Iran J Psychiatry Behav Sci. 2023 September; 17(3):e132909. https://doi.org/10.5812/ijpbs-132909.

Published online 2023 September 13. **Research Article**

Prevalence of Nomophobia and Associated Factors in Adolescent Female Students: A Cross-sectional Study in Northern Iran

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Received 2022 November 27; **Revised** 2023 June 07; **Accepted** 2023 July 05.

Abstract

Background: No mobile phone phobia (nomophobia, abbreviated here to NMP) is often utilized to show the fear of losing one's mobile phone and connectivity and has a frequency of 40 - 100% in different societies.
Objectives: This study aimed to reflect on the prevalence of NMP and the role of demographic and psychological factors in the prediction of NMP among adolescent female high school students in northern Iran.
Methods: The cross-sectional study was conducted on adolescent female high school students living in Sari, Mazandaran province, northern Iran, between 2019 - 2020. By employing cluster sampling to select the participants, 588 students were ultimately recruited. The research instruments included a demographic characteristics questionnaire, the Nomophobia Questionnaire, and the Cell Phone Addiction Scale. Using IBM SPSS software (version 26.0), the data were analyzed via Pearson's correlation coefficient and multiple regression analysis.
Results: The study results revealed that the mean ± standard deviation (SD) of the students' age was 16.1 ± 1.2 years, and 98.6% of the participants experienced various levels of NMP. Additionally, the NMP and mobile phone dependence (MPD) mean ± SD values were equal to 54.75 ± 21.61 and 49.78 ± 18.05, respectively. A statistically significant direct relationship was further observed between the prevalence rate of NMP and the demographic variables, namely age (P = 0.000), type of school (P = 0.016), level of education (P = 0.000), and father's education (P = 0.012).
Conclusions: The study results indicated the high prevalence rate of NMP and MPD in adolescent female high school students. Therefore, further research is needed to examine the depth of psychological aspects of NMP.

Keywords: Adolescent, Mobile Phone Dependence, Nomophobia, Students

1. Background

No mobile phone phobia (nomophobia, abbreviated here to NMP) refers to a specific term associated with the fear of losing one's mobile phone and connectivity, which was first introduced in 2008 to examine anxiety among mobile phone users (1). Nomophobia has also been observed in 53% of the users in the United Kingdom, particularly after they have lost their mobile phones, run out of charge, or failed to have access to the Internet (1). Although this condition has not yet been deliberated in the diagnostic and statistical manual of mental disorders, fifth edition (DSM-5), it has been defined as a novel type of phobia (in the modern DSM-IV) (2) with different clinical features, including the regular and excessive use of mobile phones; accordingly, individuals with NMP spend much time on such devices. They almost always carry their mobile phone, even sleep with their mobile phone in bed, feel scared and anxious if they do not have it at hand for some reason, or experience too much stress when their battery runs out of charge, or they do not have internet access (2). Therefore, these clinical features and the irrational fear of not having access to a mobile phone are called NMP (2, 3). From this perspective, research has

revealed that NMP has recently increased among mobile phone users, particularly adolescents and young students.

In recent times, the concept of behavioral addiction has attracted the attention of researchers and has been shown to be equivalent to substance dependence understood by current nosological systems (4, 5). Behavioral addiction to mobile phones has been called by different names as mobile phone dependence (MPD), cell phone addiction, cell phone use problem, and mobile phone abuse (6-8).

In 2019, it was reported that mobile phone users worldwide exceeded 4.68 billion individuals, and mobile phone ownership worldwide compounded from 62.9% in 2016 to 67% in 2019 with the emergence of the new generation of such gadgets (9). About 38% of mobile phones in the market were smartphones in 2014, which elevated to more than 50% in 2018 (10). A study in the United Kingdom (2008), addressing more than 2,100 individuals, also showed that men were more susceptible to NMP than women. According to another study (2015), this type of phobia was present in 65% of French college students (11). Anshari et al. similarly reported that 46% of the participants suffered from NMP (12). As stated by Prasad et al., 24.7% of dental students frequently checked their mobile phones during classes or clinical procedures (13). Moreover, a 100% prevalence rate of NMP was demonstrated in Gurbuz and Ozkan's study, recruiting 400 young individuals living in rural areas of Turkey (14). An Iranian survey (2020) further estimated a 100% prevalence rate of NMP and its health-related risks in 320 students; accordingly, 73% of the cases were mobile phone users, and the level of NMP was high (15).

2. Objectives

The study of NMP can be further considered one of the concerns about the escalating number of mobile phone users. Given the limited research in this field in Iran and, above all, no survey on the prevalence rate of NMP in northern Iran, this study was conducted to investigate the prevalence rate of NMP in adolescent female high school students in Sari, Mazandaran province, northern Iran, as a step to reach a better understanding and take appropriate actions in order to deal with this challenge.

3. Methods

This descriptive-analytical cross-sectional study was completed using IBM SPSS Amos software (version 26.0) and path analysis. The statistical population consisted of all adolescent female students (n = 16,313) enrolled in the 9th, 10th, 11th, and 12th grades of 69 high schools in the school year calendar of 2019 - 2020. In total, 15 schools were sampled via cluster sampling. Therefore, the female students enrolled in the 9th, 10th, 11th, and 12th grades at high schools for females in Sari, Mazandaran province, northern Iran, who had access to a mobile phone and were satisfied with the completion of the questionnaires, were included in the study. However, those returning incomplete questionnaires were excluded. The sample size was further estimated to be 588, using Cochran's formula. Additionally, the research instruments were a demographic characteristics questionnaire, the Nomophobia Questionnaire (NMP-Q, Yildirim and Correia, (16)), and the Cell Phone Addiction Scale (CPAS, Khazaie et al. (as cited by Koo) (17)).

3.1. Research Instruments

3.1.1. Demographic Characteristics Questionnaire

The sociodemographic characteristics of the participants included gender, age, marital status, place of residence, type of school, academic level, parents' level of education, parents' working status, household income, history of mental disorders (self-reporting), family history of psychiatric disorders (self-reporting), and smoking/drug abuse.

3.1.2. Nomophobia Questionnaire

The NMP-Q was developed by Yildirim and Correia in 2015 as the first test to measure NMP and identify and describe its dimensions (16). The given scale was based on two parts, including 22 statistical items and 20 items related to NMP. The NMP-Q also included four subscales, including the inability to communicate, loss of communication, inaccessibility of information, and loss of comfort and well-being, graded by a 7-point Likert-type scale from 1 = Completely disagree to 7 = Completely agree. The total scores were also calculated by summing the answers to each item, resulting in a score of 20 - 140, wherein the scores of $\leq$ 20 indicated the absence of NMP, $\geq$ 20 and $\geq$ 60 represented mild NMP, $\geq$ 60 and $<$ 100 showed moderate NMP, and $\geq$ 100 denoted severe NMP. Yildirim and Correia reported Cronbach's alpha coefficient for the whole scale and its subscales to be 0.945, 0.939, 0.874, 0.827, and 0.814, respectively, suggesting good internal reliability. The results of the validity analysis in the study by Yildirim and Correia additionally demonstrated that the internal reliability coefficient for all options in the NMP-Q was 0.954, and the Cronbach's alpha coefficients for the four dimensions were equal to 0.939, 0.874, 0.827, and 0.814, respectively. Therefore, Yildirim and Correia supported the fact that the NMP-Q had acceptable internal reliability and validity (16).

The evaluation of the convergent validity of the NMP-Q correspondingly showed a positive correlation between this questionnaire and the Mobile Phone Usage Questionnaire (16). This questionnaire was further validated by Elyasi et al. in Iran and was shown to be a reliable and valid instrument for this purpose (18). Moreover, Sayah et al. reported the results of the validity analysis of the given questionnaire in Iran by the internal reliability of 81% for all items, the Cronbach's alpha coefficients for four dimensions of accessibility of information (81%), loss of comfort and well-being (79%), inability to communicate (82%), and loss of communication (83%). Therefore, they supported the fact that the Persian version of the NMP-Q had acceptable internal reliability and validity (19).

3.1.3. CPAS

The 20-item CPAS was developed by Khazaie et al. (as cited by Koo) in 2009. The first part of this questionnaire included demographic characteristics and how to use a mobile phone, and the second part was associated with the items about MPD, classified and graded in three areas of tolerance of deprivation, disorders in life, and compulsion-insistence, using a 4-point Likert-type scale from 1 = Very low to 4 = Very high. The scores were accordingly classified in line with the mobile phone addicts (scores of $\geq$ 70), heavy users (scores of 63 - 69), and moderate users (scores of $<$ 63) (17).

The face validity and content validity of the CPAS have been reported in a qualitative way. Reliability using the internal consistency method by calculating Cronbach's alpha coefficient was obtained on 637 high school students of Birjand schools in Iran and reported as 0.81 (17).

Upon completing the initial stages and obtaining the required permission to implement the research project from Mazandaran University of Medical Sciences, Sari, Iran, the researcher referred to the Education Department of Sari, Iran, with a written letter of introduction from the university officials and received a letter of introduction for high school principals. It should be noted that a specialized assistant in the field of family medicine was employed to perform sampling from all centers. After explaining the study objectives to each student and assuring them of the confidentiality of information, their written consent was obtained. Of note, the questionnaires took 10 - 20 minutes to be completed.

3.2. Ethical Considerations

Before starting the study, all research aspects were explained to the participants, and then written and oral consent was obtained. The study was also submitted to the Ethics Committee of Mazandaran University of Medical Sciences, Sari, Iran, and the code of ethics (IR.MAZUMS.IMAMHOSPITAL.REC.1398.038) was acquired.

3.3. Statistical Analysis

The frequency, mean, and variance tables were used to describe the qualitative and quantitative variables of this study. Furthermore, the chi-square test was applied to determine the relationship between NMP with the demographic, socioeconomic, and electronic media ownership variables. In addition, Pearson's correlation coefficient was employed to examine the linear correlation between the NMP and MPD dimensions. Moreover, analysis of variance (ANOVA) was used to reflect on the relationship between the levels of NMP and MPD, and path analysis was run in the IBM SPSS Amos software (version 26.0) to establish the relationship between each dimension of NMP and MPD.

4. Results

This study investigated 588 adolescent female high school students. Table 1 shows the frequency and relative frequency (percentage) of the demographic variables for the participants. The mean age value of the students included in this study was 16.1 ± 1.2 years, and the age range was between 14 - 19 years. Moreover, 55.4% of the students were in the age group of 16 - 17 years. Furthermore, about 61% and 39% of the students were from public and private schools, respectively. It should be noted that 86.3% of the participants were living in rural areas, and the rest were living in urban areas, out of whom 25.4%, 25.6%, 27.4%, and 21.6% were enrolled in the 9th, 10th, 11th, and 12th grades, respectively. In addition, 45.1% of the students' mothers had high school diplomas or associate degrees, and only 1.1% of the mothers were illiterate. Most fathers had high school diplomas or associate degrees (47%), and only 1.6% of the fathers were illiterate. According to the results in Tables 2 and 3, 16 apps had been installed on the mobile phones on average, and the monthly charge of the mobile phones ranged from 0 to 4,000,000 Iranian Rial (IRR) with a mean monthly amount of 350.000 ± 46.000 IRR and a median of 200.000 IRR.

4.1. NMP and MPD

The mean NMP was 76.65 ± 30.24, and students' MPD was estimated to be 49.78 on average (standard deviation (SD) = 18.05). Table 4 shows a descriptive study of the NMP and MPD dimensions. Accordingly, 150 participants had severe NMP (25.5%), and 11 cases (1.9%) were addicted to mobile phones. Table 5 shows the frequency and relative frequency (percentage) of NMP and MPD dimensions.

Table 3. Frequency Levels of Variables Related to Mobile Phone Use

Variables	Mean	Standard Deviation
Number of apps	16	6.0
Monthly charge (IRR)	350,000	4.57
Number of daily outgoing calls	40.40	72.21
Number of daily incoming calls	7.82	5.98
The mean duration of each call	13.74	18.4
The mean number of weekly incoming calls	37.51	12.80
Number of daily messages sent	22.27	10.89
Number of daily messages received	22.75	11.5
The mean number of messages received per week	65.47	24.36
Number of daily emails sent	0.77	0.32
Number of daily emails received	1.41	0.47

Abbreviation: IRR, Iranian Rial.

Table 4. Descriptive Indices of Nomophobia Dimensions and Access to Mobile Phones in Students

Variables	Frequency	Mean ± SD
Negative effects of NMP		
Lack of access to information	588	56.52 ± 22.10
Loss of comfort and well-being	588	56.58 ± 24.71
Inability to communicate	588	58.55 ± 26.14
Loss of connection	588	46.94 ± 26.27
The total score of NMP		
The total score of NMP	588	76.65 ± 30.24
Negative effects of MPD		
Tolerance of deprivation	588	49.31 ± 20.94
Disorders in life	588	41.24 ± 19.34
Compulsion-insistence	588	57.56 ± 20.42
MPD	588	49.78 ± 18.05

Abbreviations: NMP, nomophobia; MPD, mobile phone dependence; SD, standard deviation.

4.2. Evaluating the Relationship Between Demographic Variables and Those Related to Mobile Devices and NMP Severity in Students

The chi-square test results in Table 6 indicated a statistically significant relationship between the students' age group and the NMP severity at the significance level of 0.001 (P = 0.000). There was also a significant relationship between the type of school and the severity of NMP among the students at the significance level of 0.05 (P = 0.016). In addition, a statistically significant relationship was observed between the students' grades and the NMP severity at the significance level of 0.001 (P = 0.000). Nevertheless, no significant relationship was noticed between the participants' marital status and the level of NMP at the significance level of 0.05 (P = 0.732).

Table 5. Frequency of Nomophobia and Mobile Phone Dependence in Students

Levels	Frequency (Relative Frequency (%))	Cumulative Relative Frequency
NMP		
Normal	8 (1.4)	1.4
Mild	180 (30.6)	32
Moderate	250 (42.5)	74.5
Severe	150 (25.5)	100
MPD		
Moderate user	503 (85.5)	85.5
Severe user	74 (12.6)	98.1
Addicted	11 (1.9)	100

Abbreviations: NMP, nomophobia; MPD, mobile phone dependence.

The results of other variables further suggested a significant relationship between the NMP severity with the father's education (P = 0.012) and household income (P = 0.045) at the significance level of 0.05. However, no statistically significant relationship was observed between the variables of place of residence, mother's education, history of students' mental disorders, and history of psychiatric disorders in their family members with the NMP severity at the significance level of 0.05 ($P < 0.05$). The severity of NMP was significantly correlated with owning a laptop (P = 0.037), having a mobile phone (P = 0.008), having access to social networks (P = 0.000), having internet access (P = 0.003), daily use of mobile phone (P = 0.000), and years of mobile phone use (P = 0.000) at the significance level of 0.05. Nevertheless, no significant relationship was observed between owning a personal computer and a tablet and the severity of NMP at the significance level of 0.05 ($P < 0.05$) (Appendix 1).

4.3. Relationship Between NMP and MPD

Appendix 2 shows the evaluation of the correlation between the NMP and MPD dimensions in the students using Pearson's correlation coefficient. Accordingly, the data indicated a statistically significant linear relationship between all NMP and MPD dimensions at the error level of 0.01 ($P < 0.01$). This finding showed that in addition to the existence of a linear relationship between cell phone addiction and nomophobia, there was a statistically significant correlation between each of their dimensions. (Appendix 3).

Table 6. Frequency of Nomophobia Severity in Students by Demographic Variables and Chi-square Independence Test Results [a, b]

Variables and Levels	NMP No. (%)				T-statistic	Significance Level	Correlation Coefficient
	Normal	Mild	Moderate	Severe			
Age (y)					25.197	0.000 ***	0.163 ***
14 - 15	3 (1.6)	83 (43)	74 (38.3)	33 (17.1)			
16 - 17	4 (1.2)	76 (23.3)	146 (45.7)	97 (29.8)			
17 - 19	1 (1.4)	21 (30.4)	27 (39.1)	20 (29)			
Type of school					10.382	0.016 *	-0.076
Public	3 (8)	110 (30.6)	140 (39)	106 (29.5)			
Private	5 (2.2)	79 (30.6)	110 (48)	44 (19.2)			
High school education level					32.832	0.000 ***	0.177 ***
9th	3 (2)	60 (46.3)	50 (33.6)	27 (18.1)			
10th	2 (1.3)	41 (37.3)	75 (50)	32 (21.3)			
11th	3 (1.9)	38 (23.6)	66 (41)	54 (33.5)			
12th	0 (0)	32 (25.2)	59 (46.5)	36 (28.3)			
Marital status					3.590	0.732	0.017
Single	8 (1.4)	171 (30.5)	239 (42.7)	142 (25.4)			
Married	0 (0)	6 (28.6)	8 (38.1)	7 (33.3)			
Divorced	0 (0)	2 (66.7)	0 (0)	1 (33.3)			
Place of residence					1.392	0.707	0.003
Rural	0 (0)	26 (32.9)	33 (41.8)	20 (25.3)			
Urban	8 (1.6)	153 (30.7)	208 (41.7)	130 (26.1)			
Mother's education					20.295	0.062	-0.005
Illiterate	0 (0)	4 (66.7)	1 (16.7)	1 (16.7)			
Primary school	2 (1.5)	43 (32.3)	56 (42.1)	32 (24.1)			
High school diploma and associate degree	0 (0)	81 (30.6)	116 (43.8)	68 (25.7)			
Bachelor's degree and master's degree	6 (5.1)	39 (33.1)	45 (38.1)	28 (23.7)			
PhD	0 (0)	1 (12.5)	5 (62.5)	2 (25)			
Father's education					25.643	0.012 *	-0.126
Illiterate	0 (0)	2 (22.2)	3 (33.3)	4 (44.4)			
Primary school	2 (1.4)	42 (29.4)	57 (39.9)	42 (29.4)			
High school diploma and associate degree	0 (0)	77 (28.3)	119 (43.8)	76 (27.9)			
Bachelor's degree and master's degree	5 (3.6)	54 (39.1)	59 (42.8)	20 (14.5)			
PhD	1 (5.9)	4 (23.5)	8 (47.1)	4 (23.5)			
Household income (IRR)					21.374	0.045 *	-0.019
Below 30,000,000	1 (4.5)	8 (36.4)	12 (54.5)	1 (4.5)			
30,000,000 to 50,000,000	0 (0)	9 (25.7)	12 (34.3)	14 (40)			
50,000,000 to 100,000,000	0 (0)	8 (21.6)	13 (35.1)	16 (43.2)			
Above 100,000,000	7 (2.1)	101 (30.3)	148 (44.4)	77 (23.1)			
I do not know	0 (0)	46 (31.7)	60 (41.4)	39 (26.9)			
History of mental disorders					5.308	0.151	-0.086
Yes	0 (0)	3 (11.5)	14 (53.8)	9 (34.6)			
No	8 (1.4)	177 (31.5)	236 (42)	141 (25.1)			
Family history of psychiatric disorders					8.847	0.182	0.024
Yes	0 (0)	10 (23.8)	16 (38.1)	16 (38.1)			
No	7 (1.6)	142 (32.6)	184 (42.2)	103 (23.6)			
I do not know	1 (1.1)	21 (22.1)	44 (46.3)	29 (30.5)			

Abbreviations: NMP, nomophobia; IRR, Iranian Rial.
[a] *A significant relationship at the 0.05 level.
[b] *** A significant statistical correlation at the 0.001 level.

4.4. Evaluating the Relationship Between NMP Severity and MPD Using Path Analysis

Appendix 4 reports the path analysis results to determine the relationship between the NMP and MPD dimensions in the students. According to the latest findings from this table, the relationship between NMP and MPD was confirmed by the t-statistic of 20.691 at the significance level of P = 0.000 because the significant level obtained from the goodness of fit (GoF) index of the structural model in Figure 1 for this path was 0.000, which was less than 0.001. With regard to the strong evidence of the relationship between these two variables, MPD could affect the levels of NMP in the students with a standardized direct impact of 0.78. It should be noted that the obtained results were completely consistent with the ANOVA findings in Appendix 4. Additionally, the GoF index for this model was equal to 0.983 (range: 0.5 - 1), which reflected the good fit of the conceptual model used in the path analysis and more confidence in the results.

Appendix 5 shows the mean and SD values of the students' MPD by the severity of NMP and the ANOVA results to determine their relationship. Considering no presumption of the equality of variance of the MPD scores between the levels of NMP by Levene's test (F = 2.365, P = 0.034 $<$ 0.05), Welch's ANOVA results indicated a significant relationship between MPD and NMP severity in the students at the significance level of 0.001. These four groups were also different from each other in terms of MPD (P $<$ 0.001). Appendix 6 shows the changes in the mean value of MPD at different levels of NMP.

Moreover, the pairwise comparison outcomes by Tukey's test for post-hoc analysis showed that the students with severe NMP obtained a higher MPD score than others with moderate, mild, and no NMP (i.e., the normal students) (P $<$ 0.001). In addition, the students with moderate NMP had higher MPD scores than those with mild NMP (P $<$ 0.01) and without NMP (P $<$ 0.01). However, there was no significant difference between the scores of MPD in both groups of mild NMP and the absence of NMP at the significance level of 0.05 (P $<$ 0.05).

The chi-square test results correspondingly showed the role of some demographic, socioeconomic, and electronic media ownership variables in determining the severity of NMP in the students. Pearson's correlation coefficient further revealed a significant linear relationship between the dimensions of NMP and MPD (Appendix 7). Finally, the path analysis outcomes showed the positive effect of MPD on the increased prevalence rate of NMP in adolescent female high school students (Figure 2).

5. Discussion

The study results determined the high prevalence rate of NMP and MPD in adolescent female high school students in Sari, Mazandaran province, northern Iran. The study results indicated that 98.69% of the students had different levels of NMP. The mean NMP was also mild to moderate, and the mean MPD was moderate. In this regard, Sharma et al. reported the prevalence rate of NMP in India by 73% (20). Additionally, NMP was observed to be 26% and 97% in the surveys by Menezes and Pangam (21) and Madhusudan et al. in Wayanad, a rural district in Kerala state, southwest India (22), respectively. In addition, NMP was estimated in dental students as 24.7% in Prasad et al.'s study (13). Moreover, Daei et al. showed the prevalence rate of NMP by 73% in Iran (15). In the same study in Iran, the moderate prevalence rate of NMP was reported as 71.38% (23).

According to Yildirim, 42.6% of the students showed manifestations of NMP (3). In Dasgupta et al. in India, the researchers further described that the prevalence rate of NMP was higher in engineering students (44.6%) than in medical students (42.6%) (24). Correspondingly, Yildiz Durak demonstrated that about 49% of the adolescents obtained NMP scores of $\geq$ 50, and 53% of the cases had NMP scores of $\geq$ 75 (25). Another study on French college students further reported similar results; accordingly, approximately 73% of the students were subjected to NMP (11). Harish and Bharath also showed that 99% of Indian students experienced moderate NMP (26). Numerous surveys also estimated the prevalence rate of NMP within the range of 24 - 97%.

The discrepancies in the research populations might be induced by the differences in the research instruments, including various questionnaires to evaluate NMP. For example, the research population investigated in studies by Sharma et al. (20), Pavithra et al. (27), Madhusudan et al. (22), and Prasad et al. (13) were medical students (13, 22, 27). In Daei et al.'s study, the statistical population was the Iranian students of Isfahan University of Medical Sciences, Isfahan, Iran, consisting of students of different fields (15). Furthermore, the research population in Panahi Ghashe Tuti et al.'s study included female students living at a dormitory of AlZahra University, Tehran, Iran, who were studying for three courses, a bachelor's degree, master's degree and Ph.D., in different fields other than medicine (23). Moreover, Yildirim had American non-medical students (3).

One of the most important factors influencing the prevalence rate of NMP is age, and the present study revealed that NMP had the highest frequency and severity in the age group of 16 - 17 years. Since the study participants were high school students, the mean age was lower than in

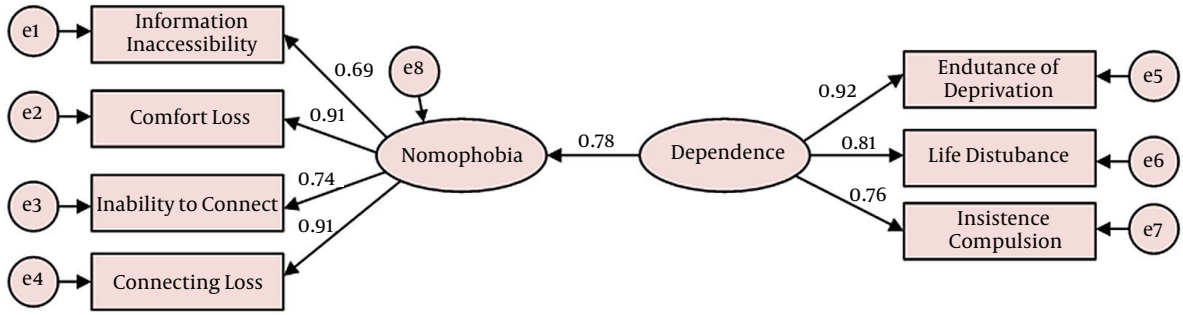

Figure 1. Results of path analysis method with conceptual model

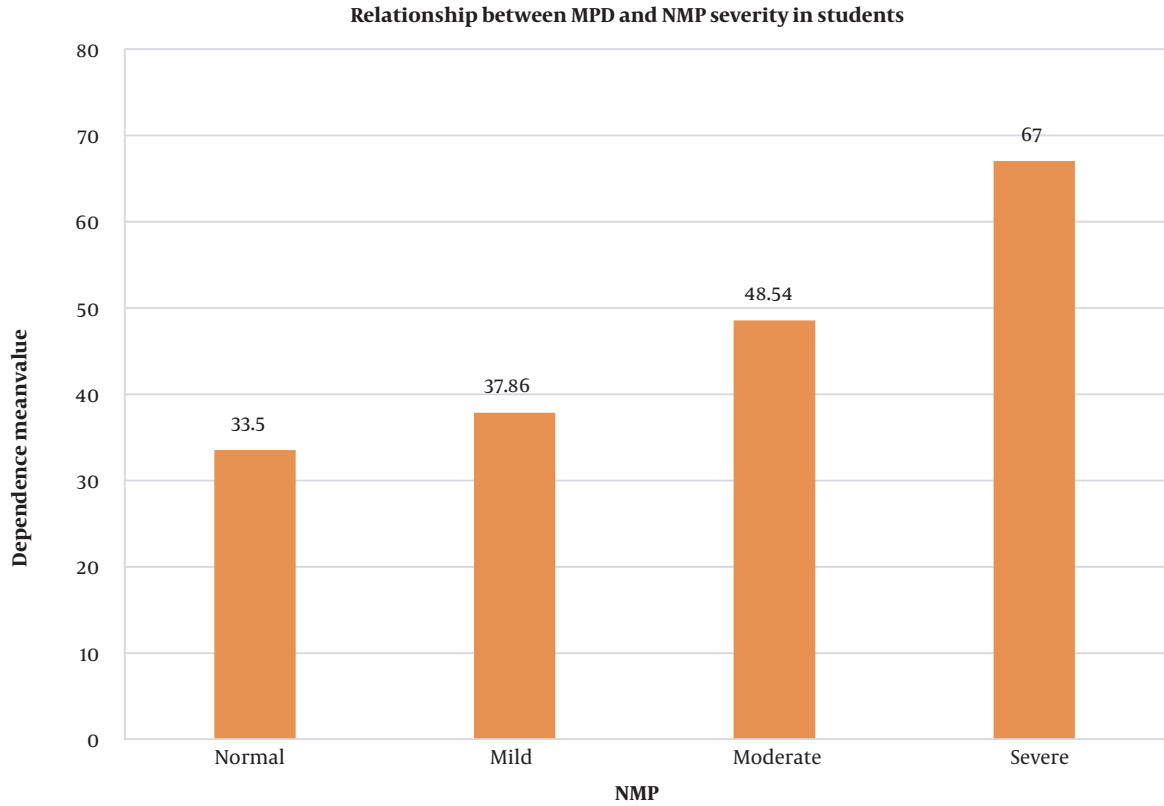

Figure 2. Relationship between mobile phone dependence (MPD) and nomophobia (NMP) severity in students

other studies, and consequently, the frequency of NMP in the statistical population was higher. On the other hand, the level of education was related to the frequency of NMP in this study; accordingly, the students in the 11th and 12th grades experienced a higher level and more severe NMP than those in the 9th grade. Considering that the Iranian students had a lower level of education in comparison to their university counterparts and other employees, the high prevalence rate of NMP in this study, compared to other surveys, could be relatively justified. The study findings are also consistent with the aforementioned results; that is, a high percentage of the participants had moderate NMP. Of note, individuals would use mobile phones to interact socially with others. As stated by Kuss and Griffiths, some individuals use mobile phones to prevent face-to-face social interactions with individuals

who upset them (28).

This study also showed a statistically significant relationship between the prevalence rate of NMP and the students' age, type of school, level of education, and father's education. Accordingly, the highest prevalence rate of NMP was observed in the age group of 16 - 17 years, and the prevalence rate of severe NMP was 29.8% versus 18% in the age group of 15 - 16 years. The prevalence rate of NMP in public schools was higher than in private ones, and the students in the 11th and 12th grades had the highest prevalence rate of NMP compared to lower grades. Additionally, the prevalence rate of NMP was higher in illiterate fathers than in those with higher education. In this regard, Pavithra et al. reported a relationship between the prevalence rate of NMP with gender, level of education, and place of residence (27). However, Madhusudan et al. found no statistically significant relationship between NMP with gender and place of residence (22).

Kara et al. further reported a positive correlation between the duration of mobile phone use by adolescents per day and NMP (29). In addition, Gonçalves et al. and Kaviani et al. demonstrated that the rate of mobile phone use during the day was moderately and positively correlated with NMP, and it was also introduced as a strong predictor of this condition (30, 31).

Moreover, the study results indicated that the mean level of students' MPD was 49.78, with an SD of 18.05. In addition, 85.5% of the participants had moderate MPD. In this regard, Mohammadzadeh et al. showed the score of MPD in high school students to be 73.16, which was much higher than the present study (32). Furthermore, Samadbeik et al. reported moderate levels of MPD in students and a significant inverse relationship between the score of MPD and the grade point average of the previous semester. Researchers have also referred to a statistically significant difference between the score of MPD among the students in terms of the fields of study with a moderate level of MPD (33). Therefore, the results of the present study are in line with the results reported by Mansourian et al. (34) on the students of Tehran University of Medical Sciences, Tehran, Iran, and Khazaie et al. (17) on the students of Birjand University of Medical Sciences, Birjand, Iran (17, 34). However, according to the results of similar studies performed in Thailand, high school students' MPD was reported to be high (35). Atadokht et al. also obtained a high rate of harmful use of mobile phones among high school students in Khalkhal, Ardabil province, Iran (36). This difference might be attributable to the discrepancy in the groups participating in the study and the research environments.

There was also a statistically significant linear relationship between all dimensions of NMP and MPD. In addition, there was a statistically significant correlation between each of these dimensions. The study findings also strongly indicated that MPD affected the prevalence rate of NMP in students. A literature review further revealed that very few studies directly evaluated MPD in terms of NMP.

The present study had some limitations to consider in interpreting the results. This study adopted a cross-sectional research design, and its variables were measured at a specific time. Therefore, the relationships could take different forms over time. Since the study samples were only female high school students in Sari, Mazandaran province, northern Iran, the indigenous and cultural considerations might have played a role in the results. Therefore, it is necessary to be more careful in generalizing the results to other statistical populations. In addition, the study was based on self-reporting that might have been biased in reporting the prevalence rate of mobile phone use. Therefore, research instruments that are more objective should be used to improve the validity of the findings in the future.

5.1. Conclusions

Despite the negative effects of NMP and MPD on the quality of life of young individuals and adolescents, the communicative and educational benefits of mobile phones and the growing use of this medium, particularly during the coronavirus disease 2019 pandemic, and the need for e-learning cannot be ignored. However, the excessive use of mobile phones has led to emotional dependence, high mental preoccupation, loss of concentration, and, ultimately, academic failure. As a result, providing necessary training for students regarding the correct and scientific use of this technology can result in the development of the correct behavior in mobile phone users to realize its benefits.

On the other hand, it is of utmost importance to make preventive decisions and develop training programs about the students' mental health due to the prevalence of moderate to severe levels of NMP in female cases. Moreover, alternative actions are recommended to treat the mild levels of NMP, prescribe medications for moderate-to-high students, and pave the grounds for leisure-time activities and entertainment in this age group. Therefore, it is suggested to take appropriate planning and control actions to prevent the negative consequences and adverse effects of mobile phone use.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal

website and open PDF/HTML].

Acknowledgments

This study was extracted from a postgraduate thesis in family medicine specialty by Sanaz Jamshidifar. The authors would like to express their gratitude to all those who helped in this study. The authors would like to express their gratitude to the principals of the affiliated high schools and all adolescent female students as the study participants for their valuable cooperation in conducting this research.

Footnotes

Authors' Contribution: SJ drafted the manuscript and contributed to data collection. FE was involved in the conception of the work, interpretation of the data, drafting the manuscript, and editing the manuscript. JM conducted the statistical analyses and interpreted the data. JM and PK also edited the manuscript. AE contributed to the language editing of the manuscript. All the authors read and approved the final manuscript.

Conflict of Interests: The authors declared no conflict of interest.

Data Reproducibility: The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval: This research project was approved by the Ethics Committee of Mazandaran University of Medical Sciences (IR.MAZUMS.IMAMHOSPITAL.REC.1398.038), Sari, Iran.

Funding/Support: This study was conducted with the financial support of the Vice-Chancellor Office for Research and Technology at Mazandaran University of Medical Sciences, Sari, Iran (grant no.: 5369).

Informed Consent: Informed consent was obtained from all the participants. The study subjects were assured that their identity would be kept anonymous throughout the study.

References

1. Daily Mail. *Nomophobia is the fear of being out of mobile phone contact - and it's the plague of our 24/7 age*. 2008, [updated 31 March 2008]. Available from: https://www.dailymail.co.uk/news/article-550610/Nomophobia-fear-mobile-phone-contact--plague-24-7-age.html.
2. Bragazzi NL, Del Puente G. A proposal for including nomophobia in the new DSM-V. *Psychol Res Behav Manag*. 2014;**7**:155–60. [PubMed ID: 24876797]. [PubMed Central ID: PMC4036142]. https://doi.org/10.2147/PRBM.S41386.
3. Yildirim C. *Exploring the dimensions of nomophobia: Developing and validating a questionnaire using mixed methods research [master's thesis]*. Ames, Iowa: Iowa State University; 2014.
4. Arumugam B, Sachi S, Nagalingam S. A Descriptive Study on Behavior Associated with Mobile Phone Usage and Its Effect on Health among Medical Students in Chennai. *J Evol Med Dent Sci*. 2014;**3**(7):1590–5. https://doi.org/10.14260/jemds/2014/2029.
5. Dixit S, Shukla H, Bhagwat A, Bindal A, Goyal A, Zaidi AK, et al. A study to evaluate mobile phone dependence among students of a medical college and associated hospital of central India. *Indian J Community Med*. 2010;**35**(2):339–41. [PubMed ID: 20922119]. [PubMed Central ID: PMC2940198]. https://doi.org/10.4103/0970-0218.66878.
6. Bivin JB, Mathew P, Thulasi PC, Philip J. Nomophobia - do we really need to worry about? A cross sectional study on Nomophobia severity among male Under Graduate students of Health sciences. *Revi Prog*. 2013;**1**(1):1–5. https://doi.org/10.6084/M9.FIGSHARE.709549.V2.
7. King AL, Valenca AM, Silva AC, Sancassiani F, Machado S, Nardi AE. "Nomophobia": impact of cell phone use interfering with symptoms and emotions of individuals with panic disorder compared with a control group. *Clin Pract Epidemiol Ment Health*. 2014;**10**:28–35. [PubMed ID: 24669231]. [PubMed Central ID: PMC3962983]. https://doi.org/10.2174/1745017901410010028.
8. Lopez-Fernandez O, Honrubia-Serrano L, Freixa-Blanxart M, Gibson W. Prevalence of problematic mobile phone use in British adolescents. *Cyberpsychol Behav Soc Netw*. 2014;**17**(2):91–8. [PubMed ID: 23981147]. https://doi.org/10.1089/cyber.2012.0260.
9. Statista. *Number of mobile phone users worldwide from 2015 to 2020 (in billions)*. 2016. Available from: https://www.statista.com/statistics/274774/forecast-of-mobile-phone-users-worldwide/.
10. Alosaimi FD, Alyahya H, Alshahwan H, Al Mahyijari N, Shaik SA. Smartphone addiction among university students in Riyadh, Saudi Arabia. *Saudi Med J*. 2016;**37**(6):675–83. [PubMed ID: 27279515]. [PubMed Central ID: PMC4931650]. https://doi.org/10.15537/Smj.2016.6.14430.
11. Tavolacci MP, Meyrignac G, Richard L, Dechelotte P, Ladner J. Problematic use of mobile phone and nomophobia among French college students. *Eur J Public Health*. 2015;**25**(Suppl 3):ckv172.088. https://doi.org/10.1093/eurpub/ckv172.088.
12. Anshari M, Alas Y, Hardaker G, Jaidin JH, Smith M, Ahad AD. Smartphone habit and behavior in Brunei: Personalization, gender, and generation gap. *Comput Hum Behav*. 2016;**64**:719–27. https://doi.org/10.1016/j.chb.2016.07.063.
13. Prasad M, Patthi B, Singla A, Gupta R, Saha S, Kumar JK, et al. Nomophobia: A Cross-sectional Study to Assess Mobile Phone Usage Among Dental Students. *J Clin Diagn Res*. 2017;**11**(2):ZC34–9. [PubMed ID: 28384977]. [PubMed Central ID: PMC5376814]. https://doi.org/10.7860/JCDR/2017/20858.9341.
14. Gurbuz IB, Ozkan G. What is Your Level of Nomophobia? An Investigation of Prevalence and Level of Nomophobia Among Young People in Turkey. *Community Ment Health J*. 2020;**56**(5):814–22. [PubMed ID: 31902048]. https://doi.org/10.1007/s10597-019-00541-2.
15. Daei A, Ashrafi-Rizi H, Soleymani MR. Nomophobia and Health Hazards: Smartphone Use and Addiction Among University Students. *Int J Prev Med*. 2019;**10**:202. [PubMed ID: 31879551]. [PubMed Central ID: PMC6921283]. https://doi.org/10.4103/ijpvm.IJPVM_184_19.
16. Yildirim C, Correia AP. Exploring the dimensions of nomophobia: Development and validation of a self-reported questionnaire. *Comput Hum Behav*. 2015;**49**:130–7. https://doi.org/10.1016/j.chb.2015.02.059.
17. Khazaie T, Saadatjoo A, Dormohamadi S, Soleimani M, Toosinia M, Mullah Hassan Zadeh F. [Prevalence of mobile dependency and adolescence aggression]. *J Birjand Univ Med Sci*. 2013;**19**(4):430–8. Persian.
18. Elyasi F, Hakimi B, Islami-Parkoohi P. The Validity and Reliability of the Persian Version of Nomophobia Questionnaire. *Addict Health*. 2018;**10**(4):231–41. [PubMed ID: 31263522]. [PubMed Central ID: PMC6593169]. https://doi.org/10.22122/ahj.v10i4.647.

19. Sayah S, Ghadami A, Azadi F. [Psychometric properties of the Nomophobia questionnaire (NMP-Q) among Iranian students]. *Psychometry*. 2018;**6**(23):7–25. Persian.
20. Sharma N, Sharma P, Sharma N, Wavare R. Rising concern of nomophobia amongst Indian medical students. *Int J Res Med Sci*. 2015;**3**(3):705. https://doi.org/10.5455/2320-6012.ijrms20150333.
21. Menezes PM, Pangam S. Prevalence, Awareness and Effects Of Nomophobia among Adolescents. *Int J Psychiatr Nurs*. 2017;**3**(2):16. https://doi.org/10.5958/2395-180x.2017.00015.9.
22. Madhusudan M, Sudarshan BP, Sanjay TV, Gopi A, Fernandes SDA. Nomophobia and its determinants among the students of a medical college in Kerala. *Int J Med Sci Public Health*. 2017;**6**(6):1046–9. https://doi.org/10.5455/IJMSPH.2017.0203115022017.
23. Panahi Ghashe Tuti Z, Khosravi Z, Farah Bijari A. [Relationship Between loneliness and Nomophobia ith the Intermediating Role of Spiritual Well-Being among Students of Alzahra University]. *J Psychol Stud*. 2019;**14**(4):73–90. Persian. https://doi.org/10.22051/psy.2019.19809.1623.
24. Dasgupta P, Bhattacherjee S, Dasgupta S, Roy JK, Mukherjee A, Biswas R. Nomophobic behaviors among smartphone using medical and engineering students in two colleges of West Bengal. *Indian J Public Health*. 2017;**61**(3):199–204. [PubMed ID: 28928304]. https://doi.org/10.4103/ijph.IJPH_81_16.
25. Yıldız Durak H. What Would You Do Without Your Smartphone? Adolescents' Social Media Usage, Locus of Control, and Loneliness as a Predictor of Nomophobia. *Addict Turki J Addict*. 2018;**5**(3):543–57. https://doi.org/10.15805/addicta.2018.5.2.0025.
26. Harish BR, Bharath J. Prevalence of nomophobia among the undergraduate medical students of Mandya Institute of Medical Sciences, Mandya. *Int J Community Med Public Health*. 2018;**5**(12):5455–9. https://doi.org/10.18203/2394-6040.ijcmph20184833.
27. Pavithra MB, Madhukumar S, Murthy TS M. A Study on Nomophobia - Mobile Phone Dependence, Among Students of a Medical College in Bangalore. *Natl J Community Med*. 2015;**6**(3):340–4.
28. Kuss DJ, Griffiths MD. Social Networking Sites and Addiction: Ten Lessons Learned. *Int J Environ Res Public Health*. 2017;**14**(3):311. [PubMed ID: 28304359]. [PubMed Central ID: PMC5369147]. https://doi.org/10.3390/ijerph14030311.
29. Kara M, Baytemir K, Inceman-Kara F. Duration of daily smartphone usage as an antecedent of nomophobia: exploring multiple mediation of loneliness and anxiety. *Behav Inf Technol*. 2021;**40**(1):85–98. https://doi.org/10.1080/0144929x.2019.1673485.
30. Gonçalves S, Dias P, Correia A. Nomophobia and lifestyle: Smartphone use and its relationship to psychopathologies. *Comput Hum Behav Rep*. 2020;**2**:100025. https://doi.org/10.1016/j.chbr.2020.100025.
31. Kaviani F, Young KL, Robards B, Koppel S. Nomophobia and self-reported smartphone use while driving: An investigation into whether nomophobia can increase the likelihood of illegal smartphone use while driving. *Transp Res Part F Traffic Psychol Behav*. 2020;**74**:212–24. https://doi.org/10.1016/j.trf.2020.08.024.
32. Mohammadzadeh M, Eftekhar Soadi Z, Bakhtiarpour S, Joharifard R. [Investigate the moderating role of mobile phone dependency in the model of predicting subjective vitality based on perceived social support and Alexithymia mediated by academic procrastination]. *Psychol Methods Models*. 2021;**11**(42):115–31. Persian.
33. Samadbeik M, Valizadeh Kakavandi F, Nouri N, Saremian M, Birjandi M. [The relationship between cellular phone dependency and academic performance of students of Lorestan University of Medical Sciences]. *Yafteh*. 2018;**20**(1):1–11. Persian.
34. Mansourian M, Solhi M, Adab Z, Latifi M. [Relationship between dependence to mobile phone with loneliness and social support in University students]. *Razi J Med Sci*. 2014;**21**(120):1–8. Persian.
35. Kawasaki N, Tanei S, Ogata F, Burapadaja S, Loetkham C, Nakamura T, et al. Survey on cellular phone usage on students in Thailand. *J Physiol Anthropol*. 2006;**25**(6):377–82. [PubMed ID: 17213690]. https://doi.org/10.2114/jpa2.25.377.
36. Atadokht A, Hamidifar V, Mohammadi I. [Over-use and type of mobile phone users in high school students and its relationship with academic performance and achievement motivation]. *J Sch Psychol*. 2014;**3**(2):122–36. Persian.

Table 1. Frequency and Relative Frequency (Percentage) of Demographic Variables for the Study Participants

Variables and Levels	Frequency (Relative Frequency (%))
Marital status	
Single	560 (95.6)
Married	21 (3.5)
Divorced	3 (0.4)
No answer	4 (0.5)
Age (y)	
14 - 15	193 (32.8)
16 - 17	326 (55.4)
18 - 19	69 (11.7)
No answer	100 (17.00)
Type of school	
Public	259 (61.1)
Private	229 (38.9)
Place of residence	
Urban	79 (13.7)
Rural	499 (86.3)
Grade	
9th	149 (25.4)
10th	150 (25.6)
11th	161 (27.4)
12th	127 (21.4)
No answer	1 (0.2)
Mother's education	
Illiterate	6 (1)
Primary school	133 (22.6)
High school diploma and associate degree	265 (45.1)
Bachelor's degree and master's degree	118 (20.1)
PhD	8 (1.4)
No answer	58 (9.8)
Fathers' education	
Illiterate	9 (1.6)
Primary school	143 (24.7)
High school diploma and associate degree	272 (47)
Bachelor's degree and master's degrees	138 (23.8)
PhD	17 (2.9)
No answer	8 (1.4)
Household income (IRR)	
Below 30,000,000	22 (3.2)
30,000,000 to 50,000,000	35 (5.7)
50,000,000 to 100,000,000	37 (6.1)
Over 100,000,000	333 (57.8)
I do not know	145 (24.8)
No answer	16 (2.7)
Department	
Human sciences	135 (22.7)
Experimental sciences	133 (22.6)

Continued on next page

Table 1. Frequency and Relative Frequency (Percentage) of Demographic Variables for the Study Participants (Continued)

Mathematics and physics	38 (6.5)
Arts and architecture	98 (16.7)
Accounting	20 (3.4)
Physical education	7 (1.3)
Computer	8 (1.4)
No answer	149 (25.4)
History of mental disorders	
Yes	19 (2.8)
No	569 (97.2)
Psychiatric complaints, if positive	
No complaints	569 (97.2)
Insomnia	3 (0.5)
Anxiety	6 (1)
Depression	5 (0.9)
Obsession	1 (0.2)
A combination of depressive and obsessive symptoms	2 (0.3)
Aggression	1 (0.2)
Mood swings	1 (0.2)
Family history of psychiatric disorders	
Yes	42 (6.5)
No	436 (75.2)
I do not know	9 (15.7)
No answer	15 (2.6)
Smoking/drug abuse	
No	455 (77.4)
I prefer not to answer	70 (11.9)
Cigarettes	10 (1.7)
Alcohol	3 (0.5)
Hashish	7 (1.2)
Hookah	9 (1.5)
Cigarettes and hookah	12 (2)
Others	2 (0.3)

Abbreviation: IRR, Iranian Rial.

Table 2. Frequency and Relative Frequency (Percentage) of Electronic Devices

Variables and Levels	Frequency (Relative Frequency (%))
Own a personal computer	
Yes	352 (60.0)
No	229 (38.8)
No answer	7 (1.2)
Own a laptop	
Yes	234 (39.7)
No	349 (59.4)
No answer	5 (0.9)
Own a tablet	
Yes	254 (43.2)
No	326 (55.4)
No answer	8 (1.4)
Access to social networks	
Yes	550 (88.4)
No	66 (11.2)
No answer	2 (0.4)
Mobile phone owner	
Yes	538 (91.5)
No	49 (8.3)
No answer	1 (0.2)
Mobile phone access	
Yes	568 (96.6)
No	20 (3.4)
Connection to the Internet	
Yes	565 (95.9)
No	23 (3.9)
No answer	1 (0.2)
Uses of mobile phones	
Listening to music	532 (90.5)
Sending messages	434 (73.8)
Browsing the web	427 (72.6)
Chats	412 (70.1)
Using camera	397 (67.5)
Watching videos	325 (55.3)
Playing games	318 (54.1)
Checking social networks	299 (50.9)
Killing time	213 (36.2)
Reading news	142 (24.2)
Using Bluetooth	131 (22.6)
Using GPS	110 (18.9)
Checking emails	91 (15.5)
Scheduling meetings and tasks	66 (11.2)
Notes for lectures	43 (7.3)
Others	49 (8.3)
When is the mobile phone used?	
Spare time	489 (83.2)

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Table 2. Frequency and Relative Frequency (Percentage) of Electronic Devices (Continued)

Waiting time	378 (6.3)
Fatigue time	361 (61.4)
Public transport	314 (53.4)
TV or movie time	251 (42.7)
Time with friends	247 (42.1)
Walking time	204 (34.8)
Time to talk to someone	194 (33.0)
Between classes	191 (32.5)
Bathroom time	122 (20.7)
Dinner time	97 (16.5)
Class time	85 (14.5)
Driving time	62 (10.5)
Free time	21 (3.6)
Others	19 (3.2)
Sleep	13 (2.2)
Daily mobile phone use by hour	
Less than 1 hour	116 (19.7)
1 - 2	185 (31.5)
2 - 4	116 (19.7)
More than 4 hours	164 (27.9)
No answer	7 (1.2)
Mobile phone use by year	
Below 1 year	65 (11.0)
1 - 2	34 (5.7)
2 - 3	48 (8.1)
3 - 4	78 (13.3)
4 - 5	119 (20.3)
Over 5 years	240 (40.9)
No answer	4 (0.7)

Abbreviation: GPS, global positioning system.