



Prevalence of smoking and reasons for continuing to smoke: a population-based study

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ABSTRACT

Objective: To investigate the prevalence of smoking and the reasons for continuing to smoke among adults in Brazil. **Methods:** This was a cross-sectional, population-based study including 1,054 individuals ≥ 40 years of age, residents of the city of Florianópolis, Brazil, of whom 183 were smokers. All of the smokers completed the University of São Paulo Reasons for Smoking Scale (USP-RSS). Depressive symptoms were evaluated with the Hospital Anxiety and Depression Scale, and spirometry was performed to screen for COPD. **Results:** Of the 183 smokers, 105 (57.4%) were female, 138 (75.4%) were White, and 125 (63.8%) were in a low economic class. The mean level of education among the smokers was 9.6 ± 6.1 years. The mean smoking history was 29 ± 15 pack-years, 59% of the men having a ≥ 30 pack-year smoking history. Approximately 20% of the smokers had COPD, and 29% had depressive symptoms, which were more common in the women. The USP-RSS scores were highest for the pleasure of smoking (PS), tension reduction (TR), and physical dependence (PD) domains (3.9 ± 1.1 , 3.6 ± 1.2 , and 3.5 ± 1.3 , respectively). Scores for the PS, TR, and weight control (WC) domains were significantly higher in women. Smokers with a > 20 pack-year smoking history scored significantly higher on the PD, PS, automatism, and close association (CA) domains. Smoking history was associated with the PD, PS, TR, and CA domains. Depressive symptoms were associated with the PD, social smoking, and CA domains ($p = 0.001$; $p = 0.01$; $p = 0.09$, respectively). Female gender and a low level of education were associated with the PS domain ($p = 0.04$) and TR domain ($p < 0.001$). **Conclusions:** The prevalence of smoking in our sample was relatively high (17.4%). The USP-RSS domains PS, TR, and WC explain why individuals continue smoking, as do depressive symptoms.

Keywords: Smoking/epidemiology; Tobacco use disorder/psychology; Smoking cessation/methods; Prevalence.

INTRODUCTION

According to the World Health Organization, smoking is associated with mental and behavioral disorders because of the accompanying dependence on nicotine, which is the main psychoactive substance in tobacco. Nicotine dependence is the primary factor in maintaining smoking behavior among adult smokers.⁽¹⁾ It is well documented that racial and ethnic differences can have a significant influence on the prevalence, patterns, health implications, and consequences of smoking, as well as on the efficacy of smoking cessation interventions.⁽²⁾

It is estimated that approximately one billion smokers consume six trillion cigarettes annually worldwide and that 10 million individuals will die from smoking-related diseases by 2030.⁽¹⁾ The prevalence of smoking varies across countries, China, India, Indonesia, Russia, the United States, Japan, Bangladesh, Germany, Turkey, and Brazil collectively accounting for over 16% of all smokers worldwide.⁽³⁾

The prevalence of smoking in Brazil varies by region, ranging from 5.1% in the city of Salvador, located in the northeastern region (in the state of Bahia), to 14.0% in the city of Curitiba, located in the southern region (in the state of Paraná), and by age group, being higher among adults in the 45- to 64-year age group.⁽⁴⁾ In the cities of Fortaleza (located in the northeastern region, in the state of Ceará) and Macapá (located in the northern region, in the state of Amapá), the prevalence of smoking is 7.3% and 8.8% respectively. In the city of São Paulo (located in the southeastern region, in the state of São Paulo), the prevalence of smoking is 13.2%, compared with 13.6% and 10.1%, respectively, in the cities of Porto Alegre (in the state of Rio Grande do Sul) and Florianópolis (in the state of Santa Catarina), both of which are in the southern region.⁽⁴⁾ It is noteworthy that, regardless of region, the prevalence of smoking in Brazil is higher among males than among females (12.7% vs. 8.0%).⁽⁴⁾

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Understanding the motivations that lead an individual to smoke is relevant because such an understanding can aid in preventing dependence and encouraging smoking cessation. Most previous studies have focused on the motivations to quit smoking, little emphasis having been placed on providing clear information about the motivations to continue smoking. Therefore, the aim of this population-based study was to identify the reasons to continue to smoking among smokers in the southern region of Brazil, through the use of standardized methodology and a validated scale.

METHODS

This was a cross-sectional, population-based study involving home interviews in the city of Florianópolis and including adults ≥ 40 years of age. We interviewed current smokers, using questionnaires that have been validated for use in Brazil,⁽⁵⁻⁸⁾ in order to collect information about their motivations to smoke. The interviews were conducted between April of 2012 and February of 2013. Each interview took, on average, 90 min to complete. This study was conducted in accordance with the methodology employed in the Latin American Project for Research in Pulmonary Obstruction study⁽⁶⁾ and the *Respira Floripa* (Breathe Floripa) study.⁽⁹⁾

The study was approved by the Human Research Ethics Committee of the Federal University of Santa Catarina (Reference no. 1136). All participants gave written informed consent. The research was also conducted in accordance with the principles of the Declaration of Helsinki.⁽¹⁰⁾

The participants were invited to complete the following questionnaires: the Latin American Project for Research in Pulmonary Obstruction/Breathe Floripa questionnaire⁽⁶⁾; the Hospital Anxiety and Depression Scale (HADS)^(7,8); and the University of São Paulo Reasons for Smoking Scale (USP-RSS).⁽⁵⁾

The USP-RSS is a self-report questionnaire that assesses the motivations for smoking. It has been translated to Portuguese, culturally adapted for use in Brazil, and validated for such use.⁽⁵⁾ Participants completed the USP-RSS individually. The 21 questions are divided into nine subscales: addiction (items 5-19); deriving pleasure from smoking (items 3-11); tension reduction (items 4, 12, and 18); stimulation (items 1, 9, and 16); automatism (items 7, 14, and 20); handling (items 2-10); social smoking (items 8-15); weight control (items 13-21); and affiliative attachment (items 6-17). Each response is scored on a Likert scale that ranges from 1 to 5, a score of 1 corresponding to a response of "never" and a score of 5 corresponding to a response of "always". Higher scores indicate greater motivation. The total score quantifies the overall level of motivation, and the subscale scores qualify that motivation. For the purposes of the present study, we established the following factors, hereafter referred to as domains, related the motivations to continue smoking: physical

dependence (nicotine dependence); pleasure of smoking (pleasure-seeking); tension reduction (use of cigarettes to relax); stimulus (demand increasing concentration); automatism (smoking without thinking); handling (pleasure derived from manipulating and lighting a cigarette); social smoking (as a facilitator of social interaction); weight control (smoking to lose or maintain weight); and close association ("affiliative attachment" in the original version of the USP-RSS, defined as a strong emotional connection to all experienced situations),⁽⁵⁾ the object (e.g., the cigarette) being transformed into a friend.

We evaluated the following variables: the USP-RSS scores, gender, race, economic class, level of education, smoking history, diagnosis of COPD (yes or no), and depressive symptoms (yes or no). We excluded smokers who met any of the following criteria: having been diagnosed with a psychiatric disorder that would limit their ability to understand and complete the questionnaire; having a history of long-term institutionalization; having recently undergone surgery; being pregnant; having had angina or acute myocardial infarction in the last three months; having active tuberculosis; and having arterial hypertension.

Sample size

The sample size calculation was based on the prevalence of COPD in the city of São Paulo, which ranges from 7.8% to 19.7% according to data from the study conducted by Menezes et al.⁽⁶⁾ The calculation also considered a margin of error of four percentage points and a 20% margin of safety for non-response and losses. We thus estimated that a sample of approximately 1,000 subjects would be required. To obtain a representative sample that would allow further group analysis, we selected 846 residences housing a collective total of 1,192 individuals. All of the participants who described themselves as smokers were asked to complete the USP-RSS.⁽⁵⁾

Sampling procedure

Given the estimated 1.4 individuals ≥ 40 years of age per household, we randomly selected 68 of the 419 census tracts in the city of Florianópolis, comprising a total of 846 residences. To obtain a representative sample of adults living in Florianópolis, we applied a cluster sampling strategy, in which economic status (purchasing power, classified as determined by the Brazilian Market Research Association and based on the Brazilian national minimum wage)⁽¹¹⁾ was specified as follows: class A—heads of households in which the total monthly income is more than 20 times the minimum wage; class B—heads of households in which the total monthly income is 10-20 times the minimum wage; class C—heads of households in which the total monthly income is 3-10 times the minimum wage; class D—heads of households in which the total monthly income is 1-3 times the minimum wage; and class E—heads of households in which the total monthly income is equal to or less than the minimum wage.

Study definitions

Participants were categorized as smokers if they had smoked at least 100 cigarettes during their lifetime and reported that they were currently smoking at the time of the interview.⁽¹²⁾ A diagnosis of COPD was defined by the presence of airflow limitation, as identified by an FEV₁/FVC ratio < 0.70 after bronchodilator administration.⁽¹³⁾

Because the study design was based primarily on the prevalence of COPD, we included data on symptoms of depression only if the HADS score was ≥ 8 points.⁽¹⁴⁾ The HADS anxiety data were not considered, because evaluating anxiety was not one of the study objectives.

Methodology

Spirometry

Before and after administration of a bronchodilator (albuterol, 200 µg), spirometry maneuvers were performed in accordance with the American Thoracic Society criteria.⁽¹⁵⁾ We employed a portable spirometer (EasyOne; ndd Medical Technologies, Zurich, Switzerland), the calibration of which was checked following the manufacturer's guidelines. All spirometry procedures were analyzed by two pulmonologists with expertise in pulmonary function testing, and the predicted values were calculated from the equations proposed in the National Health and Nutrition Examination Survey.⁽¹⁶⁾

Statistical analysis

The completed questionnaires were coded by the interviewers and reviewed by the supervisors. Data were selected and double entered into a database. The results are presented as means and standard deviations or as absolute and relative frequencies. The variables were analyzed with Student's t-tests. To compare the means among three or more groups, we used ANOVA. Logistic regression was used in order to analyze descriptive data or to determine whether the various domains or motivational factors for smoking (dependent variable) correlated with the descriptors of interest (independent variables). Odds ratios and their 95% confidence intervals were calculated for each independent variable. For all analyses, values of $p < 0.05$ were considered significant. Data were analyzed with the Predictive Analytics Software package, version 18.0 for Windows (SPSS Inc., Chicago, IL, USA).

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RESULTS

Five of the 846 selected households were not visited because of an inability to contact the residents. Of the 1,192 eligible residents, 110 declined to participate in the study. The remaining individuals ($n = 1,082$) completed all of the steps, corresponding to a response rate of 90.8%. Subsequently, 23 interviews were

excluded from the analysis because of participant inability to perform the maneuvers required to obtain reproducible flow-volume curves during spirometry. Therefore, we evaluated 1,059 individuals (88.8% of the eligible population), 188 of whom were categorized as current smokers. Finally, 5 smokers were excluded because they did not answer all of the questions on the USP-RSS. Consequently, the final sample comprised 1,054 individuals, and the prevalence of smoking in the sample was 17.4%.

The sociodemographic and clinical characteristics of the 183 smokers who completed the USP-RSS are detailed in Table 1. There was a slight, although less than significant, predominance of women, who accounted for 57.4% of the smokers, which was to be expected because there are more women than men in the city of Florianópolis, as shown in the Brazilian Institute of Geography and Statistics data for 2010.⁽¹⁷⁾ Despite the predominance of female smokers, the number of cigarettes smoked by women, expressed in pack-years, was significantly lower than the number smoked by men, a smoking history greater than 30 pack-years being observed in 59% of the men, compared with 39% of the women ($p = 0.01$). Most (75.4%) of the smokers reported their race as White. In relation to the economic class, 63.8% of the smokers were in class C, 18.6% were in class D or E, 8.2% were in class A, and 4.9% were in class B (Table 1). A functional diagnosis of COPD was made in 19.7% of the smokers evaluated. Symptoms of depression, screened with the HADS depression subscale, were identified in 29.5% of the smokers, with a significant predominance in women ($p = 0.002$).

Table 2 shows the mean scores for the USP-RSS domains studied. The domains for which the scores were highest were as follows: pleasure of smoking (mean, 3.9 ± 1.1); tension reduction (mean, 3.6 ± 1.2); and physical dependence (mean, 3.5 ± 1.3). In addition, significant differences were observed between the men and the women in relation to the mean scores for the following domains: pleasure of smoking (3.7 ± 1.3 vs. 4.1 ± 1.2 , $p = 0.01$); tension reduction (3.4 ± 1.2 vs. 4.0 ± 1.2 , $p = 0.005$); and weight control (1.7 ± 1.2 vs. 2.4 ± 1.6 , $p = 0.002$).

Individuals with 0-4 years of schooling had significantly higher scores than did the other participants for the following motivational domains: pleasure of smoking ($p = 0.04$); tension reduction ($p = 0.03$); stimulus ($p = 0.001$); handling ($p = 0.009$); social smoking ($p = 0.02$); and close association ($p = 0.001$). Individuals who reported a smoking history > 21 pack-years had significantly higher scores for the domains of physical dependence ($p < 0.001$), pleasure of smoking ($p = 0.004$), automatism ($p < 0.001$), and close association ($p = 0.006$).

Individuals who presented symptoms or a functional diagnosis of COPD had significantly higher USP-RSS scores than did those without COPD only in the physical dependence domain ($p = 0.03$) and close association domain ($p = 0.03$). Individuals with depressive

Table 1. Sociodemographic and clinical characteristics of the smokers evaluated.

Characteristic	(n = 183)
Age, in years, mean ± SD	54.5 ± 9.2
Gender, n (%)	
Female	105 (57.4)
Male	78 (42.6)
Self-reported race, n (%)	
White	138 (75.4)
Other	45 (24.6)
Economic class, n (%)	
A	15 (8.2)
B	9 (4.9)
C	125 (63.8)
D/E	34 (18.6)
Years of schooling, mean ± SD	9.6 ± 6.1
Smoking history, in pack-years, mean ± SD	29 ± 15
COPD, n (%)	36 (19.7)
Symptoms of depression, n (%)	54 (29.5)

Table 2. University of São Paulo Reasons for Smoking Scale scores, for the sample as a whole and by gender.^a

USP-RSS domain	Total (n = 183)	Male (n = 78)	Female (n = 105)	p*
Physical dependence	3.5 ± 1.3	3.4 ± 1.3	3.5 ± 1.3	0.3
Pleasure of smoking	3.9 ± 1.1	3.7 ± 1.3	4.1 ± 1.2	0.01
Tension reduction	3.6 ± 1.2	3.4 ± 1.2	4.0 ± 1.2	0.005
Stimulus	2.5 ± 1.2	2.3 ± 1.2	2.6 ± 1.4	0.3
Automatism	2.2 ± 1.2	2.1 ± 1.1	2.2 ± 1.1	0.9
Handling	2.8 ± 1.3	3.4 ± 1.3	3.5 ± 1.3	0.5
Social smoking	2.2 ± 1.3	2.1 ± 1.2	2.2 ± 1.4	0.5
Weight control	2.1 ± 1.5	1.7 ± 1.2	2.4 ± 1.6	0.002
Close association	2.9 ± 1.4	2.9 ± 1.3	3.0 ± 1.4	0.7

USP-RSS: University of São Paulo Reasons for Smoking Scale. ^aData are presented as mean ± standard deviation. *Unpaired t-test.

symptoms scored significantly higher than did those without on the following domains: physical dependence (p = 0.007); tension reduction (p = 0.001); stimulus (p < 0.001); social smoking (p < 0.001); weight control (p = 0.01); and close association (p < 0.001).

Table 3 shows the results of the logistic regression analysis, performed to evaluate the effects that gender, smoking history, level of education, presence of depressive symptoms, and COPD have on the following domains: physical dependence, pleasure of smoking, tension reduction, stimulus, automatism, handling, social smoking, weight control, and close association. The main determinants of the score for the physical dependence domain were a smoking history of 21-30 pack-years (OR = 15.8; 95% CI: 3.9-63.2; p < 0.001) and the presence of depression symptoms (OR = 3.7; 95% CI: 1.7-8.1; p = 0.001). A smoking history > 30 pack-years was also the main determinant of the scores for the following domains: pleasure of smoking (OR = 5.7; 95% CI: 2.2-52.7; p > 0.001); tension reduction (OR = 4.6; 95% CI: 1.7-7.4; p = 0.006); and close association (OR = 3.5; 95% CI: 1.1-11.2; p = 0.02). Depressive symptoms were significantly associated with the physical dependence, social smoking, and close

association domains (p = 0.001, p = 0.01, and p = 0.009, respectively). Female gender and a low level of education were key determinants of the scores for the pleasure of smoking and tension reduction domains (p = 0.04 and p < 0.001, respectively). None of the variables studied were found to be determinants of the scores for the domains of automatism and handling (p > 0.05).

DISCUSSION

In this population-based study, we employed a robust methodology to evaluate the prevalence and characteristics of smoking, as well as aspects related to the motivations to continue smoking, among individuals 40 years of age or older. Our findings show that the prevalence of smoking was relatively high (17.4%) in our sample. In addition, our data suggest that low economic class and a low level of education are characteristic of smokers. We also found that, although there were more female smokers than male smokers in our sample, the men had greater smoking histories.

Among the main findings were the fact that the USP-RSS scores were highest for the pleasure of smoking, tension reduction, and physical dependence

Table 3. Logistic regression analysis of the determinants of the scores for the University of São Paulo Reasons for Smoking Scale domains.

USP-RSS domain Determinant	OR	95% CI	p*
Physical dependence			
Smoking history			
< 10 pack-years	–	–	–
11-20 pack-years	6.2	(1.6-26.8)	0.009
21-30 pack-years	15.8	(3.9-63.2)	< 0.001
> 30 pack-years	15.1	(4.3-52.7)	< 0.001
Symptoms of depression	3.7	(1.7-8.1)	0.001
Pleasure of smoking			
Smoking history			
< 10 pack-years	–	–	–
11-20 pack-years	–	–	–
21-30 pack-years	3.9	(1.3-12.0)	0.01
> 30 pack-years	5.7	(2.2-52.7)	< 0.001
Female gender	2.1	(1.0-4.3)	0.04
≤ 4 years of schooling	2.7	(1.0-7.0)	0.04
Tension reduction			
Smoking history			
< 10 pack-years	–	–	–
11-20 pack-years	4.3	(1.3-14.4)	0.01
21-30 pack-years	–	–	–
> 30 pack-years	4.6	(1.7-7.4)	0.006
Female gender	3.5	(1.0-4.3)	< 0.001
Level of education			
≤ 4 years of schooling	6.6	(2.3-18.8)	< 0.001
5-8 years of schooling	4.9	(1.7-14.4)	0.004
9-12 years of schooling	4.3	(1.5-12.0)	0.004
≥ 13 years of schooling	–	–	–
Stimulus			
≤ 4 years of schooling	5.9	(1.2-29.1)	0.03
Symptoms of depression	3.6	(1.4-8.8)	0.006
Automatism	–	–	–
Handling	–	–	–
Social smoking			
Symptoms of depression	3.2	(1.3-7.7)	0.01
Weight control			
Female gender	3.4	(1.3-9.1)	0.01
Close association			
COPD	3.2	(1.4-7.8)	0.007
Symptoms of depression	2.7	(1.2-5.5)	0.009
> 30 pack-year smoking history	3.5	(1.1-11.2)	0.02

USP-RSS: University of São Paulo Reasons for Smoking Scale.

domains, the scores for the pleasure of smoking, tension reduction, and weight control domains being significantly higher in women. Smokers with a smoking history greater than 20 pack-years scored significantly higher on the physical dependence, pleasure of smoking, automatism, and close association domains. In addition, female gender and a low level of education were key determinants of the scores on the pleasure of smoking and tension reduction domains. For women, the pleasure of smoking, tension reduction, and weight control domains, as well as

symptoms of depression, are essential aspects to consider in personalized smoking cessation treatment. The association identified between a greater smoking history and the motivational profile, including the pleasure of smoking, tension reduction, and physical dependence domains, could contribute to the future development of novel smoking cessation strategies.

To our knowledge, this is the first population-based study investigating the reasons to continue smoking among smokers in Brazil. We chose to apply the USP-RSS because it is the result of careful work. As

previously stated, the USP-RSS has been translated to Portuguese, culturally adapted for use in Brazil, and validated for such use.⁽⁵⁾ However, it can be used in other countries, given that it is well constructed and is easily implemented in clinical practice.

The physical dependence, stimulus, handling, social smoking, and close association domains are common to both genders. That could be attributed to the release of mediators in the dopamine reward system. In addition, physical addiction to nicotine may be determined by genes (e.g., the *SLC6A3* gene) and dopamine transport, both of which are regulated by the central nervous system. The dopamine D2 and D4 receptor polymorphisms have been shown to be more common in smokers than in nonsmokers.^(18,19) In addition, smokers exhibit a significant deficit in dopamine regulation, which requires external stimulus, such as exogenous nicotine, in order to release quantities sufficient to produce pleasurable feelings.^(18,19) Other studies have also reported a correlation between nicotine dependence and continued smoking, emphasizing the fact that such dependence is not the only motivational factor for smoking and that more comprehensive studies should be conducted to improve the understanding of the complex relationship between smoking and motivational factors.^(20,21)

Other relevant findings of the present study were related to the functional diagnosis of COPD and the presence of depressive symptoms. Although the individuals evaluated were aware of the fact that COPD is a serious illness that results in significant pulmonary dysfunction, 19.7% of the smokers with COPD continued to smoke because they had established an intense emotional link (i.e., a close association) with smoking. In addition, there is evidence that depressed smokers are more motivated to smoke, in order to relieve negative feelings such as anxiety,

anger, fear, sadness, and shame.^(22,23) Our analysis of the USP-RSS domain scores confirmed those findings.

In the present study, the presence of depressive symptoms, a diagnosis of COPD, and a smoking history greater than 30 pack-years were found to correlate with a close association with smoking. However, our findings should be interpreted with caution, because those factors are influenced by the close relationships among depression, COPD, and smoking. One possible explanation for these findings is that the associations among depressive symptoms, COPD, and smoking history are only a reflection of the physical dependence or depressive symptoms. However, our findings are inconclusive and require further investigation.

We found that social smoking, also known as intermittent smoking, was predominantly associated with depressive symptoms. Although that finding may be due to the age of the individuals in the study sample (≥ 40 years), these are important data that should not be ignored. A recent study describing the motivational profile of adolescents also showed higher scores in the social smoking domain.⁽²⁴⁾

In the present study, we applied a reliable, validated instrument that provides motivational intensity scores related to smoking in adults. In our sample of 183 smokers ≥ 40 years of age, we found that the main reasons for continuing to smoke were related to the pleasure of smoking, tension reduction, and physical dependence domains. In addition, we demonstrated some differences between women and men in relation to the determinants of continued smoking. The determinants of the motivational domains pleasure of smoking, stress reduction, and weight control were found to be more common in females. The individual reasons for continuing to smoke identified in this study may contribute to the development of novel targeted smoking cessation strategies.

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