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Original Research

Predictors of Cigarette Smoking Behavior in a Cohort of Adults in India

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Abstract

Background: India is the second largest consumer of tobacco in the world. The disease burden, health care costs along with fiscal losses resulting from premature deaths attributable to tobacco consumption are increasing rapidly. This study aimed to identify and examine predictors of adult cigarette smoking behavior in India.

Methods: A cross-sectional study utilizing a self-administered questionnaire was administered to a cohort of adults aged ≥18 years in 5 metropolitan cities in India. The outcome variable was current cigarette smoking status, where smoker were classified as current cigarette smoker who had used at least one cigarette during the last one month. Independent variables included socio-demographic characteristics and smoking status of peers. Descriptive and bivariate analyses followed by stepwise logistic regression were conducted to determine predictors of smoking.

Results: The cohort comprised of 761 surveys (response rate 69%) among which 62.8% were current smokers. More than 50% of the smokers were males and had a bachelors' degree, and were aged 30-39 and 40-49 years. Bivariate analysis indicated that age, marital status, education, income level, number of smoking friends, smoking status of father, siblings, close friends, and other individuals at home were associated with smoking. Stepwise logistic regression indicated that age groups 30-39 and 40-49, higher income categories >$10,000/yr - ≤$20,000/yr and
>$ 20,000/yr, ≥2 smoking friends, and currently smoking individuals at home were predictors of smoking.

Conclusion: Our findings suggest that age, income and number of friends and family members that smoke were associated with cigarette smoking behavior in the cohort of adults in India.

INTRODUCTION

Smoking is defined as inhalation of smoke from burnt tobacco that occurs occasionally or habitually as a consequence of a physical addiction to some chemicals, primarily nicotine [1]. Tobacco use is a wide spread global phenomenon that is leading to nicotine addiction, disability, disease, lost productivity, and death, where approximately 5 million individuals globally are killed by tobacco use every year and if current trends continue, by 2030 this number will rise to approximately 10 million (WHO 2008). There are a total of 1.1 billion smokers worldwide out of which about 20% (182 million) live in India alone [2].

Tobacco introduced in India approximately 400 years ago by the Portuguese, is used in cigarettes and other cheaper forms of tobacco including 'bidi's and smokeless tobacco [2]. The consumption of cigarettes in India constitutes about 20% of the total tobacco consumption [3]. The prevalence of smoking in India is about twice in males as compared to females [4]. Smoking was found to be associated with a reduction in median survival for men (6 years) and women (8 years) in India [5]. Also, a nationwide study revealed that the rate of tobacco-related deaths is currently rising at

about 3% per year with annual total deaths estimated to almost 1 million [5].

In 2004, direct public health costs attributed to tobacco use and related illnesses were an alarming $1.2 billion, which was 4.7% of India's total national healthcare expenditure [6]. The same study reported that $411 million was lost in income due to tobacco-related work absenteeism. Tobacco accounts for about 12% of the country's excise duties and accounts for 4% of India's agricultural export costs [2]. Smoking results in additional costs associated with fire damage, and damage to the environment from the manufacturing tobacco products [2].

From a global perspective, several studies investigating predictors of smoking have found a positive correlation between smoking and males, influential peers being smokers, and socioeconomic status defined by income, occupation and educational status [7-11]. Extensive literature exists on factors associated with the use of the 'bidi' and other forms of smokeless tobacco in India [3, 10-14]. Other than a study conducted over a decade ago which indicated rise in cigarette use in India very little empirical research exists on predictors of cigarette smoking in India [15]. Identifying these factors remains imperative to develop global as well as patient specific smoking cessation strategies for adult cigarette smokers in India.

Our study investigated predictors of smoking behavior in adults to lay a foundation for the development of effective and focused smoking cessation interventions for adult smokers in India.

METHODS

A cross-sectional study utilizing a self-administered questionnaire was conducted in India between February and May 2011 in a convenient sampled cohort of adults in India above 18 years of age. This unfunded research study was approved by the Committee for the Protection of Human Subject at the University of Houston under the exempt category.

Questionnaire

The survey instrument used was adapted from a validated and reliability-tested questionnaire used in a published study [16]. Further, content validity and test-retest reliability was assessed before collecting the data. The questionnaire was distributed at variety of sites in India including pharmaceutical companies (2 sites), informational technology companies (4 sites), finance companies (2 sites), medical college (1 site), construction sites (2 sites), shopping malls (4 sites) and residential complexes (3 sites) in metropolitan cities like Mumbai, Pune, Goa, Delhi, and Bangalore. The distribution of the survey in a variety of sites was to improve variability of the cohort of adults to in the study. Adults 18 years or older and who could read and understand English participated in the study. Only after confirming this inclusion criteria with their review of the informed consent document and their voluntary agreement to consider participation was the survey administered. Participants were requested to anonymously fill out the survey. Participants were requested to return the questionnaire to the data collection assistant or drop it in a box made available at each site as appropriate.

The self-administered questionnaire with was part of a larger study was organized into multiple sections. The following section describes the variables used in this study.

Outcome variable

Two items on the questionnaire were used to assess the outcome variable current cigarette smoking status. It was analyzed as a dichotomously categorized variable where smoker were individuals that smoked cigarette currently and had used at least one cigarette during the last 30 days. Non-smokers were those that had not used cigarettes at all. Questions used to categorize smoking status were "Do you currently smoke cigarettes?" (Yes/No) and "Please indicate how many cigarettes you have smoked in the last 24 hours, 7 days, 30 days", with option to indicate the actual number for each category. A respondent was categorized as a smoker if he/she endorsed to the question "Do you currently smoke cigarettes?" and indicated that they smoked at least one cigarette in the past 30 days [17].

Independent variables

This section was further divided into two sub-sections that measured the socio-demographic characteristics and social and environmental determinants of smoking.

a. *Socio-demographic characteristics:* These included age, gender, marital status, yearly income, religion, and educational level. Age was further categorized into 5 ordinal categories: 18-29, 30-39, 40-49, 50-59, and >60 [6].

b. *Social and environmental determinants of smoking: T*his section included smoking status of peers namely father, mother, siblings, close friends, and other individuals at home. Further number of smoking friends was also obtained. The questions measuring smoking status of peers were, "Does your mother, step-mother or other female guardian smoke cigarettes?", "Does your father, step-father or other male guardian smoke cigarettes?", "Do any of your brothers or sisters smoke cigarettes?", "Do any of your close friends smoke cigarettes? " and "Do any other people in your home smoke cigarettes?". Smoking status of peers was coded as:

1=Current smoker; 2=Non-smoker; 3=Former smoker who quit last year and 4=Former smoker who quit a long time ago. The number of friends that smoked cigarettes was coded as 0, 1, and ≥2.

Statistical analysis

Descriptive analysis was conducted to evaluate frequencies of the independent variables with smoking status. Bivariate chi-square tests and fisher's analysis (n≤5) were conducted to assess the presence and strength of an association between the independent variables and smoking status. Statistically significant variables in the bivariate analyses were included in the final stepwise logistic regression model. All statistical analyses were conducted using SAS version 9.2 (SAS Institute, Cary, NC) statistical package at a priori significance level of 0.05 as widely used in research [18].

RESULTS

A total of 780 responses were collected back from 1102 individuals approached. Respondents declined to fill the survey due to lack of time, fear of identification, or sheer unwillingness to participate. A total of 19 surveys from 780 respondents were eliminated due to issues of missing data. Thus, the overall cohort considered for analyses were 761 responses with a response rate of 69% (see Figure 1).

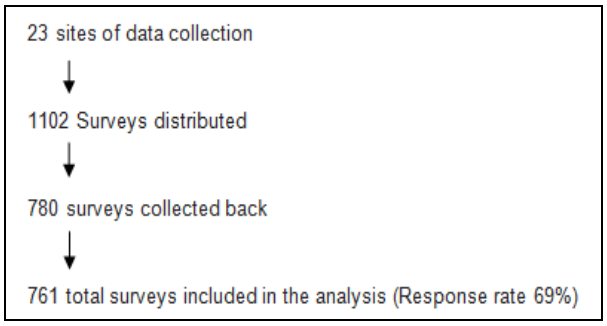

Figure 1. Response rate among surveyed population

Sample characteristics

Of the 761 surveys analyzed 62.8% (*n* = 478) were classified as current smokers (Table 1). Among the smokers, 80.9% (*n* = 230) ranged in 30-39 years category, more than 50% (*n* = 273) were males and had completed their bachelors' degree (*n* = 261) while around 40% (*n* = 229) indicated an annual income of >$10,000 - ≤$20,000/year. Almost 90% (*n* = 425) of smokers' reported their religion as "Hindu" and 78.2% (*n* = 374) were married. Assessing the smoking status of the peers indicated that 72.9% (*n* = 379) of them had ≥2 smoking friends, 91% (*n* = 231) of the smokers' fathers and 96.2% (*n* = 285) of the mothers were non-smokers, 52.7% (*n* = 252) of the smokers' siblings and 63.1% (*n* = 302) of the close friends were current smokers while 56.4% (*n* = 270) of other family members were non-smokers.

Differences between current smokers and non smokers

The bivariate analyses indicated that age (p <0.0001), education (p <0.0001), income level (p<0.0001), number of smoking friends (p<0.0001), smoking status of father (p<0.0001), siblings (p<0.0001*), close friends (p<0.0001), and other people at home (p<0.0001) were associated with cigarette smoking. The results of the descriptive and bivariate analyses have been summarized in Table 1.

Stepwise logistic Regression

A stepwise multiple logistic regression to evaluate the predictors of smoking was conducted using the statistically significant independent variables identified in the bivariate analysis (Table 2). Belonging to the age categories 30-39 years (OR 5.39, 95% CI=1.32 - 21.99) or 40-49 years (OR 4.633, 95% CI =1.10 - 19.93) increased the likelihood for a respondent to be a smoker as compared to the older age groups. Respondents belonging to the lower income groups, ≤ $2000/yr (OR 0.23, 95% CI= 0.08 - 0.64) and >$2000/yr to ≤$10,000/yr (OR 0.30, 95% CI= 0.14 - 0.60) were less likely to be smokers as compared to the higher income groups. Respondents with greater than 2 friends that smoke were found to be associated with smoking behavior (OR 0.13, 95% CI= 0.04 - 0.38). There was a higher likelihood for respondents who have current smokers at home to be smokers (OR 1.91, 95% CI= 1.17 - 3.88).

DISCUSSION

The smoking prevalence rate in our cohort of adult respondents (62.8%) is rather high in comparison to developed countries like the United States (19.3%), France (34.5%) and Britain (21%), yet similar to country like China (64.9%) and Russia (60%) [19, 20, 21, 22, 23, 24]. Smoking cessation strategies applied in countries like China and Russia may serve as potential successful interventions in India. Our main findings indicated that age groups 30-39 and 40-49 years, higher number of smoking friends, higher income, and current smokers living at home were significant predictors of cigarette smoking in this cohort of adults in India. The association of middle age and smoking is consistent with past literature. Individuals generally initiate smoking at 15 years of age, continue to increase till 50 and then follow a downward trend in smoking as reported in our study [23, 25, 26].

Table 1. Descriptive and bivariate analyses to test association of smokers and non smokers with independent variables

	Total Sample *n*=761 (%)	**Smokers *n*=478 (%)**	**Non-smokers *n*=283(%)**	**p-value**
Gender				
Male	469 (61.6)	273 (57.9)	196 (42)	0.14
Female	292 (38.3)	185 (63.3)	107 (36.6)	
Marital Status				
Single	22 (29.4)	95 (42.9)	126 (57)	<0.0001*
Married	540 (70.9)	374 (69.2)	166 (30.7)	
Age				
18-29	190 (24.9)	71 (37.3)	119 (62.3)	
30-39	284 (37.3)	230 (80.98)	54 (19.01)	<0.0001*
40-49	200 (26.3)	150 (75)	50 (25)	
50-59	67 (8.8)	13 (19.4)	54 (80.59)	
>60	20 (2.6)	13 (65)	7 (35)	
Educational Status				
Less than high school	6 (0.7)	0 (0)	6 (100)	
Completed high school	126 (16.6)	102 (80.3)	24 (18.8)	<0.0001*
College Degree (Bachelor)	391(51.3)	261 (66.7)	130 (33.2)	
Graduate Degree (Masters or Doctorate)	238 (31.2)	106 (44.5)	132 (55.4)	
Income Level				
≤ $2000/yr	72 (9.4)	12 (16.6)	60 (83.3)	
>$2000/yr - ≤$10,000/yr	212 (27.8)	114 (53.7)	98 (46.2)	<0.0001*
>$10,000/yr -≤$20,000/yr	306 (40.2)	229 (74.8)	77 (25.1)	
>$ 20,000/yr	171(22.4)	114 (66.6)	57 (33.3)	
Religion				
Hindu	676 (88.8)	425 (62.7)	253 (37.5)	
Christian	42 (5.5)	29 (69)	13(30.9)	0.06
Muslim	8 (1)	5 (62.5)	3 (37.5)	
Sikh	21 (2.7)	14 (66.6)	7 (33.3)	
Jain	14 (1.8)	0 (0)	14 (100)	
Number of smoking friends				
0	*122 (16)*	*5 (4.1)*	*117 (95.9)*	*<0.0001**
1	*119 (15.6)*	*85 (71.4)*	*34 (29.5)*	
≥2	*520 (28.9)*	*379 (72.9)*	*141 (27.1)*	
Smoking status of peers Father				
Current Smoker	*51(6.7)*	*21 (41.1)*	*30 (58.8)*	
Non-smoker	*666 (87.5)*	*435 (65.3)*	*231 (34.6)*	*<0.0001**
Former smoker quit last year	*35 (4.5)*	*8 (22.8)*	*27 (77.1)*	
Former smoker quit long ago	*9 (1.1)*	*4 (44.4)*	*5 (55.5)*	
Mother				
Current Smoker	*6 (0.7)*	*4 (0.8)*	*2 (0.1)*	
Non-smoker	*745 (97.8)*	*460 (61.7)*	*285 (38.2)*	*0.44*
Former smoker quit last year	*6 (0.7)*	*3 (50)*	*3 (50)*	
Former smoker quit long ago	*4 (0.4)*	*1 (25)*	*3 (75)*	
Siblings				
Current Smoker	*302 (39.6)*	*252 (83.4)*	*50 (16.5)*	
Non-smoker	*43 (57.1)*	*206 (47.3)*	*229 (52.6)*	*<0.0001**
Former smoker quit last year	*6 (0.7)*	*5 (83.3)*	*1 (16.6)*	
Former smoker quit long ago	*18 (2.3)*	*5 (27.7)*	*13 (72.2)*	
Close friends				
Current Smoker	*445 (58.4)*	*302 (67.8)*	*143 (32.1)*	
Non-smoker	*284 (37.3)*	*159 (55.9)*	*125 (44)*	*<0.0001**
Former smoker quit last year	*22 (2.8)*	*5 (22.7)*	*17 (77.3)*	
Former smoker quit long ago	*10 (1.3)*	*2 (20)*	*8 (80)*	
Other people at home				
Current Smoker	*233 (30.3)*	*192 (83.4)*	*41 (17.6)*	*<0.0001**
Non-smoker	*510 (67)*	*270 (52.9)*	*240 (47)*	
Former smoker quit last year.	*18 (2.3)*	*33.3 (6)*	*12 (66.6)*	

Table 2. Stepwise Logistic regression to determine predictors of smoking among a cohort of adults in India

Variables	OR (95% CI)
Age (years)	
18-29	2.49 (0.40 - 15.22)
30-39	5.39 (1.32 - 21.99)*
40-49	4.63 (1.10 - 19.43)*
50-59	0.62 (0.48 - 2.80)
>60	1.00
Income Level	
≤ $2000/yr	0.23 (0.08 - 0.64)*
>$2000/yr to ≤$10,000/yr	0.30 (0.14 - 0.6)*
>$10,000/yr to ≤$20,000/yr	0.81 (0.41 - 1.61)
>$20,000/yr	1.00
Number of smoking friends	
0	0.01 (0.003 - 0.03)*
1	0.41 (0.21 - 0.78)*
≥2	1.00
Smoking status of other people	
Current Smoker	1.70 (1.12 - 3.88)*
Former Smoker	0.19 (0.03 - 1.10)
Former smoker quit a long time ago.	1.00

OR Odds Ratio, *CI* confidence interval, *Indicates values that are statistically significant, p<0.05

Studies evaluating socioeconomic status as a predictor of smoking demonstrate the likelihood of lower income groups being inclined to smoking behavior [10, 27]. However, our study reported the association of higher income with smoking instead. This could be explained by our inclusion criteria in the cohort of only cigarette smoking population as opposed to past studies, which included smokers consuming all types of tobacco products including cheaper forms such as the 'bidi' or smokeless tobacco [11]. Another probable reasoning could be the price elasticity of cigarette demand in low and middle income countries, where cost is an important determinant of smoking [10, 28, 29]. As the affordability of the cigarette declines, the demand among the low socioeconomic strata declines, while remaining constant in the higher socioeconomic class [28, 29].

Consistent with previous findings, the stepwise logistic regression analysis also indicated a positive association between the likelihood of smoking and having friends who smoke cigarettes [9]. Cigarettes are often introduced in the presence of friends. Individuals often use smoking as the means to meet a desirable social image and gain popularity with their peers [30]. Smoking is often perceived as a trendy social activity among groups and individuals who smoke are perceived as popular helping them to socialize further in the group. Workshops and campaigns on resisting peer pressure and explaining the dangerous effects of smoking should thus be conducted in schools for children right from the young age.

The presence of smokers in the household was also found to be a predictor of smoking. Smoking status of influential peers is the strongest predictors of smoking initiation in India and around the world [8, 9]. It is thus not surprising that there is a definite influence of the smoking habits of parents, older siblings, role models or peers on the smoking behavior on impressionable children [31, 32]. Family and community interventions on smoking prevention should be executed in order to control initiation and continuation of cigarette smoking at the household level prove effective in such scenarios.

Smoking patterns have shown differences across different education levels when considered as a function of the socioeconomic status [33]. No significant differences in the smoking status were observed across education status in the final model, probably because these studies have evaluated the relationship between smoking and education among smokers of all forms of tobacco. While existing literature demonstrates the influence of marital status with smoking and smoking cessation [34], our findings failed to indicate significant differences in both the bivariate and the multiple logistic regression analysis, probably reflecting a more male dominated and patriarchal cohort in our sample.

Although India does exercise rules to control and prevent cigarette smoking, systematic research that identifies specific subpopulations in need of interventions is needed. Our findings present adequate data to emphasize the need to implement effective smoking cessation and prevention strategies. Anti-smoking interventions should necessarily target middle aged individuals and those belonging to the higher income categories. Since cost is not a factor with these individuals, the role of family and the effects of

cigarette smoking on family matters and health should be emphasized during these intervention, may it be through public health advertisements or programs that help individuals quit smoking. Research with similar objectives on former smokers who have quit successfully should also be emphasized to compare their perspectives and characteristics with current smokers and non-smokers.

One of the key limitations to this study was convenient sampling of the respondent population which could have led to a systematic bias. Also, the respondent population may not be truly representative of the entire population in India. Various studies on smoking cessation and other guidelines defined "smoker" differently from our study [35]. Results of the study should be considered based on our definitions of current cigarette smoking status.

CONCLUSION

Predictors to the disposition of cigarette smoking among an adult cohort in India were found to be age, income, and current smokers in the family. These findings coincide with the results of smoking cessation studies conducted worldwide implying that similar prevention strategies may be applied to the population in India. Anti-smoking interventions targeting middle aged workers belonging to the higher income bracket and smoking peers in families need to be undertaken and would prove beneficial to the community of smoking adults in India.

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