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Behavioral cessation treatment of waterpipe smoking: The first pilot randomized controlled trial

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Abstract

Background—Waterpipe use has increased dramatically in the Middle East and other parts of the world. Many users exhibit signs of dependence, including withdrawal and difficulty quitting, but there is no evidence base to guide cessation efforts.

Methods—We developed a behavioral cessation program for willing-to-quit waterpipe users, and evaluated its feasibility and efficacy in a pilot, two arm, parallel group, randomized, open label trial in Aleppo, Syria. Fifty adults who smoked waterpipe 3 times per week in the last year, did not smoke cigarettes, and were interested in quitting were randomized to receive either brief (1 in-person session and 3 phone calls) or intensive (3 in-person sessions and 5 phone calls) behavioral cessation treatment delivered by a trained physician in a clinical setting. The primary efficacy end point of the developed interventions was prolonged abstinence at three months post-quit day, assessed by self-report and exhaled carbon monoxide levels of <10 ppm. Secondary end points were 7 day point-prevalent abstinence and adherence to treatment.

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Conflict of interest

All authors declare that they have no conflicts of interest.

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Contributors

Taghrid Asfar, Wasim Maziak, and Kenneth Ward designed the study. Wasim Maziak and Kenneth Ward obtained funding to support the study. Taghrid Asfar and Kenneth wrote the protocol. Radwan Al Ali served as the project coordinator and interventionist. Samer Rastam served as the project statistician. Kenneth Ward wrote the first draft of the manuscript, and all authors participated in critically revising and editing the manuscript. All authors contributed to and have approved the final manuscript.

Results—Thirty percent of participants were fully adherent to treatment, which did not vary by treatment group. The proportions of participants in the brief and intensive interventions with prolonged abstinence at the 3-month assessment were 30.4% and 44.4%, respectively. Previous success in quitting (OR = 3.57; 95% CI = 1.03–12.43) predicted cessation. Higher baseline readiness to quit, more confidence in quitting, and being unemployed predicted a better adherence to treatment (all p-values <0.05).

Conclusions—Brief behavioral cessation treatment for waterpipe users appears to be feasible and effective.

Keywords

Waterpipe; Cessation; Behavioral treatment; Randomized controlled trial

1. Introduction

Tobacco use is responsible for nearly five million deaths per year worldwide, with this number expected to double in the next 20 years (Mackay & Eriksen, 2002; Mathers, Lopez, & Murray, 2006; Murray & Lopez, 1997). Waterpipe use is an important contributor to this tobacco epidemic, as its use is increasing in both developing and industrialized countries, especially in Arab societies (Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010; Eissenberg, Ward, Smith-Simone, & Maziak, 2008; Maziak, 2008, 2011; Maziak, Ward, Soweid, & Eissenberg, 2004; Primack et al., 2008). Among Arab youth in particular, numerous epidemiological studies have documented the dramatic increase in waterpipe smoking which has replaced cigarettes as the most common form of tobacco use in just a few years. For example, a multi-country study involving a representative sample of 13- to 15-year-old school children in several Arab gulf countries (Bahrain, Oman, Qatar, United Arab Emirates [UAE], Kuwait, Yemen) showed a prevalence of waterpipe smoking ranging from 9 to 15%, and mostly surpassing that of cigarettes (Maziak et al., 2013). Most waterpipe smokers seem to be drawn to it for socializing, relaxation, pleasure and entertainment, as well as the misperception of reduced harm and addictiveness (Akl et al., 2013).

Waterpipe use produces many hallmark features of dependence. For example, during a waterpipe smoking session, users are exposed to 1.7 times the nicotine dose of a single cigarette (Eissenberg & Shihadeh, 2009), and the nicotine absorption rate in daily waterpipe users is equivalent to smoking 10 cigarettes/day (Neergaard, Singh, Job, & Montgomery, 2007). Abstinent users report many of the same withdrawal/craving symptoms of cigarette smokers, which are suppressed by subsequent waterpipe use (Maziak, 2011). Furthermore, frequency of waterpipe use tends to increase over time for many users, and is associated with decreased belief in one's ability to quit, the perception of being "hooked", behavioral adaptation to support use (e.g., smoking alone and at home rather than in social/outdoor settings) (Maziak, Ward, & Eissenberg, 2004) and difficulty in quitting (Ward et al., 2005).

Despite waterpipe's spread and its addictive and harmful potential, studies looking at cessation and treatment options for waterpipe smokers continue to lag behind. Among a representative, population-based sample of adults in Aleppo, Syria, 49% of waterpipe users

wanted to quit and 23% made a quit attempt in the past year (Ward et al., 2005). Quit rates were low, however, with only 28% of ever users having quit (Maziak, Ward, & Eissenberg, 2007; Ward et al., 2006). Unfortunately, no studies have been published describing the development or evaluation of cessation methods for waterpipe users (Maziak et al., 2007).

The current study is the first attempt to build an evidence base on the efficacy of smoking cessation interventions for waterpipe smokers. Our purpose was to develop and pilot test a behavioral intervention for waterpipe users interested in quitting to: 1) evaluate the feasibility of the developed intervention, 2) test its potential efficacy, and 3) determine the adequacy of intervention “dose” in terms of contact frequency.

2. Methods

2.1. Design

The study was a pilot two-arm, parallel group, randomized, open-label trial designed to evaluate the feasibility and potential efficacy of intensive behavioral smoking cessation intervention for waterpipe users, compared to brief behavioral intervention. The trial was conducted at the Syrian Center for Tobacco Studies (SCTS) outpatient cessation clinic, located in a private general hospital in central Aleppo, Syria. The study was approved by the Institutional Review Boards of the University of Memphis and SCTS and registered at clinicaltrials.gov (NCT01135173).

2.2. Study participants

Adults who were 18 years of age, smoked waterpipe 3 times per week in the last year, did not smoke cigarettes, and were interested in quitting waterpipe, were recruited by flyers, ads, and word of mouth. An exclusion criterion was the inability to understand the study and consent procedures.

2.3. Procedures

2.3.1. Randomization—During the orientation session, study objectives and procedures were explained and informed consent was obtained. Participants then completed baseline self-report measures, and had their weight and height assessed using a calibrated balance beam scale and wall-mounted stadiometer, respectively. Participants then were randomly allocated to one of two treatment arms (“brief” or “intensive”) 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. After randomization, participants in both interventions were provided with the opportunity to begin the smoking cessation program immediately during this session. If a participant chose to postpone the first session, it was scheduled within the next 7 days.

2.3.2. Intervention delivery and follow-up—The “brief” intervention was designed to provide a level of treatment that would be considered “usual care” in the context of Syrian primary care (Maziak, Eissenberg, Klesges, Keil, & Ward, 2004). Participants in the “brief” arm received a single, 45-min, individual, in-person educational/counseling session by a trained physician. In the session, the participant was educated about the health effects and

consequences of waterpipe use, encouraged to set a specific quit date, and taught basic stimulus control and contingency management strategies to quit and prevent relapse. Stimulus control strategies included engaging in a “quitting ritual” involving disposing of smoking cues such as waterpipe and charcoals the night before the quit attempt. Contingency management strategies included self-rewards, relaxation, and building social support. In addition to the in-person counseling sessions, participants received three brief (approximately 10 min) phone calls. The first phone call was conducted the day before the quit day to remind and confirm the scheduled quit date and review behavioral strategies and quitting ritual. The other calls were conducted one and seven days after the quit day to discuss progress, review materials and information provided during the sessions, identify and problem-solve early relapse, and provide support.

Participants in the “intensive” arm received three 45-min, individual, in-person sessions and five brief (10 min) phone calls that utilized the same general approach as the brief arm, but provided enhanced counseling in using the problem-solving approach. This included instruction and practice in anticipating high-risk situations, devising a relapse prevention plan, and using cognitive and behavioral coping strategies, self-rewards, and social support. The first call was conducted one day before the quit day and the other calls at 1, 10, 21, and 30 days after the quit day (Fig. 1).

In both arms, participants received written educational self-help materials and were encouraged to abstain from all tobacco products, including cigarettes. Those who slipped or relapsed were encouraged to set a new quit date as soon as possible. Participants who missed an in-person session or phone session were contacted within 24 h to reschedule the session. If a participant could not reschedule an in-person session in a timely fashion, session content was covered during a phone contact.

An in-person follow-up assessment was conducted three months post-cessation, during which participants provided a breath sample for expired carbon monoxide (CO) assessment, had their body weight measured, and completed self-report measures. Participants also completed a semi-structured process evaluation interview administered by a physician who was not involved in the cessation treatment to assess the perceived usefulness and appropriateness of several features of the cessation intervention, along with suggestions for improving the intervention.

2.3.3. Interventionist training—The interventionist was a physician who had undergone six hours of training in the protocol and smoking cessation intervention delivery. The intervention protocol was developed based on current clinical practice standards for cigarette cessation (Fiore, Jaén, Baker, et al., 2008), our experience adapting cessation programs for the Syrian context (Asfar et al., 2008; Ward et al., 2013), and the scientific literature (Eissenberg & Shihadeh, 2009; Maziak, 2013; Maziak, Eissenberg, & Ward, 2005; Maziak, Ward, & Eissenberg, 2004).

2.3.4. Sample size—Our sample size of 50 (25/arm) provided adequate statistical power to detect an absolute difference in prolonged abstinence of 34% (25% in the brief arm vs. 59% in the intensive arm). Although the limited sample size and short follow-up precluded

us from drawing strong inference about the long-term effectiveness of the intervention, this sample size was deemed appropriate for pilot testing a novel intervention to determine feasibility of the delivery approach, collect process data to refine the intervention, and provide initial effect size estimates.

2.4. Data collection, measures and outcomes

2.4.1. Primary outcomes—This study aimed to explore the feasibility potential and efficacy of the developed intensive intervention. Feasibility outcomes included: 1) recruitment yield (number of eligible participants divided by number randomized), 2) willingness of participants to be randomized, 3) participant's acceptability of the intervention, and 4) follow-up rates, adherence/compliance rates, and the time needed to collect and analyze data (Julious, 2005; Lancaster, Dodd, & Williamson, 2004). The primary efficacy outcome was prolonged abstinence (defined as complete abstinence after a two-week grace period following the quit day from waterpipe at three months post-cessation (Hughes, Kelly, et al., 2003)), assessed by self-report and an expired carbon monoxide level of <10 ppm. Carbon monoxide was measured using a portable breath CO monitor (Vitalograph, Lenexa, KS).

2.4.2. Secondary outcomes—We also assessed two other secondary end-points that are commonly used in the cigarette smoking literature (Hughes, Shiffman, Callas, & Zhang, 2003): 1) seven day point prevalent abstinence, defined as no waterpipe use during the seven days preceding the follow-up interview, based on self-report and a CO level of <10 ppm; and 2) continuous abstinence, defined as complete abstinence since the quit day, based on self-report and a CO of <10 ppm.

2.4.3. Baseline measures—Socio-demographic variables included age, gender, marital status, years of education, employment status, religion, and density index (DI). DI is a measure of socioeconomic status and is calculated by dividing the number of people living in the participant's household by the number of rooms occupied, excluding the kitchen and bathrooms (Maziak, Asfar, Mzayek, Fouad, & Kilzieh, 2002). It has been shown to be highly correlated with other socioeconomic status indicators and to predict health status.

Tobacco-related variables included age when the participant began using waterpipe, the number of years as a waterpipe smoker, the frequency of smoking (daily vs. less than daily), the number of waterpipes smoked per week, whether the participant had made a quit attempt in the last year, the number of past year quit attempts, and the number of successful quit attempts of the last year (defined as quitting for at least one month). Participants also completed the stages of change questionnaire (DiClemente et al., 1991), adapted for waterpipe use, to determine their readiness to quit in the next month and six months. Confidence in quitting was assessed using a single item with four levels (very confident, moderately confident, a little confident, not at all confident). Four items assessed exposure to others' tobacco use, including number of bowls of waterpipe tobacco smoked per day in the household, number of adult household members who smoke waterpipe, number of adult household members who smoke any tobacco product, and number of cigarettes smoked per day in the household. Withdrawal symptomatology was assessed using the Minnesota

Nicotine Withdrawal Scale (MNWS) (Cappelleri et al., 2005). We calculated the mean of eight scale items to obtain a total withdrawal score: anxiety, depression/feeling blue, difficulty concentrating, hunger, increased appetite, insomnia, irritability/frustration/anger, and restlessness (Hughes & Hatsukami, 1986; Hughes, Wadland, Fenwick, Lewis, & Bickel, 1991).

Depressive symptomatology was assessed with the Center for Epidemiologic Studies Depression Scale (Hughes & Hatsukami, 1998; Radloff, 1977; Thomas, Jones, Scarinci, Mehan, & Brantley, 2001). Lastly, we measured social support using two items taken from the perceived social support from friends and from family questionnaire (Procidano & Heller, 1983): “My spouse will support my efforts to quit smoking” and “I have some family members or friends who will support my efforts to quit smoking”.

2.4.4. Process evaluation measures—At the 3-month follow-up, participants completed a semi-structured interview to answer several questions about their perception of the treatment program such as if the program met their expectations in terms of length and type of treatment, if they prefer to use medication, and if the strategies were helpful.

2.5. Statistical analysis

The analyses of the acceptability and feasibility outcomes were mainly descriptive. Chi-square tests and between-group t-tests were used to compare treatment arms on baseline variables. Chi-square tests also were used to compare cessation outcomes in the two arms. Multivariable logistic regression analyses were conducted to assess independent baseline predictors of cessation (both prolonged and point-prevalent). Outcome analyses were conducted using the intent-to-treat principle, with participants who did not return for the three month follow-up classified as being relapsed. Lastly, for participants in the intensive arm, we calculated Pearson correlations to assess baseline predictors of adherence to treatment, including both the number of in-person sessions and the number of total contacts received (in-person plus phone).

3. Results

3.1. Sample characteristics

Recruitment began in November 2007 and ended in October 2008. A total of 177 smokers were screened for the study, and 26% did not meet eligibility requirements (21.5% smoked cigarettes in addition to waterpipe, and 4.5% smoked waterpipe less than twice per week). Of the 131 eligible individuals, 62% (n = 81) declined participation, resulting in 50 waterpipe smokers enrolling in the study, with 27 allocated to the intensive arm and 23 to the brief arm (mean age 29.7 ± 9.3 years, 94% men, and 44% married) (Fig. 2).

3.2. Participant characteristics

None of the baseline socio-demographic variables differed between the two treatment arms. Mean expired CO level was 14.7 ± 19.0 ppm and 64% of participants had a baseline CO of <10 ppm; 57.1% of participants smoked >5 waterpipes/week, 84% were ready to quit waterpipe smoking in the next month, 42% were very confident in quitting waterpipe

smoking, 70.3% tried to quit smoking in the last year, and only 32% of these had successfully quitted smoking for at least 1 month in the past year (Table 1).

3.3. Treatment implementation, adherence, and retention

All in-person sessions were audiotaped and a sub-sample was periodically reviewed by a researcher who was not involved in treatment delivery. A total of 20% of sessions were audited in this way, indicating that intervention was delivered accurately in more than 90% of sessions.

In the intensive arm, 37% completed all three sessions, 40.7% completed all five phone sessions, and 26% completed all treatment sessions (3 in-person and 5 phone sessions). In the brief arm, 78.3% of participants completed the single in-person session, 39.1% completed all three calls, and 34.8% completed all treatment sessions (1 in-person and 3 phone sessions; 100%) (Table 2).

Retention was similar in the two arms, with 78% (21 out of 27) in the intensive arm, and 83% in the brief arm (19 out of 23) completing the 3-month follow-up.

3.4. Efficacy of interventions

The proportions of participants in the intensive and brief arms with prolonged abstinence at the 3 month follow-up were 44.4% ($n = 12$) and 30.4% ($n = 7$). In addition, at the 3-month follow-up, 18.5% ($n = 5$) and 17.4% ($n = 4$) of participants in the intensive and brief arms, respectively, had achieved continuous abstinence, and 40.7% ($n = 11$) and 30.4% ($n = 7$), respectively, had achieved 7-day point prevalent abstinence. Neither of these comparisons was statistically significant (Table 3).

3.5. Predictors of cessation

Those who had successfully quit waterpipe for at least one month during the last year were more likely to quit smoking at the 3-month follow-up (OR = 3.57; 95% CI, 1.03–12.43) (Table 4).

3.6. Predictors of adherence

In the intensive intervention arm, two measures of adherence were examined, including the number of in-person sessions attended (ranging from 1 to 3) and total number of contacts (in-person plus phone calls, ranging from 1 to 8). Significant correlates were consistent for both adherence measures, and included being unemployed, having successfully quit waterpipe for at least one month during the last year (the p -value was only of borderline significance [.074] for in-person sessions), greater confidence in one's ability to quit waterpipe, and greater readiness to quit (Table 5).

3.7. Process evaluation

Overall, 66.6% of participants reported that the behavioral intervention was helpful in quitting smoking and 95.2% stated that the interventionist was helpful. The most helpful strategies provided by the program were encouraging physical activity (71.4%), receiving important educational information (71.4%), following the rules of relapse prevention

(57.6%), and getting social support (47.6%). While 70% of participants received support from their families, only 22% received support from their friends in their quit attempt. One-third of participants were interested in participating in group counseling intervention and 74% preferred using medication.

4. Discussion

This report describes what we believe is the first attempt to develop and empirically evaluate a treatment program to assist waterpipe users to quit. Cessation rates three months post-treatment were encouragingly high, with approximately 35.5% of participants achieving prolonged abstinence and 7 day point prevalent abstinence. These rates are consistent with those reported in meta-analyses of behavioral cessation trials with cigarette smokers. For example, Fiore et al. (2008) reported that average rates of 7 day point prevalent abstinence at six months post-treatment were 26%–28% for interventions that provided total contact time in the range used in our study (75–185 min). We observed substantially lower rates for continuous abstinence (approximately 18%) – defined as not smoking even a puff after the quit day –compared to prolonged or point prevalent, indicating that many participants had slips early in treatment but went on to regain and maintain abstinence.

Cessation rates were not significantly different in the intensive and brief treatment arms, suggesting that a single in-person session of education and advice from a trained professional, along with brief telephone follow-up, may be as effective as a more intensive intervention for willing-to-quit waterpipe users. In addition, 25% of participants in the brief and intensive interventions didn't complete one in-person session because the first session wasn't provided immediately after randomization. Therefore, the first session in future trials should perhaps be provided immediately after randomization to capitalize on smokers' high (but soon-to-dwindle) motivation.

Process evaluation data indicate that participants generally were satisfied with the treatment they received. Positive comments included receiving useful educational information about waterpipe smoking and learning helpful strategies to prevent relapse. Suggestions to improve the program included having more frequent and longer contacts, and using medication. Interestingly, almost half of participants were interested in receiving group smoking cessation intervention, a method that has not been yet introduced or provided to smokers in Syria. In addition, participants were interested in receiving more phone calls than receiving more in-person sessions. It is likely that such feedback is, at least in part, due to the fact that compared to cigarettes, waterpipe smokers in the Syrian as well as some other contexts tend to be younger and more educated (Maziak et al., 2013; Ward et al., 2006). Accordingly, future cessation efforts for the waterpipe in Syria and other Middle Eastern countries should consider introducing and examining new methods of cessation intervention such as group smoking cessation programs in addition to utilizing technology such as phones, smart phones, or text-messaging that could be more attractive to waterpipe smokers, in particular, young and tech-savvy smokers.

Our results are particularly encouraging in that participants appear to have been very nicotine dependent. Indicators of dependence included a high average frequency of

waterpipe use (four times per week, on average, with more than 70% smoking daily), and a majority having tried unsuccessfully to quit in the past year. While the degree of nicotine dependence is strongly associated with the likelihood of quitting among cigarette smokers (Hyland et al., 2004, 2006), there was no evidence of this effect in our study. Number of waterpipes smoked per week, severity of withdrawal symptoms at baseline, and having tried to quit in the past year were not associated with cessation. On the other hand, the strongest predictor of cessation was having made a successful waterpipe smoking quit attempt during the last year (quit for at least one month), which may indicate that participants developed quitting skills and/or enhanced their self-efficacy that were useful during the current quit attempt.

Our treatment program was adapted from a validated cigarette smoking cessation program that we developed and tested in Syria (Asfar et al., 2008; Maziak, Eissenberg, et al., 2004; Ward et al., 2013) using best practice standards (Asfar et al., 2008). Borrowing from the cigarette literature seemed like a reasonable starting point, given that there were no waterpipe-specific treatment models to guide us. Further, despite there being many important differences between waterpipe and cigarette use that may impact treatment, these two forms of tobacco use do have many behavioral similarities, including heavy users having difficulty quitting, having urges to smoke during abstinence which may prompt relapse, and experiencing withdrawal and suppression of withdrawal with subsequent tobacco use. As such it seemed appropriate to use a similar behavioral intervention approach, emphasizing stimulus control, contingency management, training in problem solving and coping skills enhancement, and provision of social support. Process evaluation data indicated that most of these methods were acceptable, and also that potentially promising modifications may be desirable and helpful.

Adherence to treatment was less than ideal, with only 35% and 30% completing the full course of treatment in the intensive and brief arms, respectively. Greater motivation to quit and confidence in one's ability to quit, as well as having successfully quit previously, were significantly associated with greater adherence. In addition, unemployed participants were more adherent than those who had jobs. These factors indicate the need to refine intervention strategies to make them amenable to a broader body of users, including those who may have less time available to attend treatment, and those who are more ambivalent about quitting.

Several limitations of the study should be noted. First, this was a pilot study, designed to provide an initial test of a novel intervention and determine its feasibility, acceptability, and potential effectiveness. As such, we were able to follow participants for only a short period of time (three months) and the study was statistically powered to detect only a large effect. However, these data should be useful for future studies to refine the intervention and make realistic power estimates based on the effects we observed in this study. Second, better assessment tools are needed to measure nicotine dependence among waterpipe smokers, which will be useful to target interventions more appropriately. Third, we evaluated only a behavioral intervention, and future studies should investigate whether pharmacological and combined behavioral/pharmacologic interventions may be a good option to consider for waterpipe smokers. Lastly, expired CO's short half-life reduces its usefulness to confirm

self-reported abstinence in our sample, which consisted mainly of non-daily smokers. However, similar to cigarette cessation studies, CO is useful as a “bogus pipeline” to encourage participants to report truthfully, believing that the investigator has an independent and objective method to verify tobacco use. Further, reducing the CO threshold used in our study to confirm self-reported abstinence had little impact on abstinence classification. Reducing the threshold from <10 ppm to <8 ppm did not change abstinence classification for either group. Using a cut-off of <5 ppm did not change the abstinence rate for the brief intervention group, and reduced it only slightly (from 44.4% to 37.0%) in the intensive group. These limitations notwithstanding, we believe this study makes a useful contribution in beginning the important task of developing effective methods to assist the growing number of waterpipe users to successfully quit.

5. Conclusions

Future work is needed to refine behavioral strategies. Pharmacotherapy also should be considered. Brief intervention approaches that provide education and behavioral skill training, such as was used in this study, deserve further study. Also, it is important to develop intervention formats that are more highly disseminable and have greater reach than the clinic-based model we used. Since college students are a high-risk group for waterpipe smoking, cessation efforts on university campuses may be warranted, and “mHealth” interventions, such as phone, internet, and smart phone applications, also should be investigated.

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HIGHLIGHTS

- This is the first attempt to develop and evaluate a waterpipe cessation intervention.
- Brief intervention may be as effective as more intensive intervention.
- Being unemployed, motivation and confidence, and having quit previously predicted adherence.
- Previous success in quitting predicted cessation.

Fig. 1.
Study scheme.

Fig. 2.
Study flow.

Table 1

Baseline characteristics by treatment condition.

	Brief intervention n (%) = 23	Intensive intervention n (%) = 27	p-Value ^a
Demographic characteristics ^b			
Gender (% men)	22 (95.7)	25 (92.6)	0.561
Age, mean (SD)	30.6 (10.6)	28.6 (8.3)	0.522
Density index ^c (SD)	1.49 (1.18)	1.44 (0.81)	0.864
Education status (% completed high school)	15 (71.4)	15 (57.7)	0.563
Marital status (% married)	10 (43.5)	12 (44.4)	0.920
Occupation (% employed)	13 (56.5)	17 (63.0)	0.805
Religion (% Muslim)	20 (87.0)	25 (92.6)	0.397
Tobacco use			
Age of WP smoking initiation (SD)	19.9 (8.0)	20.8 (7.3)	0.675
Number of years smoking WP (SD)	6.8 (6.6)	4.3 (3.7)	0.137
Frequency of smoking (% daily)	16 (69.6)	23 (85.2)	0.335
Number of WP smoked per week			
2–5	4 (17.4)	5 (18.5)	0.873
6–15	12 (52.2)	16 (59.3)	
16–30	5 (21.7)	5 (18.5)	
>30	2 (8.7)	1 (3.7)	
Carbon monoxide (p.p.m.), mean (SD)	12.9 (18.5)	16.3 (19.6)	0.538
Quitting			
Readiness to quit			
Ready to quit in the next month	21 (91.3)	21 (77.8)	0.157
Ready to quit in the next three months	0 (0)	4 (14.8)	
Ready to quit in the next six months	2 (8.7)	2 (7.4)	
Confidence in quitting			
Very confident	10 (43.5)	11 (40.7)	0.577
Moderately confident	7 (30.4)	12 (44.4)	
A little/not at all confident	6 (26.1)	4 (14.8)	
Past quit attempts			
Attempt to quit in the last year (% yes)	17 (73.9)	18 (66.7)	0.577
Number of past quit attempts			
1–5 times	15 (65.2)	16 (59.3)	0.855
>5 times	2 (8.7)	2 (7.4)	
Successful quit attempts (quit at least one month) % yes	8 (34.8)	8 (29.6)	0.967
Exposure to SHS at home			
Number of adult household members who smoke WP	1.32 (1.2)	1.37 (1.21)	0.881
Number of adult household members who smoke any tobacco product	1.95 (2.13)	2.07 (1.80)	0.835
Depression (by CESD score)			
No (score < 16)	10 (43.5)	11 (40.7)	0.740

	Brief intervention n (%) = 23	Intensive intervention n (%) = 27	p-Value ^a
Yes (score 16)	13 (56.5)	16 (59.3)	
Social support ^d	8.22 (3.31)	9.08 (3.01)	0.545
Total withdrawal symptoms score ^e	33.5 (18.4)	31.4 (17.9)	0.753
Body mass index (BMI)	27.1 (4.28)	26.5 (4.36)	0.621

^a According to t or Chi-square test.

^b Data are shown as number (%) or mean (standard deviation).

^c Density index, defined as household members per number of rooms in the home.

^d Social Support Questionnaire consisted of only two questions: 1) does your spouse support your efforts to quit WP smoking, and 2) do you have some family members or friends who are/will support your efforts to quit WP smoking.

^e Hughes-Hatsukami Withdrawal Scale.

Table 2

Adherence to treatment by treatment condition.

Adherence	Contact	Intensive intervention (n) %	Brief intervention (n) %
In each contact			
	Session 0	27 (100)	23 (100)
	Session 1	20 (74.1)	18 (78.3)
	Call 1	18 (66.7)	16 (69.6)
	Call 2	16 (59.3)	15 (65.2)
	Session 2	15 (55.6)	–
	Call 3	16 (59.3)	17 (73.9)
	Session 3	16 (59.3)	–
	Call 4	15 (55.6)	–
	Call 5	11 (40.7)	–
	3-Month assessment	21 (77.8)	19 (82.6)
By total contact			
	0	1 (3.7)	0 (0)
	1	3 (11.1)	3 (13)
	2	1 (3.7)	5 (21.7)
	3	5 (18.5)	7 (30.4)
	4	2 (7.4)	8 (34.8)
	5	5 (18.5)	–
	6	3 (11.1)	–
	8	7 (25.9)	–
By in-person sessions			
	0	2 (7.4)	5 (21.7)
	1	9 (33.3)	18 (78.3)
	2	6 (22.2)	–
	3	10 (37)	–
By phone calls			
	0	3 (11.1)	2 (8.7)
	1	4 (14.8)	3 (13)
	2	5 (18.5)	9 (39.1)
	3	5 (18.5)	9 (39.1)
	4	3 (11.1)	–
	5	7 (25.9)	–

Table 3

Cessation rates at the 3-month follow-up by treatment condition.

	Brief intervention (n = 23)	Intensive intervention (n = 27)	p-Value^a
Seven-day point prevalent ^b	7 (30.4%)	11 (40.7%)	0.449
Prolonged ^c	7 (30.4%)	12 (44.4%)	0.309
Continuous ^d	4 (17.4%)	5 (18.5%)	0.606

^a According to Chi-square test.^b Defined as self-reported abstinence for the seven days preceding the follow-up visit confirmed by carbon monoxide <10 p.p.m.^c Defined as self-reported abstinence confirmed by carbon monoxide <10 p.p.m. following a grace period of two weeks after the scheduled quit day.^d Defined as self-reported abstinence confirmed by carbon monoxide <10 p.p.m. after the scheduled quit day.

Table 4

Predictors of smoking status at the 3-month assessment (odds ratios for point-prevalence and prolonged abstinence according to binary logistic regression analysis).

	Point-prevalence abstinence OR (95% CI)	Prolonged abstinence OR (95% CI)
Demographic characteristics		
Age	1.09 (0.96–1.08)	0.98 (0.92–1.04)
Marital status (yes vs. no)	2.08 (0.64–6.73)	1.76 (0.55–5.58)
Education (yes vs. no)	0.92 (0.26–3.20)	0.56 (0.17–1.90)
Employment (yes vs. no)	0.94 (0.29–3.09)	0.53 (0.16–1.71)
Density index	0.83 (0.42–1.62)	1.12 (0.62–2.02)
Religion (Muslim vs. Christian)	0.11 (0.01–1.10)	2.67 (0.28–25.84)
Tobacco dependence		
Number of WPs smoked/week	0.48 (0.21–1.14)	0.91 (0.43–1.91)
Number of years smoking	1.01 (0.89–1.13)	1.03 (0.92–1.16)
Tried to quit in the last year (yes)	0.82 (0.25–2.72)	0.45 (0.14–1.49)
Confidence in quitting smoking	0.59 (0.15–2.24)	2.74 (0.78–9.61)
Have successful quit attempt ^a	3.57 (1.03–12.43)	2.09 (0.62–7.05)
Readiness to quit ^b	1.18 (0.85–1.65)	1.29 (0.92–1.82)
Withdrawal scale ^c	1.01 (0.97–1.06)	1.00 (0.96–1.04)
Depressive symptomatology ^d	0.68 (0.21–2.19)	0.80 (0.25–2.53)

^aQuit waterpipe smoking for at least 1 month.

^bQuit ladder score.

^cHughes–Hatsukami.

^dCES-D score 16 vs. <16.

Table 5Predictors^a of adherence to treatment among participants^b.

	<u>In-person contact (1–3 sessions)</u>		<u>Total contact (1–8 contact)</u>	
	r	p	r	p
Demographic characteristics				
Gender	0.17	0.391	0.08	0.692
Age	–0.26	0.197	–0.10	0.635
Marital status	–0.13	0.534	–0.02	0.931
Education	–0.10	0.612	0.13	0.543
Employment ^c	–0.40	0.044*	–0.41	0.050*
Density index	0.10	0.643	0.24	0.265
Religion	0.33	0.105	0.38	0.069
Tobacco dependence				
Number of WP smoked per week	–0.20	0.329	–0.16	0.444
Number of years smoking WP	–0.21	0.290	–0.07	0.743
Made a quit attempt in the past year	–0.35	0.077	–0.24	0.244
Have successful quit attempt in the past year ^d	0.37	0.074	0.46	0.033*
Confidence in quitting WP smoking ^e	0.47	0.017*	0.49	0.016*
Hughes–Hatsukami (withdrawal scale)	–0.02	0.940	–0.21	0.420
Readiness to quit (quit ladder score)	0.61	0.001**	0.60	0.002**
Depressive symptomatology (CES-D score)	0.12	0.556	–0.12	0.566
Social support score	0.07	0.824	0.07	0.817

^a Spearman correlations are calculated for all analysis.^b In the intensive intervention (n = 27), according to the number of in-person contact, and total contact (in-person + phone calls) received.^c Being employed (yes).^d Quit waterpipe smoking for at least one month.^e Very confident.

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).