

Socioeconomic Factors Related to Nicotine Dependence in Mongolia

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Objectives: This study is aimed to investigate potential socio-economic risk factors associated with Nicotine Dependence among UB residents. It is important to identify and understand the various elements that may make people more susceptible to the negative health effects of smoking.

Methods: We applied a cross-sectional study design to define the level of nicotine dependence on 875 participants. In addition, risk factors associated with nicotine dependence were assessed through a questionnaire survey.

Results: Higher nicotine dependence in this study was associated with being a female (OR=1.208), older age groups (OR=1.5-2.9), divorced (OR=1.091), living in a house (OR=1.602), having a high school education level (OR=1.794), not having a regular job (OR=1.137), having a higher alcohol consumption level (OR=1.18-1.62), and age at initiation of smoking at 18 or younger (OR=1.796).

Conclusion: According to the results of our research, countries with low and moderate levels of income, such as Mongolia, have a significant problem with high levels of nicotine dependence. In addition to this, it underscores the importance of developing smoking cessation programs that consider the extent of nicotine dependence while placing a greater emphasis on early interventions of the linked factors.

Key words: Tobacco, Smokers, Nicotine, Smoking cessation, Socioeconomic factors

Introduction

As in 2015, one in four men and one in nineteen women smoke regularly in a daily basis [1]. Despite the major measures to reduce tobacco smoking prevalence, smoking rates remaining higher among the poor, the less educated, and individuals with less access to prevention or treatment [2-3].

Tobacco was responsible for 8.71 million deaths and 229 million DALYs worldwide. Tobacco usage has dropped across all regions and development levels, although tobacco control implementation is still lacking [4]. Of Mongolian males, 46.3% are smokers and 6.8% of women smoke in 2010. Males, city dwellers, 45–54-year-olds, and young Mongolians (15.5%) were more likely to do this. Smoking prevalence was unaffected by education [5]. Sluggish nicotine metabolism and depression put adolescents at risk of nicotine dependency, whereas smoking in the past appears to play a modest influence [6]. In 2019, 400 Delhi University college students were investigated cross-sectionally using the Fagerstrom test. The median (IQR) number of cigarettes smoked per day was 3 (2-6), the majority (80.7%) smoked within 30 minutes of waking up, and 40% had nicotine dependence [7]. Users of a form of smokeless tobacco called Toombak took the six-question Fagerstrom Nicotine Dependence-Smokeless Tobacco Test (FTND-ST) in which a score of greater than 4 indicated low-to-moderate dependence, whereas >5 indicated severe dependence. Toombak users had 9.7 pg/ml of hair cortisol, while non-users had 19.4 ($p=0.023$). Findings of psycho-dependence (score>5) and nicotine-tolerance in 85% of Toombak consumers (FTND-ST scores 4-9) [8] and large-scale cortical processes in young smokers offered a novel perspective on adolescent smoker brain networks [9]. Between 2015 and 2016, 624 Brazilian BR-050 truck drivers were surveyed. Smoking truck drivers took the Fagerstrom nicotine dependency test. Tobacco use was associated with lack of religion (AOR: 2.60; 95%CI: 1.35-5.01), contract employment (AOR = 1.98; 95%CI: 1.26-3.13), > 12 hours daily working time, and alcohol intake in the prior 30 days. Irregular exercise enhanced nicotine dependency (beta=1.87; 95%CI: 0.55-3.19) [10]. A large Norwegian population-based intervention study examined six-month smoking cessation factors. Of 4333 smokers (72.1% women) who engaged in an internet-based smoking cessation program in 2010–2012, female sex and higher

education predicted smoking cessation success, but a medium or high FTND score, student status, and use predicted failure [11]. Like these studies, numerous global studies have investigated the risk factors associated with nicotine dependence in diverse populations. However, most of the Mongolian research focuses on smoking, whereas few investigate risk factors for nicotine dependence using the Fagerstrom standard questionnaire. For instance, previous studies have examined smoking knowledge, attitude and practice, smoking prevalence in terms using general demographic characteristics. Our study compared factors related to nicotine dependence by age group, sex, marital status, household type, education level, occupation, household income, alcohol consumption, and age at initiation of smoking. There have not been any studies conducted which accounted for these characteristics in a comprehensive way in Mongolia yet. In addition, FTND level takes scores range from 0 to 10, with the following classification: 0-2=extremely low; 3-4=low; 5=medium; 6-7=high; 8-10=extremely high. We assumed that nicotine dependence level were high if the score was 6 or higher since it can be more reliable classification [12-14]. Therefore, we aimed to investigate potential socio-economic risk factors associated with Nicotine Dependence among UB residents. It is important to identify and understand the various elements that may make people more susceptible to the negative health effects of smoking.

Material and Methods

Research design

We applied a cross-sectional study design to define the level of nicotine dependence on 875 participants. In addition, risk factors associated with nicotine dependence were assessed through questionnaire survey.

Study participants

Research data was collected between the 1st February 2022 and the 15th of April 2022 from the citizens of 6 main districts in Ulaanbaatar city. The sample size was calculated to be 875 persons with a 95% confidence interval (CI), an error margin of 0.04% (ER), and a non-sampling error of 30% (NSE) based on the size of the population between the ages of 18 and 65 in six central Ulaanbaatar districts ($n=855,899$) [15] (Table 1).

Table 1. Survey sample population by district.

Districts	Number of population (18-65)	Sample population
Bayanzurkh	230,125	197
Songinokhairkhan	202,652	173
Bayangol	130,160	140
Khan-Uul	121,296	144
Chingeltei	85,313	116
Sukhbaatar	86,353	105
Total	855,899	875

Criteria for study inclusion

A Mongolian citizen aged 18-65 who smokes and lives in one of the city's six districts.

Study measurements

Independent variables: An Audit for alcohol consumption, socioeconomic and tobacco use variables.

Dependent variable: Nicotine dependence level. To assess nicotine dependence, a short version of the Fagerström Questionnaire[16, 17], developed in 1978, was used in the study. It consists of six questions designed to assess nicotine dependence based on a self-report. Each question was graded on a scale of 1 to 3. A total result of 0-2 points indicated very low correlation, 3-4 points indicated low correlation, 5 points indicated medium correlation, 6-7 points indicated high correlation, and 8 or more points indicated very high correlation. Participants were then grouped as Low level (total 0-5), or High level (≥ 6)[12].

Statistical Analysis

The data were double-checked for accuracy before being coded and processed with IBM SPSS Statistics (26.0 version). In order to investigate the association between tobacco use and nicotine dependence level, we used an independent sample t test. As for the examination of the factors linked to nicotine dependence level, chi square test was used, whereas, both univariate and multivariate binary logistic regressions were used to investigate the association between the general socio-demographic characteristics and nicotine dependence level.

Ethics

Before taking part in the research, everyone who was enrolled in the study voluntarily supplied written informed consent. The Ulaanbaatar, Mongolia branch of the Mongolian National University of Medical Sciences, Ethics Committee gave its stamp of approval to the study's protocol (No 2019-3-13). Additionally, we have received approval from our institutional ethics committee of the MNUMS(No. 2023/01).

Results

The population aged 18 to 65 in the six districts (Bayanzurkh, Songinokhairkhan, Bayangol, Khan-Uul, Chingeltei, and Sukhbaatar) appears to total 855,899 people. 875 individuals comprised the study's sample population; 197 were from Bayanzurkh, 173 were from Songinokhairkhan, 140 were from Bayangol, 144 were from Khan-Uul, 116 were from Chingeltei, and 105 were from Sukhbaatar (Table 1).

Table 2. Characteristics of the survey participants' socioeconomic backgrounds

Sociodemographic characteristic	Number (percentage)
Age group (years)	
Up to 29	106 (12.1)
30-39	216 (24.7)
40-49	244 (27.9)
50-65	309 (35.3)
Sex	
Male	650 (74.3)
Female	225 (25.7)

Marital status	
Single	113 (12.9)
Married	701 (80.1)
Divorced/widowed	61 (7)
Household type	
Ger§	81 (9.3)
House	258 (29.5)
Apartment	536 (61.3)
Education level	
Primary or less	117 (13.4)
Secondary school	341 (39)
Higher education	417 (47.7)
Occupation	
Government	236 (27)
Private organization	392 (44.8)
Retired	121 (13.8)
Student	46 (5.3)
Unemployed	80 (9.1)
Household monthly income	
Up to 1'000'000	458 (52.5)
1'000'001-2'000'000	299 (34.2)
Above 2'000'001	116 (13.3)
Alcohol consumption level	
Low	621 (71)
Moderate	186 (21.3)
High/excessive	68 (7.8)
Age at initiation of smoking	
=18	373 (42.6)
=19	502 (57.4)
Total	875 (100.0)

§ Ger-Traditional Mongolian house where raw or improved coal is burned
 ?-Tugrik official currency of Mongolia

According to Table 2, there were a total of 875 participants ages 18 to 65 who came from six different neighborhoods in the city center of Ulaanbaatar. Of those participants, 650 (74.3%) were male and 225 (25.7%) were female. In terms of age groups, 106 (12.1%) are up to 29 years old, 216 (24.7%) are between the ages of 30-39, 244 (27.9%) are between the ages of 40 and 49, 309 (35.3%) are between the ages of 50 and 65. There were 701 married participants, which accounts for 80.1% of the total, 113 participants as single (12.9%), and 61 participants (7.0%) as divorced/widowed (Table 2). Regarding the household type, 536 (60.2%) participants reside in apartments, whereas 258 (29.5%) participants in houses, and 81 (9.3%) participants in gers, respectively. There were 117 (13.4%) participants who had completed primary or less education, 341 (39%) participants had secondary school, and 417 (47.7%) participants had a higher education level. Taking into account the occupation, 236 (27.0%) participants affiliated in government organizations, 392 (44.8%) participants in private organizations, 121 (13.8%) were retired, 46 (5.3%) were students, and 80 (9.1%) were unemployed. Considering the participants household monthly income, 458 (52.5%) had up to 1,000,000 tugrik, 299 (34.2%) had 1,000,001-2,000,000 tugrik, and 116 (13.3%) had above 2,000,000 tugrik, respectively (Table 2). As for the alcohol consumption level, it was determined that 621 (71%) of the participants were in low level, 186 (21.3%) were in moderate, and 68 (7.8%) were in high/excessive level. In accordance with the initial age of smoking, 373 (42.6%) of them had started before 18 years old, while 502 (57.4%) of them were 19 or older (Table 2).

Table 3. Association between tobacco use and attempts to quit smoking and nicotine dependence level.

Indicators	Total		Nicotine dependence level			
	Mean ±SD	95% CI	Low§		High‡	
			Mean ±SD	95% CI	Mean ±SD	95% CI
Age started smoking	19.1±6.8	18.6-19.6	20±7.3	19.4-20.6	17.9±5.9	17.3-18.5
Years of tobacco use	23.7±11.8	22.9-24.5	22.2±11.8	21.2-23.3	25.7±11.5	24.5-26.9
The age when daily smoking began	20.9±7.3	20.4-21.4	21.9±7.9	21.2-22.6	19.4±6.0	18.8-20.1
Cigarette consumption per day	15.4±7.0	14.9-15.9	13.1±6.1	12.5-13.6	18.6±6.9	17.9-19.3

Number of tries of quit smoking (average)	2.4±1.5	2.2-2.5	2.4±1.5	2.3-2.6	2.3±1.5	2.1-2.5
The last time tried quitting (by year)	3.4±5.9	2.9-3.8	2.9±5.5	2.4-3.5	4.0±6.4	3.2-4.8
Time for endurance (by month)	7.1±18.5	5.6-8.5	7.3±20.5	5.2-9.5	6.6±15.3	4.8-8.6

*P value was calculated with independent t-test if there were any significant differences between two growth and standard deviations were calculated.

§Low-nicotine dependence level 5 or less

‡High-nicotine dependence level 6 or higher

Table 3 illustrates that the average age at which participants began smoking was 19.1±6.8 years, the average length of time they smoked was 23.7±11.8 years, the average age at which they began smoking daily was 20.9±7.3 years, and the average number of cigarettes smoked by participants today is 15.4±7. Low-dependence smokers started smoking later in life, smoked fewer cigarettes per day, and had a higher average age at which they began smoking (p=0.001). Heavy-dependence smokers started smoking earlier in life and had lower average ages at

which they began smoking and were heavier smokers overall (Table 3). Of the people who participated in the study, 638 (72.9%) had tried to quit smoking before (p=0.023), with an average of 2.4±1.5 failed attempts. There was a mean abstinence time of 7.1±18.5 months and a mean time since last attempt of 3.4±5.9 years. The average time since quitting smoking for the low nicotine dependence group was 2.9 years, while the average time for the high nicotine dependence group was 4 years (Table 3).

Table 4. Factors linked to nicotine dependence level

Characteristics	Nicotine dependence level†		p value ‡	cOR	P value	aOR	p value
	Low n (%)	High n (%)					
Age group			<0.0001				
Up to 29	82 (77.4)	24 (22.6)		Ref		Ref	
30 – 39	121 (56)	95 (44)		2.683 [1.582 - 4.55]	<0.0001	2.748 [1.545 - 4.888]	0.001
40 – 49	122 (50)	122 (50)		3.417 [2.032 - 5.744]	<0.0001	3.386 [1.877 - 6.105]	<0.0001
50 – 65	181 (58.6)	128 (41.4)		2.416 [1.454 - 4.016]	0.001	2.508 [1.381 - 4.555]	0.003
Sex			0.741				
Male	378 (58.2)	272 (41.8)		Ref		Ref	
Female	128 (56.9)	97 (43.1)		1.053 [0.775 - 1.431]	0.741	1.22 [0.862 - 1.728]	0.262
Marital status			0.276				
Single	73 (64.6)	40 (35.4)		Ref		Ref	
Married	397 (56.6)	304 (43.4)		1.397 [0.924 - 2.113]	0.113	0.932 [0.577 - 1.504]	0.773
Divorced/ widowed	36 (59)	25 (41)		1.267 [0.669 - 2.402]	0.468	0.957 [0.469 - 1.951]	0.903
Household type			0.001				
Ger	46 (56.8)	35 (43.2)		1.258 [0.784 - 2.019]	0.342	1.109 [0.657 - 1.872]	0.699
House	126 (48.8)	132 (51.2)		1.732 [1.283 - 2.339]	<0.0001	1.567 [1.135 - 2.164]	0.006
Apartment	334 (62.3)	202 (37.7)		Ref		Ref	
Education level			0.002				
Primary or less	52 (44.4)	65 (55.6)		2.091 [1.381 - 3.167]	<0.0001	1.683 [1.05 - 2.697]	0.031

Secondary school	193 (56.6)	148 (43.4)	1.283 [0.958 - 1.718]	0.094	1.097 [0.792 - 1.519]	0.579
Higher education	261 (62.6)	156 (37.4)	<i>Ref</i>		<i>Ref</i>	
Occupation			0.823			
Government	140 (59.3)	96 (40.7)	<i>Ref</i>		<i>Ref</i>	
Private organization	225 (57.4)	167 (42.6)	1.082 [0.78 - 1.502]	0.636	1.03 [0.727 - 1.459]	0.87
Retired	73 (60.3)	48 (39.7)	0.959 [0.613 - 1.5]	0.854	0.97 [0.573 - 1.643]	0.91
Student	26 (56.5)	20 (43.5)	1.122 [0.593 - 2.124]	0.724	1.26 [0.641 - 2.476]	0.503

§-Percentages were added up by row to obtain the total.

‡-P value for Pearson's Chi-Square Test.

cOR-Crude odds ratio

aOR - Adjusted odds ratio including all variables

Ref- Reference category

Table 4 shows the factors related to a sample population's level of nicotine dependency. A statistical test (P-value) was used to evaluate whether there is a significant difference between the low and high nicotine dependent groups. This study looked at age group, gender, marital status, household type, education level, occupation, household monthly income, alcohol consumption level, and age at first smoking. The findings demonstrate that age group, home type, education level, alcohol consumption level, and age of smoking initiation are all strongly related to nicotine dependency. Living in an apartment, having a higher education level, using alcohol at a high/excessive level, and starting smoking at an older age (19) are all connected with a higher level of nicotine dependence. However, gender, marital status, occupation, and household monthly income are not significantly related to nicotine dependence (Table 4). In terms of factors linked to nicotine dependence level (Table 4), women had a nicotine dependence that is 1.21 times more than men (p value = 0.262, CI: 0.86-1.72). According to the age group, those between the ages of 30-39 have high nicotine dependence level that is 2.74 times (p value = 0.001, CI: 1.6-4.8), while those between the ages of 40-49 have 3.38 times (p value = 0.0001, CI: 1.87-6.10), and those between the ages of 50-65 have 2.50 times higher (p value = 0.003, CI: 1.38-4.55) than those who are up to 29 years old. Participants who are married had high nicotine level 0.93 times (p value = 0.773, CI: 0.57-1.50), while divorced/widowed participants had 0.95 times (p value = 0.903, CI: 0.46-1.95) as compared to the participants who are single. As compared to the participants who live in apartments, those

who live in a house had high nicotine dependence level that is 1.56 times (p value = 0.006, CI: 1.13-2.16). Participants who obtained primary or less education tended to have 1.68 times higher nicotine dependence level as compared to the participants who obtained higher education level (Table 4). A high nicotine dependence level was observed in a higher proportion (p value = 0.0001) of respondents who began daily smoking at ≤18 years of age (49.6%) than those who began smoking at ≥19 years of age (36.7%) (Table 4).

Discussion

In this study, we compared FTND level by socio-demographic characteristics including age group, sex, marital status, household type, education level, occupation, household income, alcohol consumption level, age at initiation of smoking. In terms of internal reliability and accuracy, FTND level should be classified into two groups, namely high and low levels [18]. As for the concordance of FTND with other measures, one should consider evaluating sensitivity, specificity and kappa statistics [19]. The average score on the Fagerstrom Test for Nicotine Dependence among the subjects in this study was 3.4±1.5. It was consistent with the 2020 Global Adult Tobacco Survey in Zhejiang which found 216 (17.4%) of daily smokers were extremely nicotine dependent, with a mean Fagerstrom Test for Nicotine Dependence score of 3.1±2.4 [12]. In our study, a mean Fagerstrom Test for Nicotine Dependence score was 4.88±2.18, which is higher than the findings from the Zhejiang et al study.

This could be due to the average age at which the respondents started daily smoking. In the Zhejiang et al. study, the average age at which the respondent started daily smoking was 22.2 ± 6.1 , whereas in our study it was 19.1 ± 6.8 years. Higher nicotine dependence in this study was associated with being male, older, divorced, living in a gers district area, having a lower education level, not having a regular job, drinking more alcohol, and starting to smoke before the age of 18. These risk factors were consistent with 1026 Malaysians parents over 18 in 2021 using the FTND who were questioned about smoking. FTND nicotine dependency was associated with gender, education, occupation, marital status, residence, and monthly income (all covariates were statistically significant, $p < 0.05$) [20]. In our study, FTND nicotine dependency was significantly associated with education, household type, alcohol consumption level, and age at initiation of smoking ($p < 0.05$). There was no association between nicotine dependency and gender, marital status, and monthly income. In terms of gender, Roy et al. study enrolled 190 (18.5%) females, while we enrolled 225 (25.7%) females in our current study. As for the marital status, Roy et al. classified it into 5 groups (single, married, divorced, widowed and other), whereas, we classified it into 3 groups (single, married, divorced/widowed). In addition, the percentage of the respondents who are single was 31.2% ($n=320$) in Roy et al. study, while this percentage was 12.9% ($n=113$) in our study. Regarding the monthly income, about 769 (75%) respondents had a medium monthly income. However, in our study there were about 299 (34.2%) respondents who had a medium monthly income. The 2020 Global Adult Tobacco Survey in Zhejiang et al. found that age, education, occupation, and daily smoking age significantly affected high nicotine dependency, although residence, sex, and annual household income did not. Daily smokers with higher education showed lower nicotine dependence than primary or less educated smokers and secondary ($OR=3.07$ and $OR=2.62$). In our study, nicotine dependence level was significantly higher in primary or less educated respondents as compared to higher educated ones ($OR=1.68$). In terms of occupation, government, jobless, and industrial workers were more nicotine dependent than other workers ($OR=4.02$, 3.08 , 2.46). Nonetheless, we did not find any significant association between nicotine dependence level and occupation. Zhejiang et al. had found that smoking daily before age of 18 years old increased nicotine dependency ($OR=2.25$) [12]. Similarly, we found that smoking daily before age of 18

years old significantly increased the nicotine dependence level ($OR=1.81$). For policymakers and the government to be able to conduct effective tobacco control programs in Mongolia, it is highly important that they have access to baseline information relating to nicotine dependence and the stage of transformation that cigarette users are in. The study limitations could be (1) we enrolled our participants from Ulaanbaatar city only implying that different results may be obtained in rural areas, (2) our data collection procedure were through a cross-sectional survey only, and (3) there could be potential biases including recall bias since our survey was self-respondent and social desirability bias which may lead to underestimation, (4) Typically, knowledge, attitude and practice are investigated in most of the smoking prevalence studies, however, we did not assess this aspect in the current study.

Future research direction

Future studies should be directed in following ways. Firstly, studies should enroll participants from rural area as well. This could improve the representativeness by including the participants proportionally. Another potential direction for future is taking a comprehensive survey including psychological factors such as stress, depression and anxiety. Finally, future investigations should consider to validate the survey results by measuring biological indicators of nicotine dependence.

Conclusion

According to the results of our research, countries with low and moderate levels of income, such as Mongolia, have a significant problem with high levels of nicotine dependence. In addition to this, it underscores the importance of developing smoking cessation programs that consider the extent of nicotine dependence while placing a greater emphasis on early interventions of the linked factors.

Conflict of Interest

Pfizer USA has provided funding for this publication, and to our knowledge no conflicts of interest exist. As the designated corresponding author, I attest that all other authors have seen and agreed to the submission.

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