

# The prevalence of smartphone addiction and its relationship with the level of e-Health literacy in medical sciences students

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## Article Info

**Article type:**  
Research

## Article History:

Received: 2023-10-28  
Accepted: 2024-01-15  
Published: 2024-02-17

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## Keywords:

Smartphone  
Addiction  
eHealth  
Literacy

## ABSTRACT

**Introduction:** Smartphone addiction has increased in recent years, especially with the onset of COVID-19 among students. It is possible that as the level of eHealth literacy increases among students, their addiction to smartphones decreases. This study aims to investigate this hypothesis.

**Material and Methods:** This cross-sectional study was conducted on 390 medical sciences students. Two standard questionnaires were used to gather data. The first questionnaire was the Smartphone Addiction Inventory Scale, and the second questionnaire was the eHealth Literacy Scale. Data were analyzed using descriptive and analytic statistics.

**Results:** There was no significant relationship between the gender of the participants and the mean scores of smartphone addiction or eHealth literacy. However, the relationship between the age of the participants and the mean scores of smartphone addiction or eHealth literacy was significant. Only the relationship between the educational level of the participants and the mean scores of smartphone addiction was significant. The correlation between smartphone addiction and eHealth literacy in students was not significant.

**Conclusion:** Age and educational level were significant factors influencing smartphone addiction. To decrease smartphone addiction and increase eHealth literacy, educational programs should be implemented for medical science students, who play a crucial role as future guardians of health.

## Cite this paper as:

Hajesmaeel-Gohari S, Mirzapourestabragh F, Zeidabadi-Nejad M. The prevalence of smartphone addiction and its relationship with the level of e-Health literacy in Medical Sciences students. *Front Health Inform.* 2024; 13: 189. DOI: [10.30699/fhi.v13i0.536](https://doi.org/10.30699/fhi.v13i0.536)

## INTRODUCTION

In recent years, with the advancement of information and communication technology, the use of smartphones has increased. A smartphone has features such as an operating system, internet, and the ability to install various applications [1]. By 2023, it is predicted that approximately 7 billion people around the world will be using smartphones, indicating that about 86.5% of the world's population will have access to this technology [2]. The studies have shown that with the onset of the COVID-19 disease, the use of smartphones and the duration of their usage has significantly increased due to quarantine, remote work, and distance learning [3]. With the increasing use of this technology, addiction to it also increases.

Addiction to smartphones is said to be associated with fear of being without a mobile phone, which is caused by excessive use of the internet, games, and

applications, and increases dependence on smartphones [4]. Addiction to smartphones occurs at various ages, but the age group most affected by it is 20 to 34 years old [5]. With the prevalence of the COVID-19 disease, students are using smartphones more. This group of people, in addition to using social networks and mobile-based games, are more likely to become addicted to smartphones because of searching for scientific topics on the Internet and participating in online educational classes [6]. The results of various studies have shown that more than 50 percent of students are addicted to smartphones [7, 8]. Addiction to this technology creates many physical, psychological, and educational problems for students. For example, addiction to smartphones leads to reduced sleep quality [9], increased depression [8], increased muscle problems and pain [10], and decreased student performance [11].

The use of information and communication

technologies in various areas of health and medicine has led to the emergence of the concept of e-Health. Effective use of electronic health services also requires literacy in this area. E-Health literacy refers to the ability to search, find, understand, and evaluate health information from electronic sources and use the knowledge gained to address or solve a health problem [12]. The results of a study showed that the level of e-Health literacy among students is relatively low [13]. In another study, the level of e-Health literacy among students was reported to be average. This study mentioned that students are aware of the available electronic health resources and know how to search and use them, but they lack skills to evaluate these resources and distinguish between high and low-quality sources [14]. According to previous studies, no research has been conducted on the relationship between addiction to smartphones and e-Health literacy among different communities, especially students. It is possible that as the level of e-Health literacy among students increases, their addiction to smartphones decreases. This study aims to investigate this hypothesis. The results of this study can be useful for university officials in controlling smartphone addiction among students and for better understanding the impact of e-Health literacy and necessary measures to improve it among students.

## MATERIAL AND METHODS

### Participants

This cross-sectional study was conducted from February 2023 to June 2023 in Kerman, Iran. The participants were medical science students who studied at Kerman University of Medical Sciences. The sample size was calculated based on the Yamane formula for categorical data [15]. Since the population size was more than 5000, the sample size included 357 students with a margin of error of 0.05 and a confidence level of 1.96 standard deviations. However, to reduce sampling error, the sample size was increased to 390.

### Data collection instruments

In order to collect data, two valid questionnaires were used. The first questionnaire was the Smartphone Addiction Inventory Scale (SAIS), which has 26 items (Table 2) with 4-point scale (1=strongly disagree to 4=strongly agree) and was introduced in 2014 [16]. The range of SAIS total score is from 26 to 104. This questionnaire was translated into Persian in 2021 and validated in the Iranian population [17]. Cronbach's alpha value of the SAIS was 0.94. Participants who scored greater than the mean SAIS score were considered as having "high addiction to smartphone".

The second questionnaire was the eHealth Literacy

Scale (eHEALS), which has 8 items (Table 4) with a 5-point Likert scale (1=very disagree to 5=very agree) and was introduced in 2006 [18], and was translated into Persian and validated in the Iranian population in 2016 [19]. Cronbach's alpha value of the eHEALS was 0.88. The range of eHEALS is from 8 to 40. Participants who scored greater than the mean eHEALS score were considered as having "high eHealth literacy level."

### Data collection process

The Persian paper-based version of questionnaires was distributed to participants by two researchers with an explanation of the research objectives and the importance of the study. Participants were assured that their information would be kept confidential and that there was no need to provide any identifying information.

### Data analysis

The data was analyzed by SPSS version 26 software. In order to analyze the collected data, descriptive statistic such as frequency, mean, and standard deviation (SD), and analytic statistic such as Pearson correlation coefficient, Mann-Whitney and Kruskal Wallis test were used.

## RESULTS

A total of 390 students completed the questionnaire. Participants were mostly female (317, 81.5%). The mean age of 375 participants that mentioned their age was  $23 \pm 3.87$  years. Most of the participants were bachelor students (284, 73%). Table 1 shows the demographic information of participants.

Table 1: Demographic information of students

Variables		Number (%)
Gender	Female	317 (81.5)
	Male	73 (18.5)
Age (year)	18-28	346 (92.5)
	29-39	25 (6.5)
	40-49	4 (1)
Educational level	Bachelor	284 (73)
	Master	25 (6.5)
	PhD	16 (4)
	MD	65 (16.5)

### Smartphone addiction

The frequency of responses to each SAIS' item presents in Table 2. The range of smartphone addiction in students was from 26 to 95 (mean= $58.5 \pm 14.14$ ) (Table 3). Half of the participants (195, 50%) had high addiction to smartphone. The results of the Mann-Whitney test showed that there was no significant relationship between gender of the participants ( $p > 0.05$ ), and the mean scores of smartphone addiction. The results of the Kruskal

Wallis test showed the relationship between age of the participants and educational level and the mean scores of smartphone addiction was significant (p=0.01).

**Table 2: The frequency of responses to Smartphone Addiction Inventory Scale items**

Row	Items	Scales n (%)			
		Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
1	I spent too much time on smartphone.	13 (3.5)	72 (18.5)	205 (52.5)	100 (25.5)
2	I feel uncomfortable when I don't use my smartphone.	74 (19)	145 (37)	140 (36)	31 (8)
3	I have noticed that I have become more dependent on my smartphone than before.	69 (17.5)	113 (29)	145 (37)	63 (16.5)
4	I feel uneasy and restless when the smartphone is not available.	54 (14)	136 (35)	147 (37.5)	53 (13.5)
5	I feel very energetic when using my smartphone, regardless of how tired it makes me.	86 (22)	151 (38.5)	124 (32)	29 (7.5)
6	I use my smartphone for a longer period of time than I intend to and I spend more money than I intend on it.	40 (10.5)	120 (30.5)	161 (41.5)	69 (17.5)
7	Although using a smartphone has had a negative impact on my relationships with others, the time I spend using the internet on my phone is still high.	92 (23.5)	143 (36.5)	115 (29.5)	40 (10.5)
8	It has happened more than once that I slept less than 4 hours due to the use of a smartphone.	120 (31)	117 (30)	96 (24.5)	57 (14.5)
9	In the last three months, the duration of smartphone use has increased significantly.	114 (29)	129 (33)	107 (27.5)	40 (10.5)
10	I feel distressed or depressed when I cut back on my smartphone use.	130 (33)	146 (37.5)	97 (25)	17 (4.5)
11	I can't control my strong desire to use the smartphone.	94 (24)	150 (38.5)	118 (30.5)	28 (7)
12	I have noticed that excessive use of the smartphone reduces the opportunity to interact with my friends.	91 (23.5)	154 (39.5)	107 (27.5)	38 (9.5)
13	Due to excessive use of the smartphone, I feel pain and fatigue in my back or eyes.	87 (22.5)	162 (41.5)	116 (29.5)	25 (6.5)
14	Every morning when I wake up, the first thing that comes to my mind is to use a smartphone.	49 (12.5)	109 (28)	130 (33.5)	102 (26)
15	Using a smartphone has had negative effects on my academic status or job performance.	99 (25.5)	156 (40)	102 (26)	33 (8.5)
16	When I don't use my smartphone, I feel like I'm missing something.	76 (19.5)	144 (37)	123 (31.5)	47 (12)
17	My interactions with family members have decreased due to the use of smartphones.	120 (31)	147 (37.5)	96 (24.5)	27 (7)
18	My recreational activities have been reduced using smartphones.	118 (30)	159 (41)	89 (23)	24 (6)
19	Immediately after I put the smartphone down, I have a strong desire to use it again.	80 (20.5)	139 (35.5)	134 (34.5)	37 (9.5)
20	My life would not be enjoyable without a smartphone.	91 (23.5)	131 (33.5)	127 (32.5)	41 (10.5)
21	Spending time on the smartphone has had negative effects on my physical health. For example, "using the phone while crossing the street and while driving" which is associated with risks.	146 (37.5)	136 (35)	84 (21.5)	24 (6)
22	I try to reduce the time of using the smartphone, but my efforts are in vain.	97 (25)	159 (41)	110 (28)	24 (6)
23	I have become accustomed to using a smartphone and my sleep time and quality have decreased.	106 (27)	144 (37)	109 (28)	31 (8)
24	Now, I must spend more time on the phone to get the satisfaction I used to get from short-term use.	159 (41)	143 (36.5)	74 (19)	14 (3.5)
25	I can't eat food without using a smartphone.	222 (57)	93 (24)	62 (16)	13 (3)
26	I feel tired during the day due to using the smart phone until late at night.	115 (29.5)	140 (36)	111 (28.5)	24 (6)

**Table 3: The range of smartphone addiction and eHealth literacy in students**

Smartphone addiction score		eHealth literacy score	
Range	n (%)	Range	n (%)
26-35	16 (4)	8-18	29 (7.5)
36-45	62 (16)	19-29	227 (58)
46-55	96 (24.5)	30-40	134 (34.5)
56-65	96 (24.5)		
66-75	75 (19)		
76-85	32 (8.5)		
86-95	13 (3.5)		

### eHealth literacy

The frequency of responses to each eHEALS' item presents in Table 4. The range of eHealth literacy in students was from 8 to 40 (mean=27±5.35) (Table 3). More than half of the participants (225, 57.5%) had

high eHealth literacy level. The results of the Mann-Whitney test showed that there was no significant relationship between gender of the participants (p>0.05) and the mean scores of eHealth literacy. The results of the Kruskal Wallis test showed the

relationship between age of the participants and the mean scores of eHealth literacy was significant ( $p=0.04$ ), however the relationship between

educational level of the participants and the mean scores of eHealth literacy was not significant ( $p=0.1$ ).

**Table 4: The frequency of responses to eHealth Literacy Scale items**

Row	Items	Scales n (%)				
		Very disagree	Disagree	No idea	Agree	Very agree
1	I know what health resources are available on the Internet.	14 (3.5)	25 (6.5)	159 (41)	156 (40)	36 (9)
2	I know where to find useful health resources on the Internet.	11 (3)	41 (10.5)	137 (35)	172 (44)	29 (7.5)
3	I know how to find useful health resources on the Internet.	7 (2)	49 (12.5)	121 (31)	175 (45)	38 (9.5)
4	I know how to use the health information I find on the Internet to help myself.	11 (3)	37 (9.5)	119 (30.5)	187 (48)	36 (9)
5	I know how to use the internet to answer my health questions.	6 (1.5)	27 (7)	110 (28)	210 (54)	37 (9.5)
6	I have the skills to evaluate health resources I find on the Internet.	10 (2.5)	53 (13.5)	136 (35)	154 (39.5)	37 (9.5)
7	I can distinguish high-quality health resources from low-quality ones on the Internet.	21 (5.5)	69 (17.5)	142 (36.5)	128 (33)	30 (7.5)
8	I feel confident in using internet information to make health decisions.	25 (6.5)	86 (22)	151 (38.5)	107 (27.5)	21 (5.5)

### The relationship between smartphone addiction and eHealth literacy

There was not a correlation between smartphone addiction and eHealth literacy in students ( $p>0.05$ ) (Table 5).

**Table 5: The correlation between smartphone addiction and eHealth literacy**

		eHealth literacy
Smartphone addiction	Pearson correlation	0.019
	P-value	0.702

## DISCUSSION

This study examined the relationship between smartphone addiction and the level of e-Health literacy among medical sciences students. The results indicated that this relationship was not significant. The mean score for smartphone addiction among students was 58.5, with half of the participants exhibiting high addiction to smartphones. Another study conducted on students with Arabic speech language yielded similar results [8]. However, a separate study in China reported that approximately 40 percent of students had smartphone addiction [20]. These differences may be attributed to cultural variations across different countries. The results of a study showed that male European students had the highest level of smartphone addiction, followed by male African and male Asian [21].

The mean score of eHealth literacy in students was

27, and more than half of the participants (57.5%) had high eHealth literacy level. Another study conducted on 192 medical students in Mashhad showed a higher mean score (28.2) [13]. However, another study conducted on 1000 medical students in Alborz showed a lower mean score (26.1) [22]. The differences in the results of the studies on Iranian students may be due to the number of participants in these studies. Different factors such as English language skills, the Internet skills, skills in searching health information on the Internet have significant impact on the students' e-Health literacy [23]. Paying attention to these factors and training in this field can have a positive effect on improving the level of e-Health literacy of students.

The relationship between the age of the participants and the mean scores of smartphone addiction or eHealth literacy was significant. The students aged 18-28 years old had the highest mean score for smartphone addiction, and most of the participants belonged to this age group. Other studies have also confirmed these results and demonstrated that young adult students were more addicted to smartphones compared to other age groups [24, 25]. The students aged 29-39 years old had the highest mean eHealth literacy. Another study yielded similar results, indicating that as students' age increased, their level of eHealth literacy also increased. Specifically, students over 28 years old demonstrated a higher level of literacy [26]. This could be attributed to the fact that older students possess more information and experience in utilizing the Internet and information technologies in their daily lives, particularly regarding their health.

There was a significant relationship between the participants' educational level and the mean scores of smartphone addiction. Specifically, master's degree students had the highest mean score for smartphone addiction. These findings contradict the results of another study, which indicated that bachelor's degree students were more addicted to smartphones [27]. University students are the age group most interested in using smartphones for various activities such as studying, entertainment, accessing the Internet or social networks, and social communication [28]. It is possible that master students use smartphones more because they have more ability to use the Internet and search for information than bachelor students. Additionally, master's students typically use the Internet more to conduct research and to complete their thesis. Therefore, they may be more prone to smartphone addiction.

To the best of our knowledge, this is the first study evaluating the relationship between smartphone addiction and eHealth literacy in medical science students. However, it has some limitations. The study was conducted solely on medical students from a university in Iran. Perhaps obtaining data from medical students at other universities would yield more robust results. It is recommended that future studies collect data from different universities of Iran (medical and non-medical) and compare the results of different universities.

## CONCLUSION

This study revealed that smartphone addiction did

not have a relationship with the level of eHealth literacy among medical science students. However, approximately half of the students were found to be addicted to smartphones. Age and educational level were significant factors influencing smartphone addiction. These results provide authorities with valuable insights into which students are more prone to smartphone addiction. Additionally, more than half of the students demonstrated a high level of eHealth literacy. To further increase this number, educational programs should be implemented to enhance the information retrieval and evaluation skills of medical science students, who play a crucial role as future guardians of health.

## AUTHOR'S CONTRIBUTION

All authors contributed to the literature review, design, data collection and analysis, drafting the manuscript, read and approved the final manuscript.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this study.

## FINANCIAL DISCLOSURE

No financial interests related to the material of this manuscript have been declared.

## ETHICS APPROVAL

The ethics committee of Kerman university of medical sciences approved this research. The ethics approval code is IR.KMU.REC.1401.487.

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