

## Smoking cessation and the effect of nicotine dependence on relapse rate in İzmir, Turkey

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**Background/aim:** Smoking is the leading preventable cause of death in the world. There is growing evidence of the need for community-based programs on smoking cessation. The main purpose of this study is to establish the rate of smoking cessation and restarting in 1 year at the Balçova Smoking Cessation Center.

**Materials and methods:** This is a prospective study with a study group of 359 individuals who quit smoking at the Balçova Smoking Cessation Center for at least 4 weeks between October 2009 and April 2010. The outcomes of the study were 1-year cessation rate and relapse rate. Individuals who reported restarting and/or had CO measurements above 6 ppm were accepted as quitters who had relapsed.

**Results:** The 1-year rate of smoking cessation was 30.1% for the study group. Of the subjects who quit smoking, 50.1% started smoking again during the 1-year follow-up. Relapse rate was also higher in nicotine addicts. Pharmacological treatment was associated with increased success rates in smoking cessation.

**Conclusion:** Nicotine dependency was shown to be associated with lower rates of smoking cessation and higher rates of relapse. Therefore, it is important to begin smoking cessation attempts before individuals become serious addicts.

**Key words:** Smoking cessation, relapse rate, pharmacological treatment

### 1. Introduction

Smoking is a factor in 6 out of 8 frequent causes of death globally. Each year, 5 million deaths occur globally due to tobacco use. This figure is expected to be over 8 million by the year 2030 (1). In Turkey, 31.2% of people aged 15 or above smoke on a daily basis. The smoking rate among men (47.9%) is higher than among women (15.2%) (2). Problems caused by tobacco use were regarded as a major public health problem in the World Health Organization Framework Convention on Tobacco Control (3).

For effective tobacco control, local, cultural, social, economic, political, and legal issues should be taken into consideration (3). One of the components of MPOWER, the World Health Organization's policy package to reduce global tobacco usage, is to offer assistance to quit tobacco use (4). The most effective and feasible tool for treatment of nicotine dependency is suggested to be smoking cessation centers. Close follow-up and motivation in a specialized smoking cessation center is reported to increase the success

of quitting smoking (5). While cessation of smoking is 3%–5% without any help from a special center, a specialized center increases this rate up to 40% (6). Restarting smoking following a successful cessation within 6–12 months was reported to be 70%–80% (7). This study aimed to determine the factors that affect the cessation and restarting of smoking according to the level of nicotine dependency.

### 2. Materials and methods

In this prospective study the target population consisted of 1390 smokers from the "Heart of Balçova" project, which started in 2007, who had an intermediate or high Framingham risk score (8). These people were invited to the smoking cessation center. From those who were invited, 306 smokers (22% of the target population) and another 440 smokers from outside of the target population, making a total of 746 smokers, were admitted to the center by April 2010. The study group consisted of 581 participants who were admitted to the center and interviewed at least twice.

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The group that would be followed was defined as the 359 people who did not smoke for 4 weeks starting from 31 May 2010. Sample size was calculated by using Epi Info 3.4.3 StatCalc with an input of 50% risk of relapse, with a 5% precision and 95% confidence level, and it was found to be 186. Admittance to the center was more than expected and all patients who met the inclusion criteria were enrolled in the study. Data collection began following the written approval of the Dokuz Eylül University Ethics Committee in May 2010 and ended in May 2011.

A 30-min interview was conducted on the first visit of everyone who was admitted to the smoking cessation center. Following the interview, behavioral counseling methods were applied. The second visit was planned for 1 week later and, if the nicotine withdrawal symptoms were severe, beginning with the people with a high level of dependency, pharmacotherapy was started. Medications were given weekly. Visits were weekly for the first month, every other week for the second month, and then monthly afterwards. Data were collected with face-to-face interviews. Every third month patients had their CO levels measured at the center. In order to prevent relapse, behavioral counseling was continued during the visits. When a patient did not show up for the planned visit he or she was called and given counseling over the phone lasting no more than 10 min.

At the end of the 12-month follow-up period, a statement by the patient or a CO value below 6 ppm was considered to demonstrate successful cessation of smoking (9). Relapse was defined as smoking at least 1 cigarette for 7 consecutive days (10). A statement by the patient and/or a CO value above 6 ppm was considered as relapse. Nicotine dependency was revealed by the Fagerström dependency test (11). Pharmacological therapy use was considered as at least 4 weeks of regular use of the medication. A patient was considered as lost to follow-up when he or she could not be reached 4 times on 4 different days.

### 2.1. Statistical analysis

The associations between dependent and independent variables were analyzed using the t-test and chi-square tests. For Cox regression analysis, the time variable in the

model was the duration of follow-up. Restarting smoking during the 1-year follow-up was analyzed by using Kaplan–Meier survival analysis and differences between groups was analyzed by log-rank test. The statistical analysis was performed using SPSS 15.0 and Epi Info 2002 StatCalc software (12).

### 3. Results

People with at least 2 follow-up visits to the smoking cessation center were included in the analysis. The total number of participants was 581. The smoking cessation status of the study group at the end of the 1-year follow-up is shown in Table 1. By the end of the 1-year follow-up period, the smoking cessation rate was 30.1%.

Of the 359 patients who did not smoke for at least 4 weeks, 184 (51.3%) began smoking again. The mean duration of quitting was  $125.7 \pm 82.0$  days.

There was no significant difference between women and men in relapse. The relapse rate was significantly higher in the age group of 18–54 years compared to the group over 55. The rate of relapse was higher for employed individuals compared to unemployed individuals. Education level and marital status had no significant effect on restarting smoking.

There were no significant differences in relapse rate between women and men in survival analysis ( $P = 0.18$ ) (log-rank (Mantel–Cox)). Duration without smoking was  $8.3 \pm 0.3$  months in men and  $7.8 \pm 0.3$  months in women.

While the relapse rate was 61.2% for the age group of 18–54 years, it was 41.4% for the group over 55 (log-rank = 17.5, SD = 1,  $P = 0.001$ ). The average duration of not smoking was  $7.0 \pm 0.3$  months for the age group of 18–54 years, while it was  $9.1 \pm 0.3$  months for the group over 55, which indicates a statistically significant difference. There was a significant association between dependency level and restarting smoking. In the univariate analysis, patients with a high level of dependency were more likely to restart smoking than those with a lower level of dependency ( $P < 0.001$ ). When a survival analysis was performed according to dependency level, it was seen that the group with the shortest span of cessation consisted of those with a high

**Table 1.** Distribution of patients in respect to smoking cessation status.

Status of smoking cessation	Number	Percent
Quit, successful	175	30.1
Quit, relapsed	184	31.7
Quit, lost to follow-up	7	1.2
Never quit	215	37.0
Total	581	100.0

level of dependency (log-rank = 19.75, SD = 4,  $P = 0.001$ ). When the treatment methods used by the research group were compared, the relapse risk for those who were treated with pharmacotherapy was significantly lower than for those who received behavioral treatment ( $P < 0.05$ ). The relapse rate in the group that took varenicline was significantly lower than among those who received behavioral treatment. The relapse rate in the group that took bupropion was not statistically different compared to those who were only treated behaviorally. There was no significant association between receiving nicotine replacement treatment and restarting smoking. The status of restarting smoking for each therapy group is given in Table 2.

When survival analysis was performed a significant difference was detected between treatment methods employed (log-rank = 25.4, SD = 3,  $P = 0.0001$ ). The duration for permanence in smoking cessation was highest in the group that used varenicline. In the univariate analysis, patients with a high level of dependency were more likely to restart smoking than those with a lower level of dependency ( $P < 0.001$ ). When survival analysis was performed according to dependency level, it was seen that the group with the shortest span of cessation consisted of those with a high level of dependency (Figure) (log-rank = 19.75, SD = 4,  $P = 0.001$ ).

Table 3 shows the Cox regression analysis results regarding the status of restarting smoking according to nicotine dependency level in the research group. Four different models were employed for these analyses. The first model included nicotine dependency level, age, and sex, while the second model added employment, the third model added smoking in the household, and the fourth model added the use of medicine.

The risk of restarting smoking for the group with a high level of nicotine dependency was 2.10 (95% CI = 1.48–2.97) compared to the group with a lower dependency level.

With adjustments in Model 1 according to age and sex, the hazard ratio (HR) decreased but retained its statistical significance (HR = 1.89, 95% CI = 1.32–2.69). In Model 2, which covered employment as well as age and sex, the HR for relapse in the group with higher dependency decreased compared to the group with lower dependency and, again, it retained its statistical significance (HR = 1.84, 95% CI = 1.28–2.63). In Model 3, which was adjusted for age, sex, employment, and smoking in the household, the statistical significance was maintained although the HR decreased (HR = 1.83, 95% CI = 1.28–2.63). Model 4 added the use of medicine, and the HR for relapse of the group with higher dependency increased compared to the group with lower dependency and it was statistically significant (HR = 1.89, 95% CI = 1.32–2.72). In summary, the relapse risk for those with higher nicotine dependency was almost 2 times higher than that for those with lower dependency even when variables such as age, sex, employment, smoking in the household, and use of medication were controlled.

#### 4. Discussion

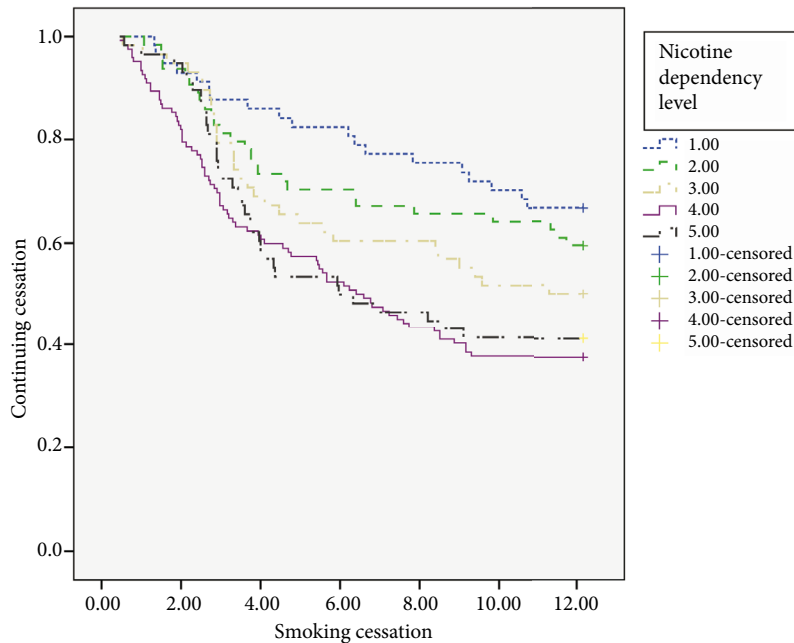
In the research group, the smoking cessation rate for 1 year was 30.1%. Three hundred and fifty-nine people who did not smoke for at least 4 weeks were followed for 1 year, and 51.3% of these people restarted smoking. In a 3-year observation study conducted in Trabzon, Turkey, the smoking cessation rate was detected to be 47.8% (13). The smoking cessation rate in this research group over 1 year is lower than the rate in Trabzon. This difference may arise from the fact that the study conducted in Trabzon was based on a center established in a university hospital; people who wished to quit smoking and had high awareness of their health status consulted that center in person and they had higher educational levels, which may be another indicator of higher awareness. In addition, in the Kaplan–Meier survival analysis comparing sex, no

**Table 2.** The effect of treatment method on restarting smoking.

Treatment method	Restarted smoking status				
	Restarted		Did not restart		P
	Number	%*	Number	%*	
Behavioral treatment	119	55.9	94	44.1	0.03**
Pharmacological treatment	65	44.5	81	55.5	
Type of therapy					
Bupropion	43	64.2	24	35.8	0.23
Varenicline	8	17.0	39	83.0	0.0001
Nicotine replacement therapy	14	43.8	18	56.3	0.19

\*Row percentage, chi-square test.

\*\*Pharmacotherapy was compared to behavioral treatment.



**Figure.** Rates of smoking cessation according to months and nicotine dependency levels.

significant difference was found in terms of permanence in smoking cessation, which is similar to this study.

In 3 studies carried out at pulmonology clinics, success rates for 1 year were detected to be 41.2%, 45.5%, and 40% respectively (14–16). The reason for higher rates of smoking cessation compared to this study may be due to the fact that people who consulted the pulmonology clinics mainly had complaints about smoking and a high risk of disease. It may be thought that individuals with risks have a higher motivation to quit smoking.

In a community-based intervention trial study conducted in Canada, the smoking cessation rate for 1 year was detected to be 43% (17). The reason for a higher rate of smoking cessation may be due to the fact that the social support intervention administered to those who wished to quit smoking covered the family of the individuals as well. Additionally, more extensive efforts were spent to increase social awareness, which may be another factor in increasing the success.

In a study conducted in the United States, the rate of restarting smoking at the end of 6 months was detected to be 62.9%. Furthermore, in the Kaplan–Meier survival analysis based on sex, no significant difference was determined in smoking cessation permanence, which is parallel to the finding obtained in this study. Japuntich et al. reported the rate of restarting smoking at the end of 6 months to be 62.9% (10). Additionally, the same study revealed that rate of restarting smoking in women and people with a high nicotine dependency was significantly

higher. The reason for a higher rate of restarting smoking compared to our study may be due to a shorter period of observation. In an International Tobacco Control study covering a 3-year observation of nicotine replacement treatment, the rate for restarting smoking was detected to be 37% (18). No significant relationship was found between restarting and sex, which is parallel to this study. In addition, the restart rate in people who were over 55 was significantly lower. The difference in restarting smoking may be due to a longer period of observation and the relapse rate, which, as was expected, decreased in the course of time.

According to dual analysis and survival analysis in the research group, the restart rate in the employed group was significantly higher compared to those who were unemployed. In a study conducted in England, where observations lasted for 13 years, the restart rate for people who were unemployed was significantly higher (19). The average age of participants in the research group of the study conducted in England was lower. Thus, while the working group was younger in the present study, the unemployed group was younger in the study from England. The difference may be due to age rather than employment. It is also possible that the smoking ban is not applied properly in small offices in Turkey, and smokers encourage one another to smoke.

In this study, no significant relationship was found between a smoking environment and restarting. In the Inter99 study, which was a community-based intervention

**Table 3.** The relationship between nicotine dependency level and status of restarting smoking in Cox regression models.

Nicotine* dependency level	RR	CI (95%)	P
Low**	1	-	0.001
Moderate	1.48	0.92–2.36	0.09
High	2.10	1.48–2.97	0.001
Model 1***			
Nicotine dependency level			
Low**	1	-	0.002
Moderate	1.37	0.85–2.19	0.18
High	1.89	1.32–2.69	0.001
Model 2****			
Nicotine dependency level			
Low**	1	-	0.003
Moderate	1.36	0.85–2.18	0.19
High	1.84	1.28–2.63	0.001
Model 3*****			
Nicotine dependency level			
Low**	1	-	0.003
Moderate	1.36	0.85–2.18	0.19
High	1.83	1.28–2.63	0.001
Model 4*****			
Nicotine dependency level			
Low**	1	-	0.002
Moderate	1.38	0.86–2.21	0.18
High	1.89	1.32–2.72	0.001

\*Cox regression analysis of relapse/nicotine dependency level, which was not modified according to any of the variables.

\*\*Taken as reference.

\*\*\*Model 1: Age was modified according to sex.

\*\*\*\*Model 2: Age was modified according to sex and employment.

\*\*\*\*\*Model 3: Age was modified according to sex, employment, and smoking in household.

\*\*\*\*\* Model 4: Age was modified according to sex, employment, smoking in household, and use of medicine.

trial study, no significant effect of a smoking environment was found when it was controlled according to work (20). However, it was seen that the group with a lower level of education had a 1.82 times greater risk of restarting smoking if they were in a smoking environment (95% CI = 1.4–2.4).

In the present study, the restart rate was significantly higher among those with a higher level of nicotine dependency. In a study conducted in England (21), no significant relationship was detected between restart rate

and nicotine dependency level at the end of 3 months. These different results may stem from shorter period of observation. In Bolt and Piper's study, nicotine dependency level was compared via a different scale and patients were either treated with bupropion or a nicotine replacement. At the end of 6 months, patients with lower dependency levels had significantly less relapse than those with a higher dependency level (22). Another study compared bupropion with a placebo in terms of restarting. At the end of 12 months, the restart rate was significantly lower among those

with lower dependency levels, which was a finding similar to the present study (23). In our group the restart rate was significantly lower among patients who were treated with pharmacotherapy than among the patients who received behavioral treatment at the end of 1 year. The Cox regression analysis detected that permanence in smoking cessation was highest in the group who took varenicline. In a double-blind randomized control study varenicline was used for 12 weeks. At the end of 1 year of observation, it was seen that varenicline was 1.34 times significantly more efficient than a placebo in preventing restarting (95% CI = 1.06–1.69) (24). In a systematic review, behavioral treatment supported by telephone calls resulted in no significant effect in terms of preventing relapse. The same study showed that the effect of a nicotine band to prevent restarting in long periods of observations was 1.30 times higher (95% CI = 1.06–1.61) and the effect of bupropion was 1.25 times higher (95% CI = 0.86–1.81); however, neither was significant (25). In a previous metaanalysis, it was seen that behavioral treatments that were implemented in various frequencies to prevent restarting had no significant effect. The same metaanalysis also showed that there was no significant effect of bupropion or nicotine replacement treatments on preventing relapses. However, varenicline decreased the rate of relapse at a significant level (RR: 1.18, 95% CI = 1.03–1.36) (26).

This study was planned as an intervention trial study of the Heart of Balçova Project regarding people who had a smoking habit and had a moderate or higher risk for coronary heart diseases. It was different from other cessation studies in that most of the participants were invited by community volunteers based on their risk status, instead of their applying themselves. Additionally, it was not located in a health facility, like a primary care unit or a hospital. Compliance to treatment might have decreased since it was not perceived as a health organization by the participants.

Starting packets for treatments used in the study were distributed by the center free of charge. Attendance packets were not used in general, although they were written for prescriptions. Pharmacotherapy was not continued free of charge for the full course; therefore, the effect of treatment should be evaluated with caution. Providing free medicine is one of the strengths of the study, although it also caused

patients who had not truly decided to quit smoking to participate in the study. This may have given rise to lower cessation and higher relapse rates.

Cessation and relapse rates for 12 months obtained through this study are in compliance with the intervals in the literature. There are only a limited number of studies in Turkey about relapse in smoking cessation. Therefore, the observation of not only cessation but also restarting is the strongest aspect of the study.

The study succeeded in revealing elements regarding cessation and restart because it was a prospective study and there were only a few lost cases during follow-up. Performing the necessary measurements, in addition to self-reporting in order to learn smoking cessation status, increased the validity of the study.

In conclusion, this study revealed that the smoking cessation rate for 1 year was 30.1% and the relapse rate was 51.3%. As nicotine dependency level increased, smoking cessation rate decreased significantly and the relapse rate increased significantly.

Among the pharmacotherapy groups, only patients who took varenicline had a significantly lower level of restarting compared to those who did not use any medicine. This result should be interpreted carefully since the study was not a randomized trial with a control group.

Attempts to quit smoking should address the whole population, and authorities should be aware of the aspect of observation. Since the employed have higher rates of relapse, attempts to include office workers should be increased. In order to increase the rate of cessation and provide permanent cessation, people with a high nicotine dependency should be given priority in pharmacotherapy initially. Individuals appropriate for pharmacotherapy should be screened systematically, and the expense of treatment should be covered by the general insurance system. These efforts will result in decreased morbidity and mortality due to smoking and a beneficial contribution to public health.

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