≥ 5 VHWs, and a patient population of at least 3000. Participants must be adult patients who visited any participating CHC during the parent randomized control trial intervention period and self-identified as current tobacco users (cigarettes and/or waterpipe) who were willing to be referred to a VHW for additional cessation counseling • Exclusion criteria: not reported • Sample size: 26 CHCs and 1318 participants (3 groups: cigarette-only smokers N = 487; waterpipe-only smokers N = 212; and dual users N = 415). Mean age for participants in arm 1 was 47.9 (SD 14.3) and mean age for arm 2 was 48.4 (SD 13.2) • Recruitment method: directly from patients at the CHCs by their healthcare providers • Definition of smoking status: self-reported current tobacco use including waterpipe use and/or cigarette smoking in the past 7 days

Jiang 2019 (Continued)

Interventions	<ul style="list-style-type: none"> • Focus of intervention: cigarettes and/or waterpipe users • Type of intervention: behavioral only • Duration of intervention: three sessions each lasted approximately 30 to 40 minutes. Time between counseling sessions was not stated. • Description of the interventions group(s): <ul style="list-style-type: none"> ◦ Group (1)/control group/usual care: participants were given a leaflet with standard health care provider messages about the harms of tobacco ◦ Group (2)/intervention: group (1) intervention + referral to VHW to receive three extra counseling sessions, each lasted approximately 30 to 40 minutes. Session 1 included assessment of smoking history and knowledge about the risks of smoking and benefits of quitting, providing educational information, discussing pros and cons of quitting, self-efficacy, social barriers to quitting, strategies for coping with challenges, and developing a quit plan including making their home smoke-free. Sessions 2 and 3 continued to foster readiness, and for those who had quit, to help prevent relapse by reinforcing strategies for dealing with challenges and triggers to smoke and building coping skills through role play and personalized feedback • Intervention delivered by health care providers and VHWs
Outcomes	<ul style="list-style-type: none"> • Length of follow-up: 6 months • CO validated self-reported 7-day point prevalence smoking abstinence at 6-month follow-up. For dual users, this was defined as smoking abstinence for both waterpipe and cigarettes. • Biochemical validation: CO cutoff level was not reported
Notes	<ul style="list-style-type: none"> • Funding: this work was supported by a grant from the National Cancer Institute (R01CA175329) • Conflict of interest: all authors declare that they have no conflicts of interest

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	<p>Method of randomization was not reported. It seems that the method of generating the sequence was somehow systematic</p> <p>QUOTE: "A quasi-experimental study embedded in a larger two-arm cluster-randomized clinical trial in which 26 health centers were randomized in three waves to one of two treatments."</p>
Allocation concealment (selection bias)	High risk	<p>Not mentioned in sufficient detail. There was possible recruitment bias. Identification or recruitment of participants happened after randomization of the cluster. Recruitment could have been affected by knowledge of the intervention.</p>
Blinding of outcome assessment (detection bias) All outcomes	Low risk	<p>Not mentioned in sufficient detail. However, the main outcome was validated using expired CO.</p>
Incomplete outcome data (attrition bias) All outcomes	Low risk	<p>Attrition rates were very low.</p> <p>QUOTE: "Of 1318 participants who completed the baseline survey, only 99 (7.5%) did not complete the 6-month follow-up."</p>
Selective reporting (reporting bias)	Unclear risk	<p>Trial registry was not reported. However, reported outcomes were consistent with the methods section.</p>

Joveini 2020

Study characteristics

Methods	<ul style="list-style-type: none"> Year(s) of study: 2014 to 2016 Study design: quasi-experimental cluster-randomized controlled trial Participants were assigned to intervention (N = 75) and control groups (N = 75) based on the college they attended Country: Iran Region: Sabzevar Setting: Islamic Azad University, at one of the student's houses Theoretical framework: Health Action Process Approach (HAPA)
Participants	<ul style="list-style-type: none"> Inclusion criteria: male undergraduate students with at least one year left until graduation, regular hookah smoker (at least once a month), no tobacco-related illness, such as heart and lung diseases, and willing to participate in the study Exclusion criteria: absence in more than two education sessions, and reluctance to continue participation at whatever stage of the study Recruitment method: participants were randomly selected through convenience sampling from male undergraduate university students in the Islamic Azad University of Sabzevar, Iran Sample size: 150 participants; mean age 21.8 (SD 2.4) Definition of smoking status: regular waterpipe smoker (≥ 1 waterpipe/month)
Interventions	<ul style="list-style-type: none"> Focus of intervention: waterpipe smoking Type of intervention: behavioral (educational) Description of the intervention group(s): <ul style="list-style-type: none"> Intervention group: seven sessions of education during two stages: 1) motivation (3 educational sessions) and 2) volition (4 educational session). In the motivation stage, in session 1 and 2, students informed about health risks and harms associated with hookah smoking and benefits of cessation. The 3rd session was divided into smaller groups, discussed barriers to quit and persuaded they were capable of quitting. In the volition stage, during the first session, the students were provided with information about the importance and role of self-planning for quitting hookah (action planning). They were asked to write down every step they had taken for quitting hookah. At the beginning of the second session, the notes made by the students were reviewed, and the problems were discussed while planning for quitting hookah. For the rest of the session, the necessity of having a personal plan to overcome perceived obstacles during the process of cessation (coping planning) was emphasized. At the end of the second session, students were asked to write down the obstacles they might face during the process of cessation, and the ways to overcome these obstacles. At the beginning of the third session, the notes made by the students were reviewed, and the obstacles they encountered, and the unique methods proposed by every student for overcoming the obstacles were discussed. For the rest of the session, the students shared their personal experiences with others. At the end of the session, the students were persuaded that they are capable enough to plan for quitting hookah successfully. The final session was devoted to recovery self-efficacy enhancement, and the students were informed about the necessity of having a personal plan to prevent relapse. They were persuaded that they were capable enough to quit hookah smoking in case of a relapse Control group: did not receive any intervention Intervention delivered by: trained instructor
Outcomes	<ul style="list-style-type: none"> Length of follow-up: 6 and 12 months Self-reported abstinence: self-reported (do you smoke hookah? No) Biochemical validation: no biochemical validation
Notes	<ul style="list-style-type: none"> Funding: this work was part of a PhD thesis, which is supported by the Tehran University of Medical Sciences Conflict of interest: authors declare no conflict of interests

Risk of bias

Joveini 2020 (Continued)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Methods of randomization was not reported. It seems that the method of generating the sequence was somehow systematic. QUOTE: "To ensure minimal contamination of groups, participants in each group were selected from different colleges. Participants in the intervention group were randomly selected from the college of health sciences, and participants in the control group were selected from the college of engineering."
Allocation concealment (selection bias)	High risk	Concealment not reported. However, as allocation was likely systematic, allocation could not have been truly concealed.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome measurement was not biochemically verified and amount of contact between trial arms were not similar
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Attrition rates were not reported.
Selective reporting (reporting bias)	Unclear risk	Reported outcomes were consistent with the methods section, but we could not find a prespecified protocol.

Lipkus 2011
Study characteristics

Methods	<ul style="list-style-type: none"> • Year(s) of study: 2009 to 2010 • Study design: randomized controlled web-based behavioral intervention • Country: USA • Region: central North Carolina • Setting: 6 college and university campuses • Theoretical framework: not reported
Participants	<ul style="list-style-type: none"> • Inclusion criteria: enrolled in a 4-year college or university, aged 18 years or older, and having smoked a waterpipe at least once during the last month • Exclusion criteria: not reported • Recruitment method: participants were recruited by newspaper advertisements, flyers posted around campuses, Craigslist, and campus-wide Listserv • Sample size: 91 adults. mean age 20.4 (SD 2.0), 24.2% women, 76.7% white • Definition of smoking status: having smoked a waterpipe at least once during the last month
Interventions	<ul style="list-style-type: none"> • Focus of intervention: waterpipe smoking • Type of intervention: behavioral • Description of the intervention group(s): <ul style="list-style-type: none"> ◦ Control group: 8 MS PowerPoint slides on waterpipe mechanism of action, chemical composition, and epidemiology; average length of intervention 3.6 minutes ◦ Intervention group: 20 MS PowerPoint slides on waterpipe mechanisms of action, chemical composition, epidemiology, puff topography, toxicant exposure, and health outcomes; average length of intervention 7.5 minutes • Intervention delivered by: online educational session
Outcomes	<ul style="list-style-type: none"> • Length of follow-up: 6 months

Interventions for waterpipe smoking cessation (Review)

Lipkus 2011 (Continued)

- The main outcome was “no longer smoking waterpipe”
- Biochemical validation: not present

Notes

- Differential effects post-intervention: not reported
- Adverse effects of intervention: not reported
- Funding: the study was funded by grants from the USA National Cancer Institute and National Institute on Drug Abuse
- Conflict of interest: none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	QUOTE: “Participants who logged on to the study's website were randomized to either a control or an experimental group with equal probability by our program.”
Allocation concealment (selection bias)	Unclear risk	Study only indicated that participants were randomized to either a control or experimental group. No information on allocation concealment Comment: insufficient confidence that allocation concealment was adequate
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome measurement was not biochemically verified and amount of contact between the intervention and control arms were not similar.
Incomplete outcome data (attrition bias) All outcomes	Low risk	23.1% of participants did not conduct the 6-month follow-up. Unlikely to be related to outcome. No reasons given for loss to follow-up. 1 participant in the 6-month follow-up had missing data and was not analyzed. No exclusions reported
Selective reporting (reporting bias)	Unclear risk	The study was not registered at clinicaltrials.gov and no protocol was available.

Mays 2021

Study characteristics

Methods	<ul style="list-style-type: none"> • Year(s) of study: 2018 to 2020 • Study design: 2-site, 3-arm, parallel group randomized trial. Participants were randomly assigned to control (N = 119) and two intervention arms: tailored (N = 113) and untailored (N = 117) • Country: USA • Region: Mid-Atlantic region • Setting: through mobile messaging
Participants	<ul style="list-style-type: none"> • Inclusion criteria: participants were young adults aged 18 to 30 years who reported smoking waterpipe tobacco in the past month and on at least a monthly basis. Participants have to be able to complete study procedures in English and agree to use a personal mobile phone to send and receive study text messages. • Exclusion criteria: there were no exclusion criteria (e.g. for other medical conditions or alcohol or substance use) • Recruitment method: participants were recruited from the community at 2 academic medical centers in Mid-Atlantic region of USA. Recruitment advertisements sought young adults for a study about waterpipe tobacco beliefs and behavior and directed interested individuals to a website with study details and a link to an eligibility screener

Mays 2021 (Continued)

- Sample size: 349 participants (control N = 119, untailored N = 117 and tailored N = 113); mean age 24.0 (SD 3.4), female 53.6%
- Definition of smoking status: smoked waterpipe tobacco in the past month and on at least a monthly basis

Interventions	<ul style="list-style-type: none"> • Focus of intervention: waterpipe smoking • Type of intervention: behavioral (educational) • Description of the intervention: <ul style="list-style-type: none"> ◦ Intervention – tailored arm: participants received 6-week mobile messaging intervention delivered on 2 days each week for 6 weeks. MMS message content was personalized to participants' baseline waterpipe tobacco smoking frequency, baseline risk beliefs, and responses to the prompts during the intervention. The 12 message themes were developed to align with misperceptions about risks of waterpipe tobacco use in young adults from previous research. Messages conveyed risks of waterpipe tobacco through text and visual imagery with images selected to convey the core risk communicated in text. The intervention was designed to enhance motivation to quit by building behavioral skills, increasing confidence, and providing strategies for behavior change. ◦ Intervention – untailored: participants received 6-week mobile messaging intervention delivered on 2 days each week for 6 weeks. MMS message content was the same as in the tailored intervention but was not personalized to participants' baseline waterpipe tobacco smoking frequency, baseline risk beliefs, and responses to the prompts during the intervention. ◦ Control group: received no intervention but completed assessments only • Intervention delivered by: mobile messaging
Outcomes	<ul style="list-style-type: none"> • Length of follow-up: 6 weeks, 3 months and 6 months • Self-reported abstinence: self-reported (completely stopped smoking waterpipe tobacco yes or no) • Biochemical validation: no biochemical validation reported
Notes	<ul style="list-style-type: none"> • Funding: this work was supported by the National Cancer Institute of the National Institutes of Health (NIH) under award R01CA217861 • Conflict of interest: authors declare no conflict of interests

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	QUOTE: "Block randomization by a computer-generated random number list was used."
Allocation concealment (selection bias)	Unclear risk	Information on allocation concealment was not reported
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome measurement was not biochemically verified, and the intervention and control arms did not receive similar amounts of contact.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rates were lower than 13%.
Selective reporting (reporting bias)	Unclear risk	Reported outcomes were consistent with the methods section. However, no prespecified protocol available.

CHC: community health centers; CO: carbon monoxide; ppm: parts per million; VHW: village health worker; WHO: World Health Organization

Characteristics of excluded studies [ordered by study ID]

Interventions for waterpipe smoking cessation (Review)

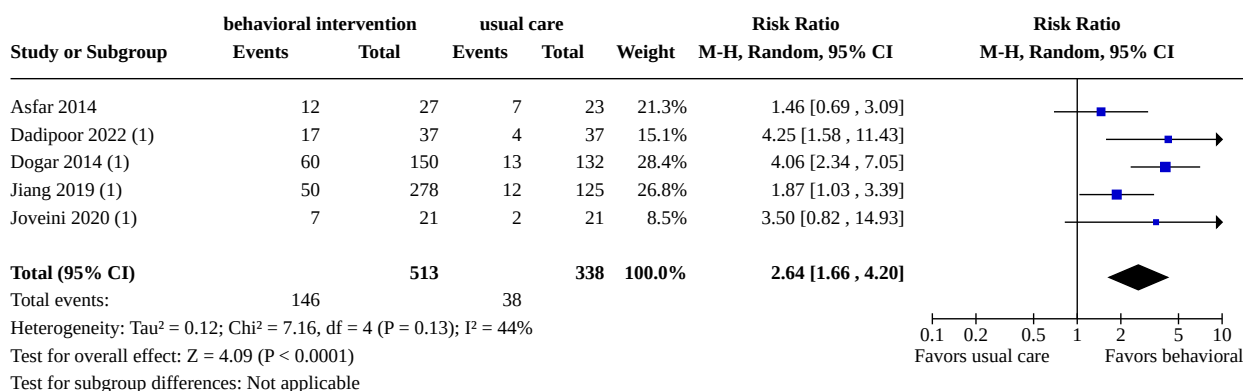
Study	Reason for exclusion
Alzyoud 2018	Follow-up is less than 3 months. Follow up was conducted 1 month after treatment.
Leavens 2018	The study tested a prevention intervention for waterpipe. No smoking cessation outcomes were reported. The investigators tested the effect of the intervention on improving participants understanding of the harms of waterpipe smoking, motivation, and confidence in ability to change waterpipe smoking behaviors, and reduction in waterpipe smoking frequency.
Mohammadi 2019	The study tested a prevention intervention for waterpipe. No smoking cessation outcomes were reported. The investigators examined the effect of a Peer-Led Behavioral Intervention Program on tobacco use related knowledge, attitude, normative beliefs, and intent to use waterpipe.
Mohlman 2013	Included nonsmokers.
Mojahed 2018	No smoking cessation outcomes were reported. Study testing the effect of the intervention on cravings and dependence on waterpipe in pregnant women.
Nakkash 2018	The study tested a prevention intervention for waterpipe. No smoking cessation outcomes were reported. A randomized controlled trial of a theory-informed school-based intervention to prevent waterpipe tobacco smoking. The investigator tested the effect of the intervention on change in knowledge and attitude in 6th and 7th Graders in Lebanon.
Shelley 2021	No waterpipe smoking cessation outcome. The study only measure cigarette smoking cessation.
Shishani 2018	Follow-up is less than 3 months. Follow up was conducted at 5-week after treatment.
Thomas 2015	No waterpipe smoking cessation outcomes were reported. This study was secondary analysis of an ineligible trial, testing how dual use (cigarette and waterpipe) affect cigarette smoking cessation outcomes among college smokers (compared abstinence rates between cigarette smokers who used waterpipe and cigarette smokers who did not use waterpipe).

DATA AND ANALYSES

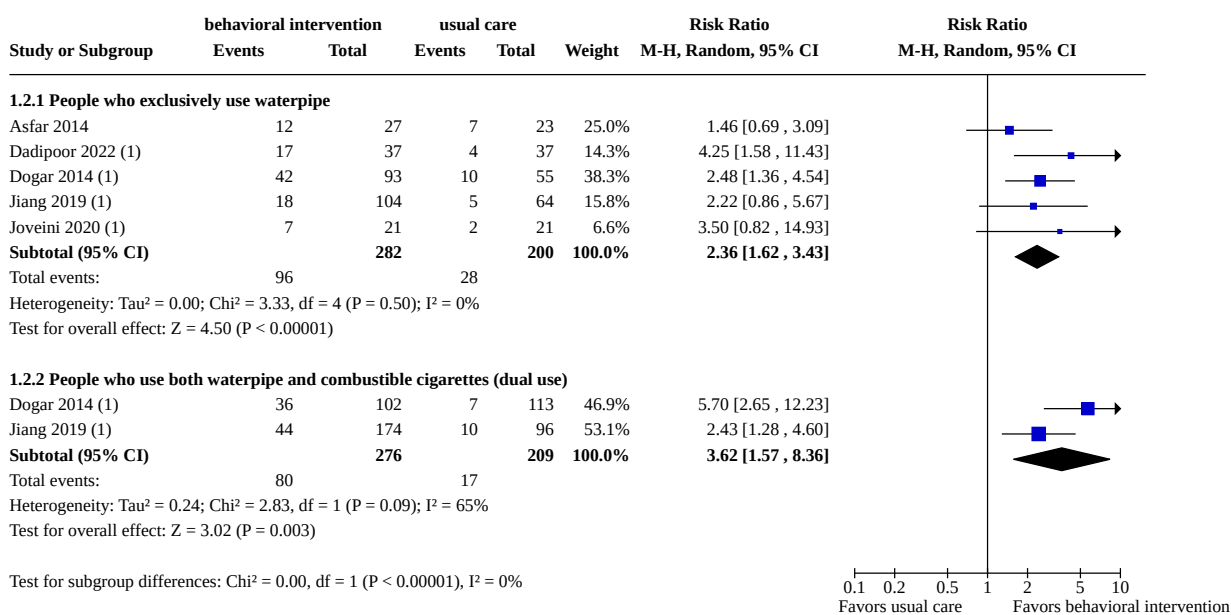
Comparison 1. Face-to-face behavioral interventions versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Waterpipe abstinence	5	851	Risk Ratio (M-H, Random, 95% CI)	2.64 [1.66, 4.20]
1.2 Waterpipe abstinence: subgrouped by exclusive waterpipe use vs dual tobacco use	5		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
1.2.1 People who exclusively use waterpipe	5	482	Risk Ratio (M-H, Random, 95% CI)	2.36 [1.62, 3.43]
1.2.2 People who use both waterpipe and combustible cigarettes (dual use)	2	485	Risk Ratio (M-H, Random, 95% CI)	3.62 [1.57, 8.36]
1.3 Waterpipe abstinence: subgrouped by baseline motivation to quit	5		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

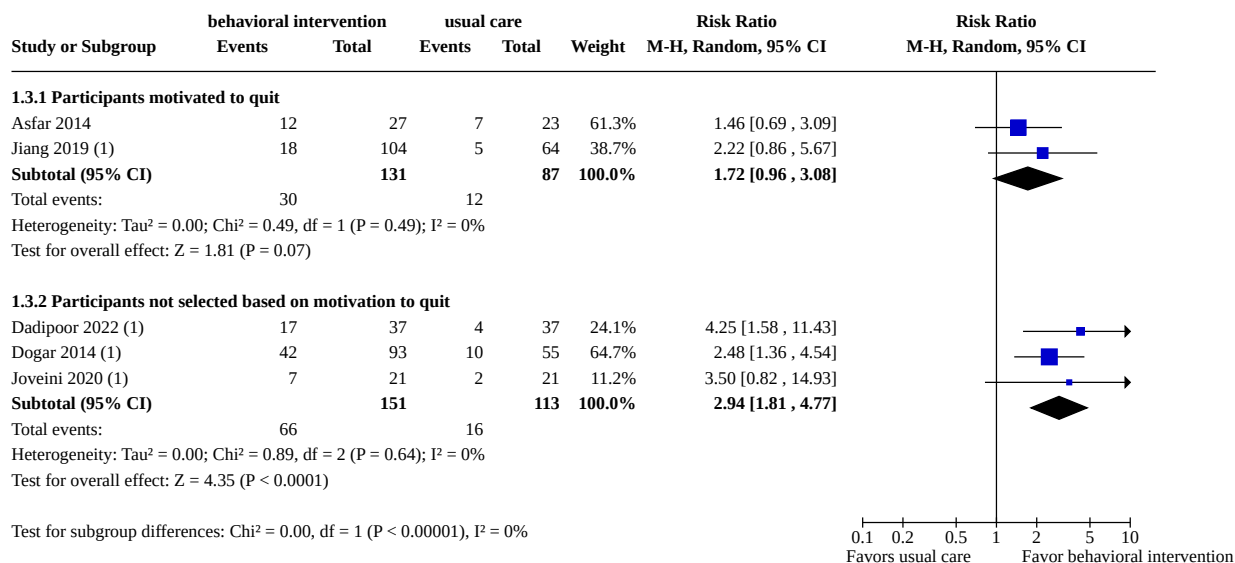
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.3.1 Participants motivated to quit	2	218	Risk Ratio (M-H, Random, 95% CI)	1.72 [0.96, 3.08]
1.3.2 Participants not selected based on motivation to quit	3	264	Risk Ratio (M-H, Random, 95% CI)	2.94 [1.81, 4.77]

Analysis 1.1. Comparison 1: Face-to-face behavioral interventions versus control, Outcome 1: Waterpipe abstinence**Footnotes**

(1) Cluster randomization was adjusted for with intraclass correlation coefficient (ICC) of 0.036

Analysis 1.2. Comparison 1: Face-to-face behavioral interventions versus control, Outcome 2: Waterpipe abstinence: subgrouped by exclusive waterpipe use vs dual tobacco use**Footnotes**

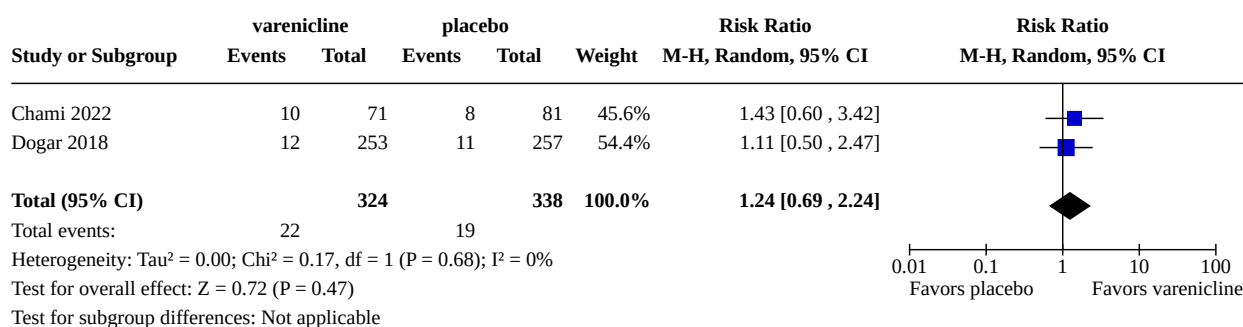
(1) Cluster randomization was adjusted for with intraclass correlation coefficient (ICC) of 0.036

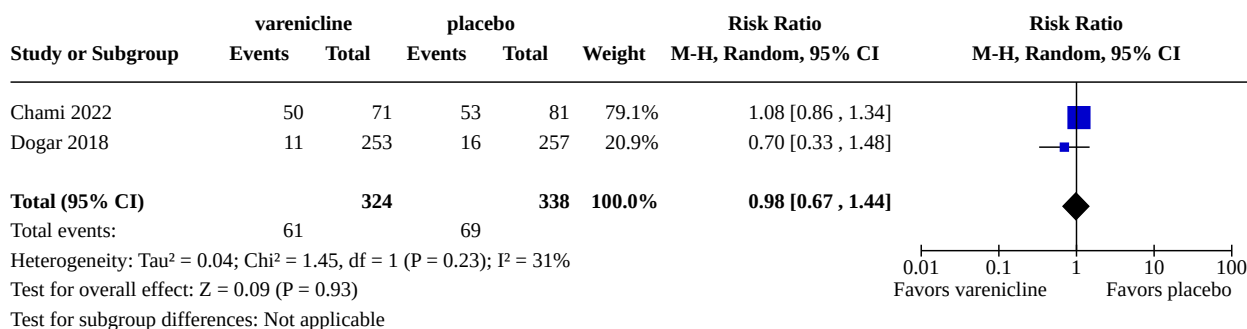
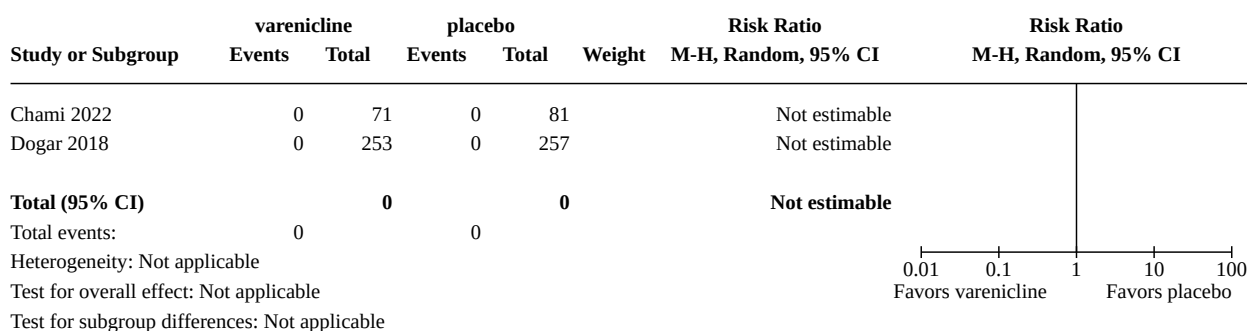
**Analysis 1.3. Comparison 1: Face-to-face behavioral interventions versus control,
Outcome 3: Waterpipe abstinence: subgrouped by baseline motivation to quit****Footnotes**

(1) Cluster randomization was adjusted for with intracluster correlation coefficient (ICC) of 0.036

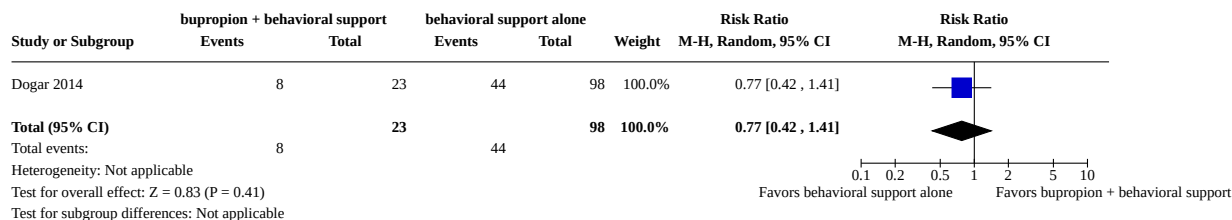
Comparison 2. Varenicline versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.1 Waterpipe abstinence	2	662	Risk Ratio (M-H, Random, 95% CI)	1.24 [0.69, 2.24]
2.2 Adverse events	2	662	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.67, 1.44]
2.3 Serious adverse events	2	0	Risk Ratio (M-H, Random, 95% CI)	Not estimable

Analysis 2.1. Comparison 2: Varenicline versus placebo, Outcome 1: Waterpipe abstinence

Analysis 2.2. Comparison 2: Varenicline versus placebo, Outcome 2: Adverse events**Analysis 2.3. Comparison 2: Varenicline versus placebo, Outcome 3: Serious adverse events****Comparison 3. Bupropion + behavioral support versus behavioral support alone**

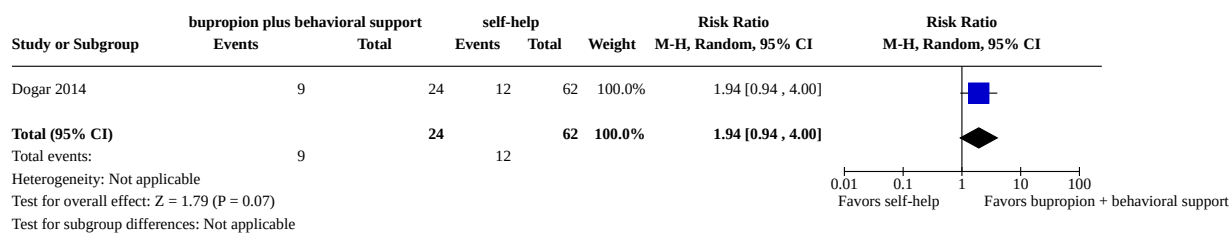
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.1 Waterpipe abstinence	1	121	Risk Ratio (M-H, Random, 95% CI)	0.77 [0.42, 1.41]

Analysis 3.1. Comparison 3: Bupropion + behavioral support versus behavioral support alone, Outcome 1: Waterpipe abstinence

Comparison 4. Bupropion + behavioral support versus self-help

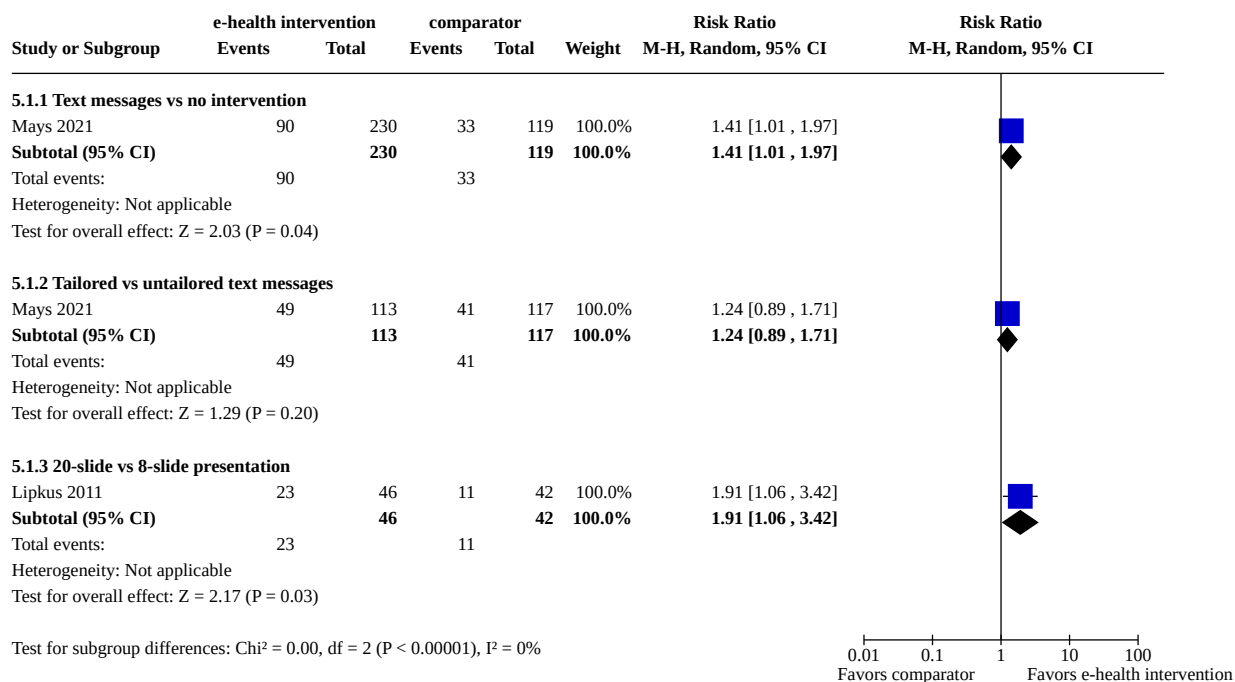
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4.1 Waterpipe abstinence	1	86	Risk Ratio (M-H, Random, 95% CI)	1.94 [0.94, 4.00]

Analysis 4.1. Comparison 4: Bupropion + behavioral support versus self-help, Outcome 1: Waterpipe abstinence



Comparison 5. E-health interventions for waterpipe smoking cessation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
5.1 Waterpipe abstinence	2		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
5.1.1 Text messages vs no intervention	1	349	Risk Ratio (M-H, Random, 95% CI)	1.41 [1.01, 1.97]
5.1.2 Tailored vs untailored text messages	1	230	Risk Ratio (M-H, Random, 95% CI)	1.24 [0.89, 1.71]
5.1.3 20-slide vs 8-slide presentation	1	88	Risk Ratio (M-H, Random, 95% CI)	1.91 [1.06, 3.42]

**Analysis 5.1. Comparison 5: E-health interventions for
waterpipe smoking cessation, Outcome 1: Waterpipe abstinence****APPENDICES****Appendix 1. Search Strategy****Search Strategy: Cochrane Tobacco Addiction Group Specialised Register**

1. (waterpipe* or narghile or arghile or shisha or goza or narkeela or hookah or hubble bubble):TI,AB,MH,EMT,KY,XKY

WHAT'S NEW

Date	Event	Description
7 June 2023	New search has been performed	Searches updated 5 new studies included
7 June 2023	New citation required and conclusions have changed	Review update, with 5 new studies included.

HISTORY

Protocol first published: Issue 4, 2005

Review first published: Issue 4, 2007

Date	Event	Description
13 March 2015	New citation required and conclusions have changed	Three new citations identified. Conclusions updated.
14 December 2014	New search has been performed	Searches updated, three studies identified and included.
4 August 2008	Amended	Converted to new review format.
9 August 2007	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

All authors contributed to the conceptualization and preparation of the review and approved the final text. TA, OJO, and TMG assessed the studies retrieved by the search strategy and updated the Methods and Results sections accordingly. TA undertook data synthesis and led the writing and revision of the review with support from JLB. All authors participated in critically revising and editing the manuscript.

DECLARATIONS OF INTEREST

TA has no known conflicts of interest

KDW has no known conflicts of interest

OJO has no known conflicts of interest

TMG has no known conflicts of interest

WM has no known conflicts of interest

TE is a paid consultant in litigation against the tobacco industry and the electronic cigarette industry. TE is named on one patent for a device that measures the puffing behavior of electronic cigarette users and on another patent for a smartphone app that determines electronic cigarette device and liquid characteristics.

JLB is managing editor of the Cochrane Tobacco Addiction Group. He has no conflicts of interest.

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Internal sources

- Nuffield Department of Primary Care Health Sciences, University of Oxford, UK
Editorial base for the Cochrane Tobacco Addiction Group

External sources

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N/A
- National Institute for Health Research, UK
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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

This update, which was carried out between 2021 and 2023 expanded the inclusion criteria for studies to broaden the scope and value of the review.

In contrast to previous versions of the review, the current review included studies that:

- 1) measured 3+ months abstinence instead of just 6+ months
- 2) used any definition for waterpipe smoking instead of only using waterpipe in the past month
- 3) reported cessation in dual users (waterpipe and any other tobacco products) instead of only exclusive waterpipe users

INDEX TERMS

Medical Subject Headings (MeSH)

Bupropion [therapeutic use]; Randomized Controlled Trials as Topic; Smoking Cessation [methods] [statistics & numerical data];
*Smoking Prevention; Tobacco Use Cessation [*methods] [statistics & numerical data]; *Water

MeSH check words

Female; Humans; Male