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Predictors of adherence to pharmacological and behavioral treatment in a cessation trial among smokers in Aleppo, Syria

Ziyad Ben Taleb^{a,*}, Kenneth D Ward^{b,c}, Taghrid Asfar^{c,d}, Raed Bahelah^{a,e}, and Wasim Maziak^{a,c}

^aDepartment of Epidemiology, Florida International University, Miami, Florida, USA

^bDivision of Social and Behavioral Sciences, School of Public Health, University of Memphis, Memphis, TN, USA

^cSyrian Center for Tobacco Studies, Aleppo, Syria

^dUniversity of Miami Miller School of Medicine, Miami, FL

^eFaculty of Medicine and Health Sciences, University of Aden, Aden, Yemen

Abstract

Introduction—The development of evidence-based smoking cessation programs is in its infancy in developing countries, which continue to bear the main brunt of the tobacco epidemic. Adherence to treatment recommendations is an important determinant of the success of smoking cessation programs, but little is known about factors influencing adherence to either pharmacological or behavioral treatment in developing countries settings. Our study represents the first attempt to examine the predictors of adherence to cessation treatment in a low-income developing country.

*Corresponding author: Ziyad Ben Taleb, Department of Epidemiology, Robert Stempel College of Public Health and Social Work, Florida International University, 1240 S.W. 108 AVE, Path, University Park, FL 33174, [zbent002@fiu.edu].

Contributors: Ziyad Ben Taleb: Dr. Ben Taleb conceptualized and designed the study, drafted and revised the manuscript, guided and interpreted the analysis, approved the final manuscript as submitted, and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Kenneth D Ward: Dr. Ward contributed to the acquisition and interpretation of the data, critically revised the article for important intellectual content, approved the final manuscript as submitted, and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Taghrid Asfar: Dr. Asfar contributed to the acquisition and interpretation of the data, critically revised the article for important intellectual content, approved the final manuscript as submitted, and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Raed Bahelah: Dr. Bahelah contributed to analysis of data, critically revised the article for important intellectual content, approved the final manuscript as submitted, and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Wasim Maziak: Dr. Maziak contributed to the acquisition and interpretation of the data, critically revised the article for important intellectual content, approved the final manuscript as submitted, and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Methods—Predictors of adherence to pharmacological and behavioral treatment were identified by analyzing data from a multi-site, two-group, parallel-arm, double-blind, randomized, placebo-controlled smoking cessation trial in primary care clinics in Aleppo, Syria. Participants received 3 in-person behavioral counseling sessions plus 5 brief follow-up phone counseling sessions, and were randomized to either 6 weeks of nicotine or placebo patch.

Results—Of the 269 participants, 68% adhered to pharmacological treatment, while 70% adhered to behavioral counseling. In logistic regression modeling, lower adherence to pharmacological and behavioral treatment was associated with higher daily smoking at baseline, greater withdrawal symptoms, and perception of receiving placebo instead of active nicotine patch. Women showed lower adherence than men to behavioral treatment, while being assigned to placebo condition and baseline waterpipe use were associated with lower adherence to pharmacological treatment.

Conclusion—Adherence to cessation treatment for cigarette smokers in low-income countries such as Syria may benefit from integrated cessation components that provide intensive treatment for subjects with higher nicotine dependence, and address concurrent waterpipe use at all stages.

Keywords

smoking; cessation; adherence; cigarettes; developing countries

1. Introduction

Tobacco smoking remains the leading cause of preventable deaths world-wide. Currently, tobacco is responsible for an estimated 6 million deaths every year (Erikson et al, 2013). This annual death toll is expected to increase to 10 million within the next 20–30 years, with 80% of these deaths occurring in developing countries (WHO, 2013a). These trends call for comprehensive approaches for tobacco control, especially in low-income countries, which continue to bear most of the brunt of the tobacco epidemic (World Bank, 2010).

Promoting smoking cessation is a cornerstone in the fight to reduce tobacco related morbidity and mortality (WHO, 2013a). This is why one of the main articles of the Framework Convention on Tobacco Control (FCTC) requires governments to take effective measures to promote cessation of tobacco use and adequate treatment for tobacco dependence (WHO, 2010). At least in developed countries, the application of a mixture of behavioral and pharmacological cessation interventions has been shown to help a proportion of smokers to quit smoking (Fiore et al., 2008). Unfortunately, in developing countries, where most of the world's smokers reside (Jha et al., 2006), the infrastructure for smoking cessation is lacking and little work is being done to develop effective cessation interventions that take into account local smoking patterns, health care resources and culture (Maziak et al., 2004). For example, in Syria, a Middle Eastern country with a high prevalence of cigarettes and waterpipe smoking (WHO, 2013b; Ward et al., 2006), there are no clinical practice standards, specialty cessation clinics or pharmacological agents available to assist smokers to quit (Asfar et al., 2008, 2011; Maziak et al., 2004; Ward et al, 2013).

To date, there is only one randomized clinical trial of a behavioral/pharmacological smoking cessation intervention that was conducted in a developing country setting (Ward et al.,

2013). Results from this trial showed that combined pharmacological and behavioral treatment induced cessation in 12% of participants at one year post-treatment. This study, along with a bulk of evidence from developed countries, highlighted the importance of adherence to treatment (e.g., attendance at counseling sessions, taking medication as instructed) in predicting successful cessation outcomes; Shiffman et al., 2008; Alterman, 1999). As such, factors contributing to better adherence to cessation treatment have received substantial attention in order to guide the development of approaches that improve adherence to cessation interventions (Alterman et al., 1999; Berg et al., 2013; Cooper et al., 2004; Patterson et al., 2003). However, little if any evidence currently exists to assist in fostering adherence to cessation treatments in developing countries. The current study aims to address this knowledge gap by identifying potential predictors of adherence to pharmacological and behavioral treatment in a developing country's health care setting (Syria).

2. Methods

2.1 Study design

This study utilized data from a multi-site two-group, parallel-arm, double-blind, randomized, placebo-controlled trial conducted in primary care clinics in Aleppo, Syria from 2007 to 2008. Full details of the trial and methods are published elsewhere (Ward et al., 2013). Eligible and interested smokers were randomized to receive either behavioral cessation counseling + active transdermal nicotine patches (TN) or behavioral cessation counseling + placebo TN. A total of 269 smokers were recruited, 18-65 years old, who had smoked > 5 cigarettes/day for at least one year. Participants were patients who resided within the catchment area of one of the four primary health care clinics included in the study. Each clinic had a primary care physician who served as a cessation coordinator, liaised between other physicians and clinic-staff to ensure adherence to the study protocol, and delivered the intervention to participants.

2.2 Pharmacological Intervention

Patients in the active treatment group received a six-week supply of Nicotinell™ patches, 24-h dose, using a step-down algorithm. Patients in the placebo group received the same step-down algorithm. Placebo patches were provided by a local manufacturer.

2.3 Behavioral counseling

All patients received behavioral cessation counseling using approaches shown to be effective in developed countries (Abrams and Niaura, 2003; Fiore et al., 2008) and adapted for the local culture based on previous research (Asfar et al., 2008). Three individual, in-person sessions (approximately 30 min each) and 5 brief (approximately 10 min) phone calls, were delivered by the cessation coordinator.

2.4 Procedures

Participants provided baseline demographic data, smoking related information (e.g., smoking history, level of dependence, previous quit attempts, readiness to quit smoking), and completed additional questionnaires to assess quitting self-efficacy, stage of change,

withdrawal symptoms, perceived social support, and depression/mood. Participants then were assigned to one of two treatment conditions [Arm A (n=134): behavioral counseling + active TN vs. Arm B (n=135): behavioral counseling + placebo TN] using random permuted blocks, stratified by clinic and gender.

2.5 Measures

2.5.1 Baseline predictors—Socio-demographic variables included age, gender, marital status, number of people in the house, years of education and religion. Smoking-related variables included number of years as a cigarette smoker; current amount smoked (cigarettes/day); previous successful quit attempts defined as quitting smoking for at least 24 hours in the past six months; the Readiness To Quit Ladder (Biener and Abrams, 1991); a single item, Likert-type scale assessing confidence in one's ability to quit; the three subscales of the Smoking Self-Efficacy/Temptations Questionnaire (Long Form)—Positive Affect/Social Situations, Negative Affect Situations, and Habitual/Craving Situations (Velicer et al., 1990); the Fagerström Test for Nicotine Dependence (FTND; Heatherton et al., 1991); waterpipe use status and tobacco withdrawal symptomatology using the Minnesota Nicotine Withdrawal Scale (MNWS; Hughes and Hatsukami, 1986). We calculated the mean of eight scale items to obtain a total withdrawal score. Other variables included: perceived social support (Zimet et al., 1988, 1990), and depressive symptomatology using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977; Thomas et al., 2001). To assess blindness during treatment, patients indicated whether they believed they had received nicotine or placebo patch.

Participants were queried weekly for the duration of the treatment (six weeks) on whether they had followed treatment instructions to use one patch every day over the past week. Based on the literature (Kopjar et al., 2003; Nachega et al., 2006; Ruddy and Partridge, 2009; Berg et al., 2013), we defined being adherent to patch use as responding “yes” to this question during at least 5 of the 6 weeks (>80%). Accordingly, adherence to patch was set up as a dichotomous variable (non-adherent=0, adherent=1).

2.5.2 Adherence to behavioral counseling—Following previous work (Asfar et al., 2008; Klesges et al., 1988; Mizes et al., 1998; Patterson et al., 2003), adherence to behavioral counseling was set as a dichotomous variable (non-adherent=0, adherent=1) indicating whether the subjects completed all vs. some sessions. Specifically, the variable distinguished participants who completed all three in-person sessions + five phone calls from those who missed at least one session or a phone call.

2.6 Statistical Analysis

Baseline characteristics (socio-demographic, smoking and psychosocial characteristics) were compared according to adherence to pharmacological and behavioral treatment for all subjects using the chi-square test for categorized variables and t-tests or Mann–Whitney *U* tests where appropriate for continuous variables. Bivariate correlations for all predictor variables revealed no multicollinearity. This was also inspected by checking for extraordinary estimated coefficients and standard errors, which would have suggested the existence of collinearity. The outcomes of interest were adherence to patch use and

adherence to behavioral counseling. Separate logistic regression models were developed for each outcome variable. All predictors (socio-demographic, smoking-related, and psychosocial variables) significant at the < 0.20 level in bivariate analyses were entered into the models using backward stepwise entry, with only those variables contributing at the < 0.05 level being allowed to remain in the model. The Wald statistic was used to assess the contribution of each predictor to the overall model. Adjusted odd ratios and 95 % Confidence intervals were calculated and reported. All analyses controlled for age and sex. Data were analyzed using SPSS version 21 (SPSS Inc., Chicago, IL, USA).

3. Results

3.1 Characteristics of the sample

Males comprised 78 % of the sample. The mean age was 39.9 years (SD=11.4), with a mean of 10.2 years of education (SD=4.0). The mean number of cigarettes smoked per day was 27.7 (SD= 12.7), while the mean age for the onset of daily smoking was 18.6 years (SD=5.3) and the mean Fagerström nicotine dependence score was 5.7 (SD=2.2). The two treatment groups (nicotine vs. placebo) did not differ significantly on any of these variables at baseline.

Out of the 269 study participants, 183 (68%) were adherent to patch use and 187 (70%) were adherent to behavioral counseling sessions. To assess blindness during treatment, patients indicated whether they believed they had received nicotine or placebo patch, in which 62% of participants on nicotine patch guessed their assignment correctly as compared to only 40% of participants on placebo patch ($P < 0.001$).

3.2 Bivariate associations

Table 1 summarizes the bivariate analysis for baseline characteristics by adherence to patch and behavioral counseling.

3.2.1 Adherence to patch use—Lower adherence was associated with greater number of cigarettes smoked per day at baseline ($P = 0.001$), higher FTND score ($P=.041$), waterpipe smoking ($P=.005$), self-perception of being allocated to placebo group ($P= <.001$), greater total withdrawal symptoms ($P=.036$), being on placebo treatment ($P = 0.002$), and lower readiness to quit score ($P=.033$).

3.2.2 Adherence to behavioral counseling (In-person + phone contact)—Lower adherence to behavioral treatment was associated with greater number of cigarettes smoked per day at baseline ($P=.002$), self-perception of being allocated to placebo group ($P= <.001$), greater total withdrawal symptoms ($P=.022$) lower readiness to quite score ($P=.027$), and younger age ($P=.024$).

3.3 Regression modelling

For the adjusted model predicting adherence to pharmacologic treatment (Table. 2), participants who received nicotine patch (OR=2.5; 95% CI = 1.3-4.7), perceived themselves as being on nicotine patch (OR=4.3; 95% CI = 2.2-9.3), and who did not use waterpipe

(OR=4.2; 95% CI =1.6-11.1), were more likely to adhere to patch usage. Participants who smoked a greater number of cigarettes per day at baseline (OR=0.97; 95% CI =0.94-0.99) and had higher withdrawal symptoms (OR=0.97; 95% CI= 0.95-0.98) were less likely to adhere to patch usage. The adjusted model predicting adherence to behavioral counseling (Table. 2) shows that male participants (OR=2.4; 95% CI=1.2-4.9) and those who perceived themselves as being on nicotine patch (OR=4.6; 95% CI =2.4-8.8) were more likely to adhere to counseling. On the other hand, participant who smoked a greater number of cigarettes per day at baseline (OR=0.97; 95% CI =0.94-0.98) and who had higher withdrawal score (OR=0.98; 95% CI =0.96-0.99) were less likely to adhere to counseling.

For both study outcomes, we examined several interaction terms, including treatment group with baseline withdrawal score, number of cigarettes smoked per day, and perception of treatment allocation (i.e., belief that one had received nicotine and not placebo). We also examined the interaction between gender and baseline withdrawal score. All interaction terms yielded non-significant results (all P-values were > 0.27).

4. Discussion

This is the first study to examine predictors of adherence to smoking cessation treatment in a developing country's health care context. Our findings indicate that lower adherence to pharmacological and behavioral treatments was associated with heavier smoking rate at baseline, greater withdrawal symptomatology, and participants' belief they were receiving placebo instead of active nicotine patch. Women showed lower adherence than men to behavioral treatment, while being assigned to the placebo condition and baseline waterpipe use were associated with lower adherence to pharmacologic treatment. Our findings suggest that adherence to cessation treatment for cigarette smokers in low-income countries such as Syria may benefit from integrated cessation components that provide intensive treatment for subjects with higher nicotine dependence, and address concurrent waterpipe use at all stages. Such novel insights on factors that influence adherence to cessation treatment in a developing country's setting, can help improve cessation treatments for smokers living in countries at similar level of development.

Adherence rates to pharmacological and behavioral treatment achieved in this study appears comparable to studies that have been done in developed countries. For example, the adherence rate to pharmacological treatment in our study (68%) was in agreement with a previous study that examined adherence to medication among adult smokers in two smoking cessation trials in the US (Hays et al., 2010). Moreover, adherence rate to behavioral counseling sessions of 70% achieved in our study also appears comparable with rates achieved in a cessation trial that evaluated adherence to seven sessions of behavioral counseling among adult smokers in the US. (Patterson et al., 2003). This shows that high adherence rates can be achieved in developing country settings when applying standardized procedures and protocols to follow-up with study's participants.

Overall, our study indicates the importance of nicotine dependence as a barrier to adherence to pharmacological and behavioral cessation treatments. Greater tobacco use at baseline and more severe tobacco withdrawal symptomatology both indicate greater dependence, and

were associated with lower adherence in our study. A higher FTND score also was associated with lower adherence in bivariate level ($P = .041$), although such association was outside the significant level in the multivariable models. While nicotine dependence appears to make adherence difficult, it is encouraging that in the current study, the assignment to active nicotine, compared to placebo, was associated with a more than two folds greater odds of being adherent to pharmacologic treatment. This indicates that nicotine replacement therapy can enhance adherence to treatment in highly dependent smokers.

One of the unique findings of this study that is likely to be relevant to most countries in the Middle East, is the association between lower adherence to pharmacological treatment and concurrent waterpipe use. Waterpipe is a common form of tobacco use in the Middle East that delivers substantial amounts of nicotine and is associated with nicotine dependence (Aboaziza and Eissenberg; Maziak, 2014). Furthermore, studies that looked into concurrent use of tobacco products has shown that dual smokers have the highest prevalence of nicotine dependence in contrast to exclusive users (Post et al., 2010; Timberlake, 2008; Tomar et al. 2010). While such evidence is indicative of a potential role of nicotine dependence in mediating the association between waterpipe smoking and lower adherence, this cannot be asserted based on this finding alone. This association however, suggests that cessation efforts in societies, where cigarettes are not the only main tobacco use method, should devote special attention to cultural-specific smoking behaviors (Maziak et al, 2004, Asfar et al, 2008). Previous studies from the same population, show that cigarette smokers can revert to waterpipe smoking during quit attempts, which can facilitate relapse (Hammal et al, 2008; Asfar et al, 2008). As a result, asking about waterpipe smoking and emphasizing cessation of all tobacco use can be instrumental to cessation success.

Interestingly, our data shows that women were less adherent to behavioral counseling than men. This might be attributed to social barriers and gender roles (Maziak, 2006) that might prevent women from freeing themselves from their home duties in order to commit to behavioral counseling. Factors such as transportation, child care and other household responsibilities may have played a role in lowering women's adherence to behavioral counseling. On the other hand, adherence to pharmacologic treatment did not differ by gender, which understandably does not require attendance and can be done at home.

Beliefs and expectations about nicotine patch's effectiveness has been shown to affect adherence beyond whether an active nicotine or a placebo patch is received (Darredeau and Barrett, 2010). In our study, adherence to pharmacologic and behavioral treatment was greater among those who believed that they had received nicotine compared with those who believed they had received placebo, regardless of the actual patch assignment. So believing that one may have received a nicotine patch even if it was in fact a placebo may have increased compliance or encouraged adherence to cessation treatment in general. This suggests that, psychological factors may play an important role in participants' subjective responses to treatment assignment, the effects of which cannot be solely attributed to the direct pharmacological effects of nicotine.

Our study comes with limitations. First, a relatively small sample size may not have allowed us to detect differences that were clinically meaningful but not statistically significant. Thus,

we discussed marginally significant findings that might warrant future investigation. Secondly, adherence to patch use was based on self-report. Nevertheless, self-report of adherence to treatment has been widely used in the literature for both smoking cessation treatment and other medications in general (Alterman, et al., 1999; Cooper et al., 2004; Hollands et al., 2013; Okuyemi et al., 2010; Stein et al., 2006).

These limitations notwithstanding, this study provides the first evidence about factors influencing adherence to cessation treatments in a low income country setting in the Middle East. It suggests that adherence to cessation treatment for cigarette smokers in low-income countries such as Syria may benefit from integrated cessation components that provide intensive treatment for subjects with higher nicotine dependence, and address concurrent waterpipe use at all stages.

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References

- Aboaziza E, Eissenberg T. Waterpipe tobacco smoking: what is the evidence that it supports nicotine/tobacco dependence? *Tob Control*. 2014; 24:44–53.
- Abrams, DB.; Niaura, R., editors. *The Tobacco Dependence Treatment Handbook: A Guide To Best Practices*. Guilford Press; New York: 2003.
- Alterman AI, Gariti P, Cook TG, Cnaan A. Nicodermal patch adherence and its correlates. *Drug Alcohol Depend*. 1999; 53:159–165. [PubMed: 10080041]
- Asfar T, Vander Weg MW, Maziak W, Hammal F, Eissenberg T, Ward KD. Outcomes and adherence in Syria's first smoking cessation trial. *Am J Health Behav*. 2008; 32:146–156. [PubMed: 18052855]
- Asfar T, Al-Ali R, Ward KD, Vander Weg MW, Maziak W. Are primary health care providers prepared to implement an anti-smoking program in Syria? *Patient Educ Couns*. 2011; 85:201–205. [PubMed: 21168300]
- Berg CJ, Ahluwalia JS, Cropsey K. Predictors of adherence to behavioral counseling and medication among female prisoners enrolled in a smoking cessation trial. *J Correct Health Care*. 2013; 19:236–247. [PubMed: 23955055]
- Biener L, Abrams DB. The Contemplation Ladder: validation of a measure of readiness to consider smoking cessation. *Health Psychol*. 1991; 10:360–365. [PubMed: 1935872]
- Cooper TV, DeBon MW, Stockton M, Klesges RC, Steenbergh TA, Sherrill-Mittleman D, Jennings LC, Johnson KC. Correlates of adherence with transdermal nicotine. *Addict Behav*. 2004; 29:1565–1578. [PubMed: 15451124]
- Darredeau C, Barrett SP. The role of nicotine content information in smokers' subjective responses to nicotine and placebo inhalers. *Hum Psychopharmacol*. 2010; 25:577–581. [PubMed: 21312293]
- Erikson, M.; Mackay, J.; Ross, H. *The Tobacco Atlas*. 4. American Cancer Society; New York: 2013.
- Fiore MC, Jaen CR, Baker TB, Bailey WC, Bennett G, Benowitz NL, Christiansen BA, Connell M, Curry SJ, Dorfman SFA. A clinical practice guideline for treating tobacco use and dependence: 2008 update. A US Public Health Service Report. *Am J Prev Med*. 2008; 35:158–76. [PubMed: 18617085]
- Hammal F, Mock J, Ward KD, Eissenberg T, Maziak W. A pleasure among friends: how narghile (waterpipe) smoking differs from cigarette smoking in Syria. *Tob Control*. 2008; 17:e3–e3. [PubMed: 18375726]

- Hays JT, Leischow SJ, Lawrence D, Lee TC. Adherence to treatment for tobacco dependence: association with smoking abstinence and predictors of adherence. *Nicotine Tob Res.* 2010; 12:574–581. [PubMed: 20457644]
- Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO. The Fagerstrom Test For Nicotine Dependence: a revision of the fagerstrom tolerance questionnaire. *Br J Addict.* 1991; 86:1119–1127. [PubMed: 1932883]
- Hollands GJ, Sutton S, McDermott MS, Marteau TM, Aveyard P. Adherence to and consumption of nicotine replacement therapy and the relationship with abstinence within a smoking cessation trial in primary care. *Nicotine Tob Res.* 2013; 15:1537–1544. [PubMed: 23430709]
- Hughes JR, Hatsukami D. Signs and symptoms of tobacco withdrawal. *Arch Gen Psychiatry.* 1986; 43:289–94. [PubMed: 3954551]
- Jha, P.; Chaloupka, FJ.; Moore, J. Tobacco addiction. In: Jamison, DT.; Breman, JG.; Measham, AR., editors. *Disease Control Priorities in Developing Countries.* Oxford University Press and World Bank; Washington, DC, New York, NY: 2006. p. 869-886.
- Klesges RC, Brown K, Pascale RW, Murphy M, Williams E, Cigrang JA. Factors associated with participation, attrition, and outcome in a smoking cessation program at the workplace. *Health Psychol.* 1988; 7:575–89. [PubMed: 3215163]
- Kopjar B, Sales AE, Piñeros SL, Sun H, Li YF, Hedeem AN. Adherence with statin therapy in secondary prevention of coronary heart disease in veterans administration male population. *Am J Cardiol.* 2003; 92:1106–1108. [PubMed: 14583366]
- Maziak W. The waterpipe: a new way of hooking youth on tobacco. *Am J Addict.* 2014; 23:103–107. [PubMed: 25187045]
- Maziak W, Eissenberg T, Klesges RC, Keil U, Ward KD. Adapting smoking cessation interventions for developing countries: a model for the Middle East. *Int J Tuberc Lung Dis.* 2004; 8:403–413. [PubMed: 15141730]
- Maziak W. Health in the middle East. *BMJ.* 2006; 333:815–816. [PubMed: 17053215]
- Mizes JS, Sloan DM, Segraves K, Spring B, Pingitore R, Kristeller J. The influence of weight-related variables on smoking cessation. *Behav Ther.* 1998; 29:371–385.
- Nachega JB, Hislop M, Dowdy DW, Lo M, Omer SB, Regensberg L, Chaisson RE, Maartens G. Adherence to highly active antiretroviral therapy assessed by pharmacy claims predicts survival in HIV-infected South African adults. *J Acquir Immune Defic Syndr.* 2006; 43:78–84. [PubMed: 16878045]
- Okuyemi KS, Zheng H, Guo H, Ahluwalia JS. Predictors of adherence to nicotine gum and counseling among African-American light smokers. *J Gen Intern Med.* 2010; 25:969–976. [PubMed: 20495885]
- Patterson F, Jepson C, Kaufmann V, Ruktalis M, Audrain-McGovern J, Kucharski S, Lerman C. Predictors of attendance in a randomized clinical trial of nicotine replacement therapy with behavioral counseling. *Drug Alcohol Depend.* 2003; 72:123–131. [PubMed: 14636967]
- Post A, Gilljam H, Rosendahl I, Bremberg S, Rosaria Galanti M. Symptoms of nicotine dependence in a cohort of Swedish youths: a comparison between smokers, smokeless tobacco users and dual tobacco users. *Addiction.* 2010; 105:740–746. [PubMed: 20148785]
- Radloff LD. The CES-D: a self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977; 1:385–401.
- Ruddy KJ, Partridge AH. Adherence with adjuvant hormonal therapy for breast cancer. *Ann Oncol.* 2009; 20:401–402. [PubMed: 19246419]
- Shiffman S, Sweeney CT, Ferguson SG, Sembower MA, Gitchell JG. Relationship between adherence to daily nicotine patch use and treatment efficacy: secondary analysis of a 10 week randomized, double-blind, placebo-controlled clinical trial simulating over-the-counter use in adult smokers. *Clin Ther.* 2008; 30:1852–1858. [PubMed: 19014840]
- Stein M, Cantrell C, Sokol M, Eaddy M, Shah M. Antidepressant adherence and medical resource use among managed care patients with anxiety disorders. *Psychiatr Serv.* 2006; 57:673–680. [PubMed: 16675762]

- Thomas JL, Jones GN, Scarinci IC, Mehan DJ, Brantley PJ. The utility of the CES-D as a depression screening measure among low-income women attending primary care clinics. The Center for Epidemiologic Studies-Depression. *Int J Psychiatry Med*. 2001; 31:25–40. [PubMed: 11529389]
- Timberlake DS. A latent class analysis of nicotine-dependence criteria and use of alternate tobacco. *J Stud Alcohol Drugs*. 2008; 69:709–717. [PubMed: 18781246]
- Tomar SL, Alpert HR, Connolly GN. Patterns of dual use of cigarettes and smokeless tobacco among US males: findings from national surveys. *Tob Control*. 2010; 19:104–109. [PubMed: 20008157]
- Velicer WF, Diclemente CC, Rossi JS, Prochaska JO. Relapse situations and self-efficacy: an integrative model. *Addict Behav*. 1990; 15:271–283. [PubMed: 2378287]
- Ward KD, Asfar T, Al Ali R, Rastam S, Weg MWV, Eissenberg T, Maziak W. Randomized trial of the effectiveness of combined behavioral/pharmacological smoking cessation treatment in Syrian primary care clinics. *Addiction*. 2013; 108:394–403. [PubMed: 22882805]
- Ward KD, Eissenberg T, Rastam S, Asfar T, Mzayek F, Fouad MF, Hammal F, Mock J, Maziak W. The tobacco epidemic in Syria. *Tob control*. 2006; 15(Suppl 1):i24–i29. [PubMed: 16723671]
- World Bank. [Accessed January 14th, 2015] Tobacco Control at glance. 2010. Available at: <http://siteresources.worldbank.org/INTPH/Resources/376086-1238076532997/TobaccoControl2010Nov15.pdf>
- World Health Organization (WHO). [accessed on 17 December, 2014] FCTC/COP4(8): Guidelines for Implementation of Article 14 of the WHO Framework Convention on Tobacco Control. 2010. Available at: http://www.who.int/fctc/protocol/guidelines/adopted/article_14/en/index.html
- World Health Organization. [accessed on 2 December, 2014] Report on the Global Tobacco Epidemic The MPOWER Package. 2013a. Available at: http://www.who.int/tobacco/global_report/2013/en/
- World Health Organization. [accessed on 22 April 2015] Report on the Global Tobacco Epidemic: country profile Syrian Arab Republic. 2013b. Available at: http://www.who.int/tobacco/surveillance/policy/country_profile/syr.pdf
- Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. *J Pers Assess*. 1988; 52:30–41.
- Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA. Psychometric characteristics of the Multidimensional Scale of Perceived Social Support. *J Pers Assess*. 1990; 55:610–7. [PubMed: 2280326]

Highlights

- First study to examine predictors of adherence to smoking cessation treatment in a developing country's health care context
- lower adherence to pharmacological and behavioral treatments was associated with higher daily smoking rate, greater withdrawal symptoms, and participants' belief of being assigned to placebo instead of active nicotine patch
- Waterpipe use was associated with lower adherence to pharmacologic treatment
- Offering intensive treatment for smokers with higher nicotine dependence may improve adherence to cessation treatment in low-income countries such as Syria

Baseline characteristics by adherence to pharmacological and behavioral counseling in a cessation trial among smokers in Aleppo, Syria

Table 1

80% Adherence to pharmacological treatment				Adherence to behavioral counseling		
	Adherent (n =183) mean (SD) or %	Non Adherent (n =86) mean (SD) or %	p-value*	Adherent (n =187) mean (SD) or %	Non Adherent (n =82) mean (SD) or %	p-value*
Demographics						
age	40.8(11.1)	38.2(11.7)	0.084	41.0(11.2)	37.6(11.4)	0.024
Gender (male %)	77.6	80.2	0.751	80.4	73.2	0.185
Education (years completed)	10.3(4)	10(4)	0.648	10.3(3.8)	10.2(4.6)	0.938
Number of people in the house	5.4(2.9)	5(2.2)	0.333	5.3(2.8)	5.4(2.6)	0.830
Marital status (Married %)	80.9	75.6	0.452	82.6	72	0.245
Religion (Muslim %)	72.7	79.1	0.381	73.9	76.8	0.596
Tobacco use						
Treatment group (Nicotine %)	56.3	23.1	0.002	53.8	41.5	0.063
Amount smoked (cigarettes/day)	26(11.7)	31.4(14.1)	0.001	26(11.4)	31.3(14.3)	0.002
Age when smoked first cigarette	19(5.3)	17.7(5.2)	0.049	18.8(5.3)	18.3(5.2)	0.526
Readiness to quit score ^a	7.9(0.9)	7.6(1.1)	0.033	7.9(0.9)	7.6(0.9)	0.027
Fagerstrom Test of Nicotine Dependence ^b	5.5(2.2)	6.1(2.2)	0.041	5.5(2.2)	6.1(2)	0.060
Confidence in ability to quit ^c	6.9 (2.4)	6.9 (2.5)	0.950	6.9(2.2)	6.8(2.6)	0.698
Carbon monoxide (p.p.m.)	27.4(17.1)	27.8(13.9)	0.822	28(17.1)	26.2(13)	0.404
Tobacco withdrawal symptoms score	27.3	32.4	0.036	27.2	32.9	0.022
Water pipe use (%)	7.1	18.6	0.005	9.2	14.6	0.192
Perception of treatment (placebo %)	30.1	62.3	<0.001	30.4	61.8	<0.001
Psychosocial						
Social support ^d	20.7(11.8)	18.9(11.4)	0.240	20.1(11.7)	19.6(11.5)	0.950
Depressions (CES-D) score ^e	17.6(10.5)	18.8(9.1)	0.358	17.5(10.1)	19.4(10.2)	0.145

* For continuous predictors, a two-sample *t*-test or Mann–Whitney *U* test when appropriate evaluated differences in means. For dichotomous predictors, a chi-square test evaluated differences in proportions.

^a Range of possible values for readiness to quit is 0–10.

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- b Range of possible values for the Fagerstrom Test of Nicotine Dependence is 0–10.
- c Range of possible values for confidence in ability to quit is 0–10.
- d Range of possible values for the social support score is 0–60.
- e Range of possible values for CES-D score is 0–60

Table 2
Predictors of adherence to pharmacologic treatment and behavioral counseling in a cessation trial among smokers in Aleppo, Syria determined by logistic regression

Adherence to pharmacologic treatment	OR	CI (95%)	P-value
Treatment group			
Nicotine	2.52	1.37–4.78	0.003
Placebo	Ref		
Water-pipe use			
Non-smoker	4.25	1.61–11.1	0.004
Smoker	Ref		
Total withdrawal symptoms score	0.97	0.95–0.98	0.003
Cigarettes per day	0.97	0.94–0.99	0.014
Perception of treatment allocation			
Nicotine	4.31	2.29–9.31	<0.001
Placebo	Ref		
Adherence to behavioral counseling	OR	CI (95%)	P-value
Gender			
Male	2.41	1.21–4.94	0.017
Female	Ref		
Total withdrawal symptoms score	0.98	0.96–0.99	0.015
Cigarettes per day	0.97	0.94–0.98	0.021
Perception of treatment allocation			
Nicotine	4.61	2.41–8.84	<0.001
Placebo	Ref		

Note. CI = confidence interval; OR = odds ratio.