Prevalence and Determinants of Non-daily Smoking Among Iranian University Students: A Web-based Survey

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Abstract
Background and aims: Usually non-daily smokers do not consider themselves smokers, and they are at a higher level of health risks due to smoking compared to non-smokers. This study aimed to identify the prevalence of non-daily smoking (NDS) and its associated factors among university students.

Methods: This cross-sectional web-based study was performed in Tabriz, Iran. A proportional random sample of 3666 students from all universities of Tabriz were recruited from July to August, 2019, and an online questionnaire was used to collect data. Predictors of NDS were investigated using a multiple logistic regression model.

Results: A total of 15.7% and 7.8% of the students were daily and NDSs, respectively. Compared to the non-smokers, the NDSs were more likely to exhibit high-risk behaviors such as substance abuse (odds ratio [OR] = 2.96; 95% CI: 2.12-4.13), alcohol drinking (OR = 2.54; 95% CI: 1.78-3.62), hookah smoking experience (OR = 9.30; 95% CI: 6.06-14.25), and regular hookah use (OR = 24.22; 95% CI: 14.86-39.46). Compared to daily smokers, NDSs were more likely to be female gender (OR = 0.16; 95% CI: 0.10-0.24), denial of being a smoker (OR = 11.69; 95% CI: 6.86-19.91), not addicted to nicotine (OR = 10.02; 95% CI: 4.21-23.85), and less likely to have an intention for quitting in recent months (OR = 2.27; 95% CI: 1.28-4.04).

Conclusion: Non-daily smokers do not consider themselves smokers and have no intention to quit smoking. They are more prone to present high-risk health behaviors. Health policymakers should pay more attention to NDS while planning smoking cessation programs.

Keywords: Health risk behaviors, Smoking, Smoking water pipes, Substance-related disorders, Smoking cessation

Introduction
No clear definition is proposed for non-daily smoking (NDS).1 Non-daily smokers are typically called social, occasional, intermittent, and recreational smokers.7 NDS is often considered to be either a transition to daily smoking (DS) or a step towards a gradual reduction in DS.2 Non-daily smokers are usually younger and more educated and have a higher income than daily smokers.4 Studies have shown that non-daily smokers often consider themselves as a non-smoker9; a belief that might be negatively associated with a person’s recent/future attempts to quit smoking.7 A significant number of non-daily smokers become daily smokers over time. Results of a study conducted in the United States indicated that 18.4% of non-daily smokers became daily smokers after 12 months.8 Although non-daily smokers have lower levels of health risk perception of their smoking habits,9 it is reported that NDS may increase the risk of morbidity and mortality associated with several diseases, including cardiovascular diseases, various types of cancer, respiratory diseases, and reproductive health problems.10 Results of a study conducted among the United States adult population showed that non-daily smokers have 72% higher levels of mortality risk for the diseases such as cancers and cardiovascular and respiratory diseases.11 Compared
to non-smokers, non-daily smokers were twice more likely to develop pulmonary diseases,\textsuperscript{12} be more prone to depression and suicide attempts,\textsuperscript{13} and have higher levels of anxiety.\textsuperscript{14}

Although the prevalence rate of DS has recently declined in many countries,\textsuperscript{15,16} previous studies have demonstrated an increasing trend in the number of non-daily smokers.\textsuperscript{16,17} The results of a study in Mexico indicated that the prevalence of DS decreased by about 50% from 2002 to 2016, while the prevalence of NDS increased by 35% from 2009 to 2016.\textsuperscript{18} In Iran as a developing country, few studies have examined the prevalence of NDS. A study among a sample of the Iranian (15-75 years old) population showed the prevalence of NDS to be 1.7%, with 2.9% and 0.8% prevalence among men and women, respectively.\textsuperscript{19}

Research on the smoking behaviors of students is particularly important because this behavior among students could indicate smoking among young people in society. Any change in smoking behaviors of students can significantly contribute to the increasing and/or decreasing prevalence rate of smoking within society.\textsuperscript{20}

The majority of the students who smoke cigarettes do not smoke on a daily basis.\textsuperscript{21} NDS is common among students and accounts for more than two-thirds of smoking modes among students.\textsuperscript{22} Previous studies on American students have displayed that the prevalence rates of DS and NDS were 7\%-13\% and 16.6\%-22\%, respectively.\textsuperscript{23-25} Another study among Irish students reported the prevalence rates of DS and NDS to be 7\% and 12\%, respectively.\textsuperscript{26} All these findings indicate the high prevalence rate of NDS compared to daily consumption among students.

The prevalence rate of NDS among Iranian students is unknown as no study was found with reports on NDS among this population. However, there are studies that display 4\%-5\% of occasional smoking among Iranian students.\textsuperscript{27,28} Accordingly, the present study aimed to investigate the prevalence rate and determinants of NDS among university students in Tabriz, Iran.

Materials and Methods

Study Design and Participants

This cross-sectional web-based study was conducted on the students of nine universities in Tabriz, Iran, from July to August 2019. All students of these universities who consented to participate in the study were eligible to be included. Stratified-random sampling was employed to recruit the subjects, proportional to the size of students in each university. Subsequently, 3775 students completed the online questionnaire, and 109 of them were excluded due to delivering incomplete or unanswerd questionnaires. Hence, the statistical analysis was performed for 3666 students.

Measure

A questionnaire was designed based on a literature review and using the experts’ opinions. To ensure content validity, the questionnaire with a response form was sent to three groups of knowledgeable persons (five smoking researchers, six research methodology and instrumentation experts, and five knowledgeable students) to comment quantitatively on the questionnaire’s relevance and transparency. To assess reliability, the questionnaire was completed by 30 students as a pilot test. The Spearman correlation coefficient in two consecutive measurements of the questionnaire variables exceeded 80%.

The final questionnaire included the following four categories:

1. Demographic characteristics: This included age, gender, level of education, marital status, and field of education.

2. High-risk health behaviors: Alcohol drinking during the past month (Yes/No), hookah smoking (never smoked hookah/ only tried or experienced hookah/ regular hookah smoker/ smoked at least one time for a month), and a history of substance abuse, including opium, heroin, cannabis, methamphetamine, ecstasy, Ritalin, crystal, weed, and marijuana. The response format for all items was Yes/No.

3. Smoking status: Smoking status was assessed using the following single self-declared item\textsuperscript{26}: “Which item may best describe your smoking status?” The items included (1) never smoked a cigarette, (2) not smoked regularly, (3) smoked regularly, but now I have quit it, (4) I smoke, but not on a daily basis, and (5) I smoke daily. The participants who chose items 1, 2, and 3 were classified as non-smokers, those who chose item 4 were considered as non-daily smokers, and those who chose item 5 were classified as daily smokers.

4. Psychological factors: Psychological factors were investigated by applying the following five items: (1) Do you consider yourself as a smoker? Response format: Yes/No.\textsuperscript{2} (2) How soon do you smoke your first cigarette after you wake up? Answer choices: Within 30 minutes/after 30 minutes. This item was selected from the Fagerström test for nicotine dependence,\textsuperscript{29} which was shown to be the strongest item in determining nicotine dependence.\textsuperscript{30} (3) Do you think that it is difficult for you to quit smoking? Response format: Yes/No. (4) In the last 12 months, how many times have you stopped cigarette smoking (with the intention to quit) for a day or longer?\textsuperscript{2} Answer choices: I have made attempts to quit smoking at least once in the last 12 months/I made no attempt. (5) Which of the following items may best describe your intention to quit smoking?\textsuperscript{23} (a) I never intend to quit, (b) I will probably quit in the future, but not in the next six months, (c) I may quit in the next 6 months, and (d) I will quit smoking next month. The answer choices to this question were grouped into two categories while analyzing the data: I never intend to quit and I will quit in the coming months.

Data Collection

Revising the items based on the students' feedback, we
designed the online questionnaire in Google Drive online platform. All participants were asked to complete the online questionnaire which was provided as a shortened Uniform Resource Locator (URL). To motivate the students to participate in the study, social media platforms (Telegram and Instagram) were used. For this purpose, we asked the admins of the identified channels and groups, where the students of Tabriz universities were joined as members, to share the link of the questionnaire in their channels and/or groups so that the students can easily complete the online questionnaire anonymously. Participation in the study was voluntary. The process of sampling was monitored to ensure that the students were recruited from all universities in proportion to the sample size.

**Data Analysis**

In univariate analysis, chi-square and one-way analysis of variance tests were used to assess the associations between qualitative and quantitative independent variables and smoking status, respectively.

To determine the determinants of NDS, two separate multiple logistic regression models were used, and non-smokers and daily smokers were considered as the reference group in the first and second models, respectively. To choose the best fitting model, all variables were entered into the univariate logistic regression model, then the significant variables at the level of 0.2 were entered into the multiple models, and eventually, the final model was developed using the backward stepwise method involving gender, the field of education, alcohol consumption in the past 30 days, lifetime substance abuse, and hookah use. All analyses were performed using SPSS-22 software.

### Results

The mean age of study participants was 22.85 ± 3.6 years.

### Table 1. Smoking Status by Demographic and High-risk Behavior Variables

| Characteristics                  | Non-smokers | Daily Smokers | Non-daily Smokers | P Value |
|----------------------------------|-------------|---------------|-------------------|---------|
|                                  | n (%)       | n (%)         | n (%)             |         |
| **Age (mean ± SD)**              | 22.90 ± 3.86| 22.80 ± 2.85  | 22.28 ± 3.13      | 0.032   |
| **Gender**                       |             |               |                   |         |
| Male                             | 1284 (63.6) | 536 (26.6)    | 198 (9.8)         | <0.001  |
| Female                           | 1478 (92.4) | 35 (2.2)      | 86 (5.4)          |         |
| **Marital status**               |             |               |                   |         |
| Single                           | 2461 (75.8) | 523 (16.1)    | 262 (8.1)         | 0.003   |
| Married                          | 287 (83.7)  | 42 (12.2)     | 14 (4.1)          |         |
| **Field of education**           |             |               |                   |         |
| Technical and engineering        | 675 (67.1)  | 239 (23.8)    | 92 (9.1)          |         |
| Medical of sciences              | 711 (85.9)  | 78 (9.4)      | 39 (4.7)          |         |
| Humanities                       | 440 (76.7)  | 84 (14.7)     | 49 (8.6)          | 0.001   |
| Agriculture                      | 92 (84.4)   | 10 (9.2)      | 7 (6.4)           |         |
| Fundamental sciences             | 197 (80.7)  | 27 (11.1)     | 20 (8.2)          |         |
| Art                              | 116 (61.1)  | 49 (25.8)     | 25 (13.2)         |         |
| Not responded                    | 548 (80.1)  | 84 (12.3)     | 52 (7.6)          |         |
| **Education level**              |             |               |                   |         |
| Associate                        | 42 (62.7)   | 15 (22.4)     | 10 (14.9)         |         |
| Undergraduate                    | 1888 (75.1) | 421 (16.7)    | 206 (8.2)         | 0.002   |
| Postgraduate                     | 424 (81.1)  | 63 (12.0)     | 36 (6.9)          |         |
| Doctorate (Ph.D and MD)          | 404 (80.2)  | 70 (13.8)     | 30 (6.0)          |         |
| **Alcohol consumption (in the past 30 days)** | | | | |
| No                               | 2652 (82.9) | 334 (10.4)    | 213 (6.7)         | <0.001  |
| Yes                              | 108 (26.3)  | 234 (57.1)    | 68 (16.6)         |         |
| **Hookah smoking**               |             |               |                   |         |
| Never                            | 1644 (97.6) | 16 (0.9)      | 26 (1.5)          | <0.001  |
| Experiementer                    | 996 (65.6)  | 351 (23.1)    | 172 (11.3)        |         |
| Regular (at least once per month)| 130 (31.1)  | 202 (48.3)    | 86 (20.6)         |         |
| **Substance abuse**              |             |               |                   |         |
| No                               | 2483 (83.8) | 283 (9.5)     | 198 (6.7)         | <0.001  |
| Yes                              | 131 (29.6)  | 247 (55.9)    | 64 (14.5)         |         |

*Note: SD: Standard deviation; Ph.D: Doctor of philosophy; MD: Doctor of medicine.*
(Range: 18–37), 55.5% of them were male, and 10.0% were married. The prevalence rates of NDS and DS were 7.8% (95% confidence interval [CI]: 7.0–8.7) and 15.7% (95% CI: 14.6–16.9), respectively.

The smoking status by demographic factors and high-risk behaviors are presented in Table 1. Significant associations were found in smoking status by all demographic characteristics and high-risk health behaviors (P<0.05).

The comparison of non-daily smokers with non-smokers and daily smokers by demographic and risky behavior variables is illustrated in Table 2. The results of logistic regression analysis showed that being a male increases the chance of NDS in comparison to non-smoking by 1.98 times and decreases the probability of NDS in comparison to DS by 84%. Further, medical students in comparison to technical and engineering students had a 39% lower chance of being non-daily smokers compared to non-smokers. In

| Characteristics                      | Nondaily Smokers vs. Non-smokers<sup>a</sup> | Nondaily Smokers vs. Daily smokers<sup>b</sup> |
|-------------------------------------|---------------------------------------------|-----------------------------------------------|
| Gender                              |                                             |                                               |
| Male (vs. Female)                   | 1.98 (1.48-2.66)                            | 0.16 (0.10-0.24)                              |
| Field of education                  |                                             |                                               |
| Medical sciences                    | 0.61 (0.41-0.90)                            | 1.68 (1.08-2.60)                              |
| Humanities                          | 0.90 (0.61-1.33)                            | 0.99 (0.65-1.53)                              |
| Agriculture                         | 1.13 (0.54-2.37)                            | 1.28 (0.52-3.16)                              |
| Fundamental sciences                | 1.30 (0.79-2.14)                            | 1.85 (1.02-3.38)                              |
| Art                                 | 1.69 (1.02-2.80)                            | 1.55 (0.91-2.66)                              |
| Not responded                       | 0.75 (0.51-1.13)                            | 1.58 (1.01-2.49)                              |
| Alcohol consumption (in the past 30 days) |                                             |                                               |
| Yes (vs. No)                        | 2.54 (1.78-3.62)                            | 0.51 (0.36-0.71)                              |
| Substance abuse                     |                                             |                                               |
| Yes (vs. No)                        | 2.96 (2.12-4.13)                            | 0.42 (0.30-0.58)                              |
| Hookah smoking                      |                                             |                                               |
| Never (referent)                    |                                             |                                               |
| Experimenter                        | 9.30 (6.06-14.25)                           | 0.54 (0.29-1.02)                              |
| Regular (at least once per month)   | 24.22 (14.86-39.46)                         | 0.73 (0.37-1.42)                              |

Note: CI: Confidence interval; OR: Odds ratio.
<sup>a</sup> Reference group = non-smokers; <sup>b</sup> Reference group = Daily smokers.

| Characteristics                              | Daily Smokers n (%) | Non-daily Smokers n (%) | P-value | OR (95% CI) | P-value |
|----------------------------------------------|---------------------|-------------------------|---------|-------------|---------|
| Considering oneself as a smoker              |                     |                         |         |             |         |
| Yes                                          | 480 (88.6)          | 62 (11.4)               | <0.001  | 1           |         |
| No                                           | 76 (26.6)           | 210 (73.4)              |         |             |         |
| Quit attempts (past 12 months)               |                     |                         |         |             |         |
| Yes                                          | 280 (72.9)          | 104 (27.1)              | 0.010   |             |         |
| No                                           | 269 (64.5)          | 148 (35.5)              |         |             |         |
| Intention to quit in future months           |                     |                         |         |             |         |
| Yes                                          | 371 (74.5)          | 127 (25.5)              | <0.001  | 1           |         |
| No                                           | 174 (61.1)          | 111 (38.9)              |         |             |         |
| Think that quit of smoking is difficult      |                     |                         |         |             |         |
| Yes                                          | 257 (86.0)          | 42 (14.0)               | <0.001  | 1           |         |
| No                                           | 297 (57.8)          | 217 (42.2)              |         |             |         |
| Smoke within 30 minutes of waking up         |                     |                         |         |             |         |
| Yes                                          | 254 (96.6)          | 9 (3.4)                 | <0.001  | 1           |         |
| No                                           | 300 (56.3)          | 233 (43.7)              |         |             |         |

Note: OR: Adjusted odds ratio; 95% CI = 95% Confidence interval for OR.
addition, medical students in comparison to technical and engineering students had a 68% higher chance of being non-daily smokers compared to being daily smokers. Moreover, the association between substance abuse and alcohol consumption with being a non-daily smoker in the past 30 days was statistically significant in comparison to non-smokers and daily smokers.

Table 3 presents a comparison between daily and non-daily smokers by psychological factors. Non-daily smokers were significantly less prone to consider themselves as a smoker, quit attempts during the last 12 months, have the intention to quit smoking, be nicotine dependence, and think that quit of smoking is not difficult in univariate analysis \( (P < 0.05) \). After adjustment of estimates in the multiple models, we found that non-daily smokers were almost 11.5 times less likely to consider themselves a smoker and 2.27 times less likely to have the intention to quit smoking in the coming months (Table 3). Moreover, non-daily smokers were 10 times less likely to be addicted to nicotine (those who lit their first cigarette 30 minutes after waking up), as depicted in Table 3.

Discussion

The results of the present study showed that among the smoking students, 15.7% and 7.8% were daily smokers and non-daily smokers, respectively. In a study conducted in North Carolina, the United States, about 20% of the students were non-daily smokers and only 9% smoked daily. Another study in Minnesota found that 22% and 13% of the students were non-daily and daily smokers, respectively. An Irish study also showed the prevalence rates of NDS and DS to be 12% and 7%, respectively. These findings are in contrast to those found in the current study, which could be due to the use of different definitions for non-daily smokers. The above-mentioned studies have used “the number of days that an individual smoked in the last month” to define NDS. According to this definition, if a person does not smoke even for one day out of the past 30 days, he/she is defined as a non-daily smoker. However, based on the definition used in our study, a non-daily smoker was a person who smokes but not on a daily basis. Another reason for the dissimilarities could be associated with the claim that NDS is more prevalent in developed countries due to having more preventive policies on DS. A study conducted among the Iranian adult population indicated that DS and NDS prevalence rates were 8.3% and 1.7%, respectively. These results were in line with those found in the present study. However, the differences in the prevalence rates of NDS between these two studies may be due to the difference in the mean age of study participants (23 years in the present study versus 32 years in the associated study). Furthermore, the prevalence rate of NDS among students and young individuals is reported to be higher than that among the general population.

Moving further, male students in our study were more likely to be daily smokers, while female students were more likely to be non-daily smokers. Several studies, particularly those conducted in developing countries, have suggested that being male increases the chance of performing many high-risk health behaviors, such as smoking. The results of previous studies among university students in North Carolina, Minnesota, and Ireland indicated no gender difference in the mode of smoking (being a non-smoker, daily smoker, and non-daily smoker). Such discrepancies between the results found in our study and those found in the previous studies may be due to cultural differences. Compared to women in developed countries, Iranian women have a lower level of social acceptance when smoking cigarettes and are faced with a higher level of smoking obscenity.

Our results also indicated that medical students were less likely to be daily and/or non-daily smokers than those who studied in the field of engineering, which was consistent with the results reported in other studies. Compared to the students in other fields, the students in medical and health sciences have higher levels of health literacy and may have a better understanding of the adverse effects of smoking, which may result in less possibility to smoke. Similar to what was found in previous studies, the students who had at least one smoker among their family members were more likely to smoke, particularly on a daily basis, and having a history of self-harm increased the students’ chance to be a daily smoker.

In line with previous studies, our study showed that both daily and non-daily smokers have more probability to engage in high-risk behaviors such as alcohol use in the past 30 days, substance abuse, and regular hookah use compared to non-smokers. This can be justified based on problem behavior theory (PBT). According to PBT, problematic behaviors co-occur in individuals, and engaging in one high-risk behavior increases the likelihood of experiencing other high-risk behaviors. In the present study, two high-risk behaviors, alcohol use in the past 30 days and substance abuse, were less common among non-daily smokers than among daily smokers. These findings confirm the theoretical basis of PBT and are similar to those reported in previous studies.

We also found that the non-daily smokers, unlike daily smokers, did not regard themselves as smokers. Many studies conducted on students and the general population have confirmed this finding and suggested that non-daily smokers, despite acknowledging their smoking, consider themselves non-smokers. Consistent with other studies, our results indicated that non-daily smokers, unlike daily smokers, have slight nicotine dependence, so they were very unlikely to smoke their first cigarette soon after waking up. It was also found that the non-daily smokers, unlike daily smokers, did not intend to quit smoking in the coming months. A high proportion of daily smokers (73%) had attempted to quit smoking at least once during the past year; however, only 27% of non-daily smokers had such attempts. Evidence suggested that a majority of non-daily smokers underestimate the health risks of NDS and do not regard themselves as smokers, so they
pay less attention to the advice of health professionals and do not feel the need for smoking cessation counseling. Therefore, they may not have the intention to quit their occasional smoking. On the other hand, there is a claim that non-daily smokers are more prone to quit smoking in the coming months compared with daily smokers. There is a group of non-daily smokers called “converted nondaily smokers”. They used to be daily smokers and, then, became non-daily smokers. These individuals are more likely to decide to quit smoking in the coming months and attempt to quit. Therefore, in the studies that used the definition of “the number of days people smoked in the last month”, there is a higher possibility for “converted non-daily smokers” in their sample. Among participants of the present study, the non-daily smokers were much less nicotine dependent than daily smokers. Given the close association between nicotine dependence and the decision to quit, the non-daily smokers were less likely to quit smoking in the coming months due to less nicotine dependence.

Limitations
The present study had some limitations. A major concern of web-based studies is the low response rate, and our study may have such a limitation as well. However, as we did not know the number of students who received the questionnaire link, we were not able to calculate the response rate. Another possible limitation of the study is participation bias similar to other web-based surveys, which may affect our results. In other words, only certain individuals who had access to the Internet, a social media account, and a desire to participate in the study may have answered the questionnaire. Moreover, the results of the present study are based on self-reported data, so the accuracy of the collected data depends on the honesty of the respondents. Another limitation is the cross-sectional nature of the study, so any cause-effect inferences from the results are warranted.

Conclusion
Among Iranian university students who participated in our study, DS was more prevalent than NDS. However, the non-daily smokers, just similar to daily smokers, were involved in high-risk health behaviors such as hookah use, alcohol consumption, and substance abuse, which can pose a greater threat to their health. The non-daily smokers did not consider themselves smokers, were less nicotine dependent, and were less likely to decide to quit. These behavioral characteristics might put them at a greater risk of health damage and may even turn them into DS in the future. These characteristics should be considered as core categories while designing smoking cessation interventions among young non-daily smokers. Therefore, besides paying attention to daily smokers, health policymakers and health professionals should consider the educational needs of non-daily smokers while planning for smoking cessation programs among young populations.

Authors’ Contribution
Conceptualization: Farhad Shekari, Asghar Mohammadpoorasl, Haidar Nadrian. Data curation: Farhad Shekari, Mohammad Asghari Jafarabadi. Formal analysis: Farhad Shekari, Asghar Mohammadpoorasl, Mohammad Asghari Jafarabadi. Funding acquisition: Tabriz University of Medical Sciences. Investigation: Farhad Shekari, Asghar Mohammadpoorasl, Hossein Akbari. Methodology: Asghar Mohammadpoorasl, Haidar Nadrian, Hossein Akbari. Project administration: Farhad Shekari, Asghar Mohammadpoorasl. Supervision: Haidar Nadrian, Asghar Mohammadpoorasl. Validation: Asghar Mohammadpoorasl, Haidar Nadrian, Mohammad Asghari Jafarabadi. Writing – Original Draft: Farhad Shekari, Asghar Mohammadpoorasl, Mohammad Asghari Jafarabadi. Writing – review & editing: Farhad Shekari, Asghar Mohammadpoorasl, Haidar Nadrian, Mohammad Asghari Jafarabadi, Hossein Akbari.

Competing Interests
The authors declare that they have no competing interests.

Consent for Publication
Not applicable.

Data Availability Statement
The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval
The study protocol and designed questionnaire were approved by the Ethics Committee of Tabriz University of Medical Sciences with reference code IR.TBZMED.REC.1398.190, and the necessary permissions were obtained to conduct the study (Webpage of the Ethical Approval code is http://ethics.research.ac.ir/IR.TBZMED.REC.1398.190).

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