**Original article**

# Predictors of retention in a multicomponent treatment for smokers

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## Abstract

**Background:** There is a lack of knowledge about factors that promote or hinder retention of smokers in treatment. **Objective:** The aim of this study was the identification of variables that predict retention of smokers who received a multicomponent treatment against smoking. **Method:** Participants (n = 79) simultaneously received pharmacological and psychological treatment, including an intervention phase prior to the date of smoking cessation. They were evaluated periodically in their abstinence, depressive and anxious symptoms, and were randomly assigned to three treatment conditions (nicotine patch, bupropion or nicotine patch + bupropion). Eighteen variables were grouped into four categories (demographic, consumption pattern, mood and treatment). Data were analyzed using student's $t$ test and $X^2$, for inclusion into a multivariate logistic regression model. **Results:** Results indicate that age of onset of regular tobacco consumption, secondary education and bupropion pharmacological treatment are significant in relation to the retention of smokers to smoking treatment. **Discussion:** The reported "age of onset" correlates with treatment retention (OR = 1.545, 95 % CI = 1.175-2.032). This variable has not previously been reported in the literature, and taking it into account in the design of prevention and treatment for smoking could increase their success.

## Introduction

Tobacco smoking is the main risk factor associated with preventable mortality worldwide[1]; there are currently one billion smokers in the world, of which approximately 650 million will die of tobacco smoking[2]. It is estimated that tobacco smoking will be responsible for 6.5 million deaths in low and medium income countries by 2030[3]. According to the National Survey of Addictions, 21.7% of Mexican population smokes and 8.9% smokes daily[4]. Data is alarming considering that around 60,000 people die each year in Mexico due to smoking-related diseases causing loss of 10-15 years of productive life[5].

According to the U.S. Department of Health and Human Services, the risk of smoking-related illnesses and mortality decrease through cessation[6]. Therefore, cessation at age 30 results in a gain about 10 years of life expectancy[7].

Although there are various treatment options for abstinence, lack of retention in treatment may hinder its success and a number of variables have been identified to be related to it. Curtin *et al.*[8] found that smokers with major depression had higher attrition rates than individuals with less depression symptoms. Another study found that pregnant smokers who were single, used drugs and had lower education were less likely to stay in treatment[9].

Furthermore, lower levels of depressed mood, fewer 'pros' for smoking[10], early initiation of treatment after the intake session[11], low rates of smoking, having children, being female, being married and poor general health[12] are predictors of attendance to treatment.

Identifying the predictors of treatment adherence allows to develop strategies to decrease attrition rates and improve treatment success[13].

## Objective

In this study, we sought to identify predictors of retention in a multicomponent smoking cessation treatment, as a secondary analysis of results from a previous publication[14].

## Method

### Participants

Inclusion criteria for the smoking cessation treatment were as follows: smoking 10 or more cigarettes a day, and ages 18 to 65. Exclusion criteria were as follow: use or abuse of another psychoactive substance (including psychiatric medications), diagnosis of mental disorders and conditions, pregnancy, lactation, hypersensitivity or presence of any medical condition with contraindications to the pharmacological treatment. Criteria were corroborated by participants self-report.

A total of 136 smokers who participated voluntarily in a smoking cessation treatment were recruited at the Center for Prevention of Addiction at the Psychology School of the National Autonomous University of Mexico (UNAM) from September to December 2009. Of those participants, 79 met the criteria for participation in the study and received psychological and pharmacological treatment. Due to the secondary nature of this study, the data was obtained from the same participants as the main publication[14].

### Instruments

#### Beck Depression Inventory (BDI)

A 21 question, multiple choice self-report inventory that measures depression severity. It has content, construct and concurrent validity, and it was standardized for Mexican population[15].

#### Beck Anxiety Inventory (BAI)

A 21 question, multiple choice self-report inventory for measuring severity of anxiety. It was standardized for Mexican population with high internal consistency and construct validity[16].

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*Fagerström Test for Nicotine Dependence (FTND)*

A standard instrument of six items to assess nicotine addiction and classifies smokers in three degrees of dependence. This is the most used scale for dependence worldwide[17].

*Clinical history form*

A questionnaire was designed to assess sociodemographic information (age, sex, marital status and education), and consumption patterns: age of onset, number of years smoking, amount of cigarettes, number of cessation attempts, reasons to quit, etc.

## Procedure

Research protocol was reviewed and approved by the Research Ethics Committee of the UNAM addiction research macro project: "Development of New Models for Prevention and Treatment of Addictive Behaviors". Eligible subjects were interviewed to assess whether they met inclusion criteria and were given a written consent sheet. Those who met criteria and agreed to continue in the study were evaluated with BDI, BAI, FTND and the Clinic History Form, and were randomly allocated in one of the three treatment settings (Transdermal nicotine patches [TNP] pharmacological therapy, bupropion pharmacological therapy, and TNP and bupropion pharmacological therapy). All treatment settings included sessions of cognitive-behavioral psychological therapy (CBPT). The first two sessions (one per week) were aimed to assess their cognitions about tobacco smoking and their specific pattern of addiction, respectively. At the same time, patients changed their usual cigarettes for 0.1 mg low nicotine cigarettes (LNC) and gradually reduced their daily cigarette consumption until abstinence was reached at the beginning of the third week of treatment. Participants received two more weekly sessions of CBPT that focused on strategies to prevent or deal with specific tobacco smoking related situations and to prevent relapse. Pharmacological treatment began on the first session and continued for three months. During this period, participants were monitored by abstinence biomarkers and psychological indicators related to mood [for more details on the treatment see[18]].

## Data analysis

Treatment retention was considered whenever a participant completed the active phase of treatment (equal to or greater than 90 days of monitoring).

Data analysis was conducted in two phases, taking into account the recommendations of Hosmer and Lemeshow[19]. First, we identified the predictors of retention, then we evaluated binary associations of continuous and categorical variables using Student's $t$ and chi square ($X^2$) respectively. We used a cutoff for inclusion in the multivariate model of $p < 0.25$. Subsequently, we conducted a multivariate logistic regression that included the variables obtained in the previous analysis. Data analysis were performed using SPSS version 19.

## Results

Sample consisted of 45 men and 34 women, whose average age was 42.6 years old (SD 11.17), 45% reported being married and 38% being single; more than half of the sample had undergraduate or graduate studies (60%). The main reason for wanting to quit smoking was related to health problems (76%). Out of the 79 patients, 55 (69%) were maintained throughout the treatment. Tables 1 and 2 show the features of participants who remained in the active phase of treatment and of participants who abandoned it.

**Table 1.** Participants characteristics

| Variables | Retention to treatment (n = 55) | | Treatment abandonment (n = 24) | | Bivariate analysis |
|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | |
| Sex | | | | | $X^2_{(1)} = 0.68$ |
| Male | 33 | 60 | 12 | 40 | |
| Female | 22 | 64.7 | 12 | 35.3 | |
| Marital Status | | | | | $X^2_{(3)} = 10.18*$ |
| Single | 15 | 50 | 15 | 50 | |
| Married | 28 | 77.7 | 8 | 22.3 | |
| Cohabiting | 5 | 83.3 | 1 | 16.7 | |
| Divorced | 7 | 100 | 0 | 0 | |
| Education | | | | | $X^2_{(4)} = 5.89*$ |
| Primary | 0 | 0 | 1 | 100 | |
| Secondary | 7 | 50 | 7 | 50 | |
| High School | 13 | 76.4 | 4 | 23.6 | |
| Graduate | 21 | 72.4 | 8 | 27.6 | |
| Post graduate | 14 | 77.7 | 4 | 22.3 | |
| Living with other smokers | | | | | $X^2_{(1)} = 0.13$ |
| Yes | 46 | 69.6 | 20 | 30.4 | |
| No | 9 | 75 | 3 | 25 | |
| Reasons to quit smoking | | | | | $X^2_{(2)} = 0.46$ |
| Health problems | 41 | 68.3 | 19 | 31.7 | |
| Family problems | 9 | 69.2 | 4 | 30.8 | |
| Economic problems | 1 | 100 | 0 | 0 | |
| MDE at some point in life | | | | | $X^2_{(1)} = 0.62$ |
| Yes | 30 | 73.1 | 11 | 26.9 | |
| No | 22 | 64.7 | 12 | 35.3 | |
| Type of Treatment | | | | | $X^2_{(2)} = 3.23*$ |
| TNP | 18 | 62 | 11 | 38 | |
| Bupropion | 14 | 63.3 | 8 | 36.7 | |
| TNP + Bupropion | 23 | 82.1 | 5 | 17.9 | |

MDE: Major Depressive Episode; TNP: Transdermal Nicotine Patch. * $p < 0.25$.

Bivariate analysis between treatment retention and demographic, consumption, mood and treatment variables, resulted in seven variables that met the criteria for inclusion in the multivariate regression analysis: treatment modality ($X^2_{(2)}$ = 3.23, $p$ = 0.199), education ($X^2_{(4)}$ = 5.89, $p$ = 0.207), marital status ($X^2_{(3)}$ = 10.18, $p$ = 0.017), age ($t_{(45)}$ = -1.37, $p$ = 0.175), age of first cigarette consumption ($X^2_{(60)}$ = -1.48, $p$ = 0.142), age of onset of regular consumption ($X^2_{(76)}$ = -2.49, $p$ = 0.015) and years consuming the current number of cigarettes ($X^2_{(77)}$ = -1.55, $p$ = 0.124).

Table 3 shows the multivariate regression model for treatment retention, which indicates that adherence to treatment increases when the age of onset of regular consumption is higher (OR = 1.545, 95% CI = 1.175 - 2.032). Secondary education decreases retention to treatment compared to postgraduate education (OR = 0.018, 95% CI = 0.001 – 0.365); likewise bupropion intake was less likely promote retention when compared the combined drug therapy (TNP and bupropion) (OR = 0.085, 95%, IC = 0.01 - 0.745). The model was statistically significant ($X^2_{(11)}$ = 47.4, $p$ = 0.000).

The proportion of variance explained was Nagelkerke $R^2$ = 0.649. The model has a specificity of 69.6% and a sensitivity of 90.9%; with these values we obtained an overall successful prediction of 84.6%. The fit of the model was tested using the Hosmer and Lemeshow test ($X^2_{(8)}$ = 3.014, $p$ = 0.933).

## Discussion

Multivariate regression results suggest that higher age of onset of regular consumption increases the probability of adherence to treatment. On the contrary, secondary education and pharmacological treatment with bupropion reduce the probability of treatment retention. These results are noteworthy since only three variables provided relevant information of a total of 18 sociodemographic, consumption pattern, mood and treatment variables.

Age of onset of regular consumption is a variable that has not been reported previously as a predictor of retention to treatment. In the study sample, we found that average age of onset in patients

**Table 2.** Assessed variables

| Variables | Retention to treatment | | Treatment abandonment | | Bivariate analysis |
|---|---|---|---|---|---|
| | (n = 55) | | (n = 24) | | |
| Sociodemographics | Mean | SD | Mean | SD | |
| Age | 43.71 | 11.27 | 40.04 | 10.72 | $t_{(45)}$ = -1.37* |
| Consumption pattern | | | | | |
| Age of first cigarette | 15.69 | 4.63 | 14.35 | 3.12 | $t_{(60)}$ = -1.48* |
| Age of onset of regular smoking | 20.98 | 7.3 | 17.09 | 2.39 | $t_{(76)}$ = -2.49* |
| Number or years smoking | 23.38 | 11.69 | 22.04 | 10.3 | $t_{(49)}$ = -0.51 |
| Cigarettes per day | 14.07 | 8.09 | 15.54 | 7.25 | $t_{(48)}$ = 0.79 |
| Years smoking the current amount of cigarettes | 7.45 | 8.17 | 4.67 | 4.77 | $t_{(77)}$ = -1.55* |
| Number of quitting attempts | 2.59 | 3.03 | 2 | 2.8 | $t_{(43)}$ = -0.81 |
| FTND score | 3.56 | 2.25 | 4.13 | 2.39 | $t_{(39)}$ = 0.96 |
| Health status | | | | | |
| Anxiety level | 10.68 | 7.84 | 11.57 | 7.53 | $t_{(43)}$ = 0.46 |
| Depression level | 9.24 | 6.34 | 9.39 | 6.28 | $t_{(41)}$ = 0.09 |

* $p < 0.25$.

**Table 3.** Logistic Regression Model of treatment retention

| Variables | B | SE | Wald | $p$ | OR | 95% CI | |
|---|---|---|---|---|---|---|---|
| | | | | | | Low | High |
| Age of onset of regular smoking | 0.435 | 0.14 | 9.67 | 0.002* | 1.545 | 1.175 | 2.032 |
| Years smoking the current amount of cigarettes | 0.1 | 0.061 | 2.671 | 0.102 | 1.105 | 0.98 | 1.297 |
| Education | | | | | | | |
| Primary | 47.257 | 43595.7 | 0 | 0.999 | 0 | 0 | . |
| Secondary | -4.037 | 1.545 | 6.828 | 0.009* | 0.018 | 0.001 | 0.365 |
| High School | -0.371 | 1.328 | 0.078 | 0.78 | 0.69 | 0.051 | 9.317 |
| Graduate | -0.022 | 1.023 | 0 | 0.983 | 0.978 | 0.132 | 7.259 |
| Post graduate | . | . | . | . | . | . | . |
| Type of treatment | | | | | | | |
| TNP | 0.147 | 0.944 | 0.024 | 0.876 | 1.158 | 0.182 | 7.364 |
| Bupropion | -2.463 | 1.106 | 4.956 | 0.026* | 0.085 | 0.01 | 0.745 |
| NP + Bupropion | . | . | . | . | . | . | . |
| Marital status | | | | | | | |
| Single | 21.441 | 12727.8 | 0 | 0.999 | 0 | 0 | . |
| Married | 18.759 | 12727.8 | 0 | 0.999 | 0 | 0 | . |
| Cohabiting | 3.324 | 21145 | 0 | 1 | 27.764 | 0 | . |
| Divorced | . | . | . | . | . | . | . |

TNP: Transdermal Nicotine Patch. * $p < 0.25$.

that finished treatment was 20.98 years old, while age of onset of patients that did not finish treatment was 17.09 years and also were the group who consumed more cigarettes per day and had higher dependence levels.

Additionally, the finding that secondary education is a risk predictor of treatment abandonment in comparison with higher education is in agreement with previous reports[9]. Educational institutions plays a dual role in the onset of substance use; as a protective factor that provides knowledge in the area of health promotion and life skills to deal with social pressure[20], and as a risk factor favoring drug use among young people who decide to experience new sensations and achieve insertion into a social circle through the substances, sidelining academic performance and consequently increasing the likelihood of school dropout[21-23]. It is not unlikely that people with secondary education or lower have a smaller repertoire of health related information and of coping skills related to smoking situations. The greater rate of treatment retention of participants with higher education could be explained by the latter.

Bupropion has been recognized as an effective smoking cessation treatment that maintains long-term abstinence in several clinical trials[24], however, treatment success largely relies on retention to treatment. It has previously been reported that several patients abandon pharmacological treatment and stop taking the drug voluntarily due to the fear of adverse reactions, their perception of lack of improvement and the belief that the drug was unnecessary, excessive or that it could cause addiction[25]. In order to avoid the introduction of a confounding factor, i.e., the cessation of bupropion intake by the participants, we provided sufficient information during the evaluation session about the characteristics of the drugs used in this research.

Several variables have been associated to retention to treatment for smoking cessation, such as age, sex, marital status[9,11,12], nicotine dependence level, depressive symptoms and a major depressive episode at some point in life[8].

Although 76% of our patients reported health problems in their clinic history, this information was not corroborated with additional studies. It was not possible to assess this variable in the multivariate regression model because we did not find and association with treatment retention in the bivariate analysis; this is similar to the results reported by Lee *et al.*[10] who did not find either an association between health state and retention to treatment in Latin American populations. For future research in this subject we suggest the conduction of a thorough medical evaluation to confirm patients self-reports and to classify them more accurately to determine if health status is associated or not with treatment retention.

Other variables such as anxiety symptoms, family support, environmental barriers, number of attempts to quit smoking and living with other smokers, have been associated with tobacco smoking and were considered in this study, but since they showed no relation to retention to treatment, they were not evaluated in the multivariate logistic regression model. A possible explanation for these results is the small sample size and consequently, the lack of statistical power of the tests used. We propose to continue studies with these variables that take into account other treatment modalities and bigger sample sizes to promote statistical power[26].

Due to the efforts of clinicians and researchers to increase retention to treatment for substance abuse, it has been identified that most dropouts occur mainly during the first 30 days[27-30] as a result of patient, therapist and context variables[31,32]; however, this information does not come from smoking cessation treatments themselves, therefore it is of vital interest to identify critical periods of treatment abandonment in smoking cessation patients. This will clarify the variables related to retention to treatment and will stimulate adherence to treatment and improve the tobacco abstinence prognosis.

The main limitations of this study were: (i) sample size, because it does not allow the generalization of our results to other contexts, (ii) the psychological treatment that complemented all the pharmacological treatment conditions because it may be a confounding factor that hinder the assessment of the associations, (iii) the unavailability of information regarding the patients' reasons for treatment abandonment, and (iv) the lack of measurements of plasma drug concentration because it is unknown whether the specific effect of these drugs are related to treatment adherence or abandonment.

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## Conflict of interest

Authors declare no conflict of interest and agree on the order of authorship.

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