



Review



Smartphone addiction, risk factors and its adverse effects in nursing students: A systematic review and meta-analysis

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ARTICLE INFO

Keywords:

Addiction
Nomophobia
Nursing students
Smartphone
Systematic review

ABSTRACT

Background: Smartphones are technological devices that have a great impact on people's daily lives changing their habits and behaviors. The utilities and capabilities of these devices are increasing and the foresight is that this tendency will grow in the next years. However, the problematic use of the smartphone has increased dangerously, interfering with the clinical practice of healthcare professionals.

Objective: To conduct a systematic review and a meta-analysis to estimate the prevalence of smartphone addiction, also known as nomophobia, in nursing students and to identify its related factors and its negative effects.

Design: Systematic Review and Meta-analysis.

Data sources: The literature search was done in CINAHL, Proquest, Pubmed, Scopus and Web of Science databases.

Review methods: The search equation was "(nomophobia OR smartphone) AND nurs* student*". $n = 16$ articles were identified.

Results: The meta-analytic estimation of nomophobia or smartphone addiction was 22% (CI95% 18%–26%) in a sample of $n = 2780$ nursing students. Smartphone usability is very extended during the clinical practice by nursing students. They indicated using the device or watching other students distracted with their smartphone. Some variables related to excessive use in nursing students are lower sleep quality, lower self-esteem, higher social distress, lower perceived social support or lower communication skills between others.

Conclusions: The main use of the smartphone by nursing students is for communication with other people and some of them indicate that it can be a distraction.

1. Introduction

Smartphones have become an essential part of our lives and their use has increased in recent years. 65% of the world population declared having a smartphone in 2019. The areas where it is most used are North America (82%) China (72%) and Europe (70%). The prediction is that 80% of the population will have a smartphone by 2025 and this proportion increases to 90% in countries with higher use (GSMA, 2020).

The versatility of this technology has had a high impact on our lives and social relationships (Aranda López et al., 2017). Younger

generations use smartphones for a variety of activities such as studying, entertaining, accessing the internet or social networks and social communication (Aker et al., 2017). Smartphone use has become conventional in our lives and has introduced changes in our daily activities and habits (Bragazzi et al., 2019).

2. Background

However, problematic smartphone use has increased worryingly in developed countries in recent years (Gutiérrez-Puertas et al., 2019). The

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<https://doi.org/10.1016/j.nedt.2020.104741>

Received 7 June 2020; Received in revised form 25 November 2020; Accepted 17 December 2020

Available online 28 December 2020

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term nomophobia has emerged referring to users's dependence or addiction to their smartphones (Dixit et al., 2010). Nomophobia is described as "the fear of not having contact with the mobile phone or an uncontrollable fear of leaving home without a mobile phone" (SecurEnvoy, 2012). The term nomophobia comes from the expression "non-mobile-phone phobia" (Yildirim and Correia, 2015).

Using the smartphone continuously can interfere in the hospital environment, since professionals and the students carry it with them throughout the work shifts. Regarding nurses, 75% admit using their mobile phones at work for personal matters. Interruptions caused by the inappropriate use of these technologies can cause essential nursing tasks to be overlooked or to create a deficit in patient care (Gutiérrez-Puertas et al., 2019). Also, the use of the smartphone can interrupt communication with patients, can affect visual contact and verbal and non-verbal communication, which favor active listening, and can difficult the therapeutic relationship. Furthermore, the use of smartphones and social networks can compromise patients' confidentiality. On the other hand, these devices present on their surface a high level of bacterial contamination, which compromises hygiene and asepsis in spaces like the operating room (Gill et al., 2012).

Taking into account the risks that the use of the smartphone has in the clinical environment, it is interesting to assess this problem in nursing students. Therefore, the aim of this study was to analyze the prevalence of smartphone addiction in nursing students, its negative effects and its related factors.

3. Method

This systematic review with meta-analysis was done following the PRISMA guideline (Preferred report items for systematic reviews and Meta-analyses) (Moher et al., 2015).

3.1. Information resources and search equation

The electronic databases CINAHL, Proquest, Pubmed, Scopus and Web of Science were consulted. MeSH descriptors were used and the search equation was "(nomophobia OR smartphone) AND "nurs * student". To minimize publication bias, no restrictions were established according to the date of publication, the study design or the sample size of the studies. Systematic reviews or previous meta-analyses related to the topic were reviewed to find more studies. The bibliographic references of the studies included in this work were also reviewed. The search was conducted in February 2020.

3.2. Inclusion and exclusion criteria

The inclusion criteria were the following: (a) Primary research studies, (b) Publication language (English or Spanish), (c) Nursing student sample, (d) Data about smartphone addiction, negative effects or related variables in nursing students.

The exclusion criteria were: (a) Studies with mixed samples without individual information about nursing students and (b) studies with the aim of analyzing the benefits of smartphone use in the educational environment. The duplicate articles were excluded or the ones that didn't fulfilled the inclusion criteria.

The search in the databases identified 569 articles. The first step was to remove duplicate articles, a total of 298 studies. Second, the titles and abstracts were read and after that, 212 articles that did not meet the inclusion criteria were removed. Finally, 59 full text were reviewed, leaving a final sample of $n = 16$ studies that met the inclusion criteria for this work. From the final sample of the systematic review ($n = 16$), only half of the studies had the necessary information for the meta-analysis, leaving a final sample for the meta-analysis of $n = 8$ studies (Fig. 1).

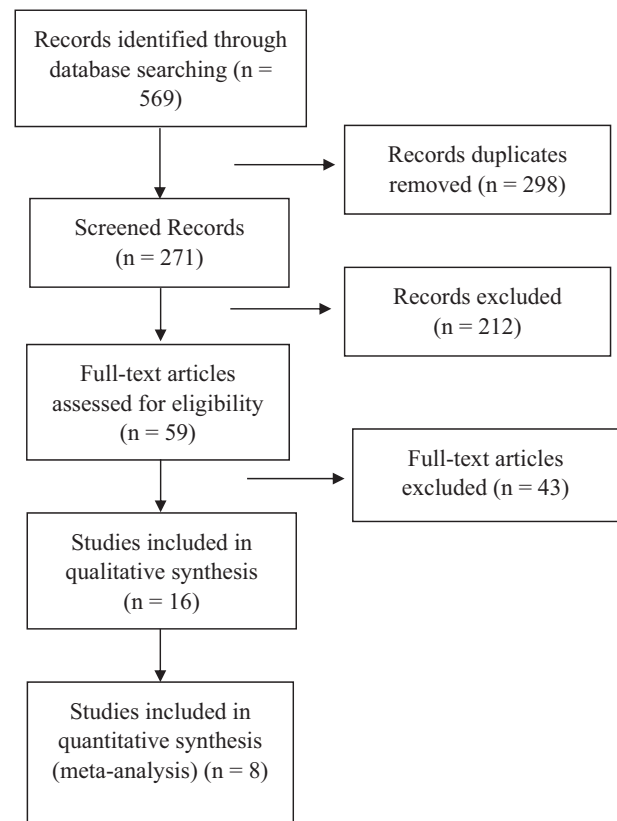


Fig. 1. Flow diagram.

3.3. Codification of the results

The codification of the studies was performed out by two members of the research team independently. In cases of disagreement, a third researcher with extensive experience in systematic review and meta-analysis studies was consulted.

In this systematic review the following variables were included:

Publication variables: (a) authors, (b) date of publication, (c) country of publication, (d) language (English or Spanish), (e) sample size, (f) percentage of woman in the study, (g) age in years of the study sample (mean, standard deviation or range).

Methodological variables: (h) design, (i) level of evidence, (j) usability of a nomophobia measuring instrument, (k) nomophobia measuring instrument, (l) original vs adaptation nomophobia instrument.

Nomophobia variables: main results of nomophobia in nursing students, including (m) prevalence of nomophobia, (n) hours spent using the smartphone per day, (or) mean and standard deviation of the scoring in nomophobia, (p) related variables with the excessive use of the smartphone and (q) adverse effects of the smartphone use during the clinical practice.

3.4. Data analysis

A descriptive analysis of the variables included in the systematic review was performed, informing about the quality of the publications using the evidence levels (going from 1 to 5) and the recommendations grades (being A de highest and D the lowest) proposed by the Oxford Centre for Evidence-Based Medicine (OCEBM, 2011) as reference.

The meta-analytical estimation of smartphone addiction prevalence in nursing students with a 95% confidence interval was calculated with a random effects meta-analysis using StatsDirect software. In addition, a sensitivity analysis (eliminating one study from the analysis each time to check that the results of the meta-analysis did not significantly change)

Table 1
Summary table of studies included in the systematic review.

Author & year	Design & sample	Instruments	Results	Evidence/degree of recommendation
Ahn and Kim (2015). South Korea	Cross-sectional descriptive study. N = 723. 89.9% are women. The average age of participants is 21.06.	Smartphone use was measured using the Hwang et al. (2010) scale based on the Han and Hur (2004) mobile phone addiction scale.	There is a relationship between the use of the smartphone and the quality of sleep. Greater use of the smartphone is related with lower quality of sleep. Excessive use of smartphones and stress are influential factors in the quality of sleep of nursing students in this study.	2c/B
Jeong and Lee (2015) South Korea	Cross-sectional descriptive study. N = 598. 88.3% are women. 65.3% of the participants were between 20.24 years old.	Smartphone Addiction Proneness Scale (National Information Society Agency, 2011).	The 17.5% of the participants are in the group of smartphone addicts, of which 11.5% are in the potential risk group and 6% in the high-risk group. The factors that influence smartphone addiction in nursing students are: "reading quantity, number of friends, number of groups involved, academic achievement, average daily hours of smartphone use, and personal distress".	2c/B
Cho and Lee (2016) Republic of Korea	Cross-sectional descriptive study. N = 312. 89.1% are women. The average age of the participants is 21.7 years.	Scale on Attitude Towards Smartphone Use in Clinical Practicum (Cho and Lee, 2016).	The 27.2% used more than 5H/day their smartphone and 55.7% minimum 3 h/day. 46.2% reported using a smartphone at least "sometimes", while 63.2% of respondents had seen other students using smartphones during clinical practice at least "sometimes". In distractions, 42.9% "always, often or sometimes" had seen other students distracted with smartphones.	2c/B
Oh and Oh (2017) Korea	Cross-sectional descriptive study. N = 329. 100% are women. 98.5% of participants are under 20 years of age.	Smartphone Addiction Proneness Scale (National Information Society Agency, 2011).	64.1% of participants use 3 h or more a day on their smartphone. The main motivation for its use was to be communicated (49.8%). The average of participants in self-esteem, empathy and smartphone addiction was above the moderate level. There is a negative relationship between self-esteem and smartphone addiction.	2c/B
Aguilera-Manrique et al. (2018) Spain	Cross-sectional descriptive study. N = 304. 73% are women. The average age of the participants is 22.77.	Nomophobia Questionnaire (Yildirim and Correia, 2015). Scale on Attitude Towards Smartphone Use in Clinical Practicum (Cho and Lee, 2016).	The 23.4% of participants indicate that they use their smartphone for >5 h a day. The average nomophobia score was 82.39 (18.63). The women's group scored higher than the men's group. Positive relationships were found between smartphone use and "giving up convenience" and total nomophobia score. Positive relationships were also found between opinion on smartphone restriction policies and total score and nomophobia subscales.	2c/B
Ayar et al. (2018) Turkey	Cross-sectional descriptive study. N = 755. 82.5% are women. The average age of participants is 21.4.	Nomophobia Scale (Yildirim and Correia, 2015).	The 51.1% of the participants spent between 1 and 3 h daily on social networks and 22.8% used them between 4-6H daily. According to nomophobia scores, 51.9% of participants were moderately nomophobic and 13.6% were severely nomophobic. We found a direct relationship between the levels of nomophobia and the variables "problematic internet use", "social appearance anxiety" and "social media use".	2c/B
Kim and Kim et al. (2018) Korea	Cross-sectional descriptive study. N = 185. 91.4% are women. 49.2% are 21–22 years old.	Smartphone Addiction Proneness Scale (National Information Society Agency, 2011).	The 21.1% of the participants belonged to the "smartphone addiction" Group (8.1% high-risk users and 13% potential high-risk users). Differences were found in social distress, showing the group of addicts a higher level of social distress (39,74) than the normal group (37,21). A positive relationship was found between the level of smartphone use and social distress. Communicative competence was negatively related to social evasion and social distress.	2c/B
Lee et al., 2018 Korea	Cross-sectional descriptive study. N = 324. 91.4% were women. 98.1% of the participants were under 25 years of age.	Smartphone addiction inventory (Kang and Park, 2012).	In the Smartphone Addiction Inventory, the subscale with the highest score was "overuse" and "cyberspace-oriented relationship" scored the lowest. The cyberspace-oriented relationship, subscale of smartphone addiction, and social support were positively related to the interpersonal competence of nursing students.	2c/B
Yayan et al. (2018) Turkey	Cross-sectional descriptive study. N = 788. 58% are women The average age of participants is 20.80 (2.67).	Smartphone Addiction Scale (Kwon, Lee et al., 2013).	None of the participants left their phones outside their room while asleep, and 77.7% checked their phones when they woke up. 47.7% used their phones during classes. Participants with sports or reading habits had lower average scores on the internet and smartphone addiction scales. Participants who checked their phones early in the morning or used their phones during classes had higher average scores on the internet and smartphone addiction scales.	2c/B
Akturk and Budak (2019) Turkey	Cross-sectional descriptive study. N = 1049. 62.7% were women. 48.6% of the	Brief Form of Smartphone Addiction Scale (Kwon, Kim et al., 2013).	50.3% of the participants used the smartphone >4 h a day. Differences were found in total smartphone addiction scores by age, sex, duration of smartphone use, and internet use of smartphone. We found a negative	2c/B

(continued on next page)

Table 1 (continued)

Author & year	Design & sample	Instruments	Results	Evidence/degree of recommendation
Greer et al. (2019) United States	participants were 21–23 years old. Cross-sectional descriptive study. N = 253. 87.7% are women. The average age of participants is 31.3.	Adapted Attitude Towards Smartphone Use in Health Care survey (Cho and Lee, 2016)	relationship between smartphone addiction scores and perceived Social support. 90% of participants used a smartphone during the practicum. Text messages were the most frequent activity. Regarding the daily usage time, 25.3% use the phone >5 h/day and 36.7% use it between 3 and 5h/day. Most students said there was no need for restrictive policies (63.6%)	2c/B
Gutiérrez-Puertas et al., 2019a Portugal	Cross-sectional descriptive study. N = 128. 87.5% are women. The average age of the participants is 20.04	Nomophobia Questionnaire (Yildirim and Correia, 2015).	54.7% of Portuguese students indicated that they would feel anxious if they ran out of mobile phone battery. The average total score of the nomophobia questionnaire was 93.82 (21.98) (range 20–140). The boys had an average score of 79.19(25.39), and the girls had an average score of 95.91 (20.75).	2c/B
Gutiérrez-Puertas et al., 2019b Spain	Cross-sectional descriptive study. N = 258. 74.6% are women. The average age of participants is 21.52.	Nomophobia Questionnaire (Yildirim and Correia, 2015).	35.4% of students said they would feel anxious if their mobile phone ran out of battery In Spain, the average total nomophobia score was 78.84 (18.91) (range 20–140). In the nomophobia instrument, the highest score was obtained in the dimension “not being able to communicate” [25.44(0.90)], followed by the dimension “giving up convenience” [19.98(5.50)].	2c/B
Sok et al. (2019) Korea	Cross-sectional descriptive study. N = 139. 84.2% were women. 59% of participants were ≤22 years old	5 items about the features of using the smartphone	52.5% of participants started using smartphones after entering university. Most participants indicated that the main function of smartphones was social networks (77.7%). In relation to the time of daily use of smartphones, 36% of participants use their smartphone daily between 3 and 6 h and 21.6% use it >6 h a day. 28.7% of participants are in the group at risk of addiction to smartphones. There are differences in self-control and stress between the group at risk and the general group.	2c/B
Zarandona et al. (2019). Spain	Cross-sectional descriptive study. N = 234. 86.3% are women. The average age of participants is 21.55 (3.42).	23 items of several validated instruments (Cho and Lee, 2016; McBride et al., 2015; Tran et al., 2014)	Regarding the Daily time of use, 39.7% of the participants used their smartphone from 3 to 5 h a day and 20.7% admitted using it >5 h a day. Students used their smartphones to access social networks (98.3%), and for internet searches (77.9%). When students were asked how much they used their smartphones in working hours during their internships, the vast majority said they used it for less than an hour (94.8%). 23.3% of participants admitted having used their smartphone for personal reasons at least once during their practice.	2c/B
Celikkalp et al. (2020). Turkey	Cross-sectional study. N = 292.	The Smartphone Addiction Scale-Short Version (Kwon, Kim et al., 2013).	The nursing students used their smartphones mainly to send messages and connect to social media services. Low SAS-SV and academic scores were lower in groups of students using smartphones in class. It was found that smartphone addiction negatively affected participants' communication skills.	2c/B

and publication bias with Egger linear regression test and I^2 test for heterogeneity were performed.

4. Results

4.1. Study characteristics

The articles included in the systematic review were published between 2015 and 2020. According to the publication year of the studies included in the systematic review, 2 of the studies were published in 2015 (Ahn and Kim, 2015; Jeong and Lee, 2015), 1 study was published in 2016 (Cho and Lee, 2016), 1 study was published in 2017 (Oh and Oh, 2017), 5 studies were published in 2018 (Aguilera-Manrique et al., 2018; Ayar et al., 2018; Kim and Kim, 2018; Lee et al., 2018; Yayan et al., 2018), 6 studies were published in 2019 (Akturk and Budak, 2019; Greer et al., 2019; Gutiérrez-Puertas et al., 2019; Sok et al., 2019; Zarandona et al., 2019) and 1 study has been published in 2020 (Celikkalp et al., 2020). According to the country of the study, 7 were conducted at university centers in Korea (Ahn and Kim, 2015; Cho and Lee, 2016; Jeong and Lee, 2015; Kim and Kim, 2018; Lee et al., 2018; Oh and Oh, 2017; Sok et al., 2019), 4 in Turkey (Akturk and Budak, 2019; Ayar et al., 2018; Celikkalp et al., 2020; Yayan et al., 2018), 3 in Spain

(Aguilera-Manrique et al., 2018; Gutiérrez-Puertas et al., 2019; Zarandona et al., 2019), 1 in Portugal (Gutiérrez-Puertas et al., 2019b) and 1 in the United States of America (Greer et al., 2019). According to the design of the research, all studies were cross-sectional and descriptive. The sample size of the studies varies among 128 participants (Gutiérrez-Puertas et al., 2019a) and 1049 participants (Akturk and Budak, 2019). The average number of participants is 417 (SD = 275). The 16 studies included in the systematic review group a total of 6671 nursing students.

A total of 15 studies indicated the percentage of women in the sample. The average percentage of women in the studies was 83.10% (SD = 11.35), taking a minimum value of 58% (Yayan et al., 2018) and a maximum value of 100% (Oh and Oh, 2017). Regarding the age of the participants, 9 of the studies indicated the mean age of the participants, taking a minimum value of 20.04 years (Jeong and Lee, 2015) and a maximum value of 31.30 years (Greer et al., 2019). The mean age of the participants is 22.46 years (SD = 3.39). Among studies that indicate age in a range, the majority of nursing students were in the age range of 20 to 24 years (Akturk and Budak, 2019; Jeong and Lee, 2015; Kim and Kim, 2018; Lee et al., 2018; Sok et al., 2019).

4.2. Nomophobia measurement instrument

The nomophobia was measured with different instruments. The instruments were created specifically for the measurement of nomophobia and, in cases where a non-original version of the same instrument was used, a trial of adaptation and validation of the instrument was previously done. The instruments used for measuring nomophobia were the Smartphone Addiction Proneness Scale developed by the National Information Society Agency in 2011 (Jeong and Lee, 2015; Kim and Kim, 2018; Oh and Oh, 2017), the Nomophobia Questionnaire developed by Yildirim and Correia in 2015 (Aguilera-Manrique et al., 2018; Ayar et al., 2018; Gutiérrez-Puertas et al., 2019a,b), the Scale on Attitude Towards Smartphone Use developed by Cho and Lee in 2016, (Aguilera-Manrique et al., 2018; Cho and Lee, 2016; Greer et al., 2019) and the Smartphone Addiction Scale by Kwon, Lee et al. (2013); Yayan et al., (2018) or the Smartphone Addiction Scale–Short Version developed by Kwon, Kim et al. (2013a); Akturk and Budak, 2019; Celikkalp et al., 2020). To a lesser extent, other instruments have been used to measure nomophobia: the scale developed by Hwang et al. (2010) (Ahn and Kim, 2015) or the Smartphone Addiction Inventory developed by Kang and Park in 2012 (Lee et al., 2018). The most used instrument in the included studies was the Nomophobia Questionnaire (Cronbach's alpha of 0.945), used in 25% of the studies. The Smartphone Addiction Proneness Scale (Cronbach's alpha of 0.88), the Smartphone Addiction Scale (Cronbach's alpha of 0.94) and the Scale on Attitude Towards Smartphone Use (Cronbach's alpha of 0.81) were used in 18.75% of the studies.

4.3. Relationship between the smartphone addiction with other variables

The main reason for using the smartphone in nursing students is to be communicated (Celikkalp et al., 2020; Oh and Oh, 2017; Sok et al., 2019). Nursing students indicated that they would feel anxious if the battery ran out on their smartphone (Gutiérrez-Puertas et al., 2019), being the usual thing not to leave the smartphone out of the room while sleeping and check it when they wake up (Yayan et al., 2018).

Among the variables related to the excessive use of smartphones, a relationship has been found with lower sleep quality (Ahn and Kim, 2015), lower self-esteem (Oh and Oh, 2017), higher social distress (Kim and Kim, 2018), lower perceived social support score (Akturk and Budak, 2019), lower communication skills (Celikkalp et al., 2020), less sports or reading habits (Yayan et al., 2018), lower academic performance (Celikkalp et al., 2020; Jeong and Lee, 2015) and problematic internet use (Ayar et al., 2018).

Regarding the sex of the participants, differences have been found in nomophobia scores, with the group of women presenting significantly higher scores than men (Aguilera-Manrique et al., 2018; Akturk and Budak, 2019; Gutiérrez-Puertas et al., 2019).

4.4. Usability during the clinical practice

One of the reasons of concern is the distractions that the use of the smartphone may cause during clinical practice. In the studies included in this systematic review, it has been found that the use of smartphones is widespread during the clinical practices (Cho and Lee, 2016; Greer et al., 2019; Zarandona et al., 2019). Students recognize that they use their smartphone between 46.2% (Cho and Lee, 2016) and 90% (Greer et al., 2019) during their clinical practices, with text messages being the most frequent activity. Distractions are not only caused by the use of the smartphone itself, but also the use of the device by peers. Students indicated that 63.2% had seen other students using their smartphone and 42.9% that seen other students with the smartphone distracted them (Cho and Lee, 2016). Regarding the time of use of the smartphone during clinical practices, 94.8% said they used it less than an hour and 23.3% used it for personal reasons (Zarandona et al., 2019).

Due to the misuse of the smartphone during clinical practice hours,

nursing students were asked about the need for restrictive policies on smartphone use during clinical practice, most students indicated that there was no need to apply restrictive measures (Greer et al., 2019), only a small part agreed with the implementation of restrictive policies. Students with higher smartphone use tended to disagree with hospital smartphone restriction policies (Cho and Lee, 2016).

4.5. Smartphone addiction

Smartphone addiction is measured in the studies included in this systematic review with two indicators. Given the daily number of hours using the smartphone, the National Information Society Agency (2011) states that a daily use of the smartphone >5 h a day is a criterion indicating addiction. In the studies in which the percentage of participants using their smartphone is indicated, a minimum of 5 h per day is between a range of 20–27% (Aguilera-Manrique et al., 2018; Ayar et al., 2018; Cho and Lee, 2016; Greer et al., 2019; Sok et al., 2019; Zarandona et al., 2019). Given the daily number of hours using the smartphone, the percentages of smartphone use between 3 and 5 h daily vary between 36% and 64.1% (Akturk and Budak, 2019; Ayar et al., 2018; Cho and Lee, 2016; Greer et al., 2019; Oh and Oh, 2017; Sok et al., 2019; Zarandona et al., 2019). According to the score obtained in the instruments of nomophobia administered to nursing students (Ayar et al., 2018; Jeong and Lee, 2015; Kim and Kim, 2018; Sok et al., 2019), the percentages vary between 13.6% CI95% [0.11, 0.16] (Ayar et al., 2018) and 28.7% CI95% [0.21, 0.37] (Sok et al., 2019) (Table 1:).

4.6. Meta-analysis estimation of smartphone addiction

The meta-analytical estimation of nomophobia prevalence was 22% CI95% [18%, 26%] (Graphic 1) with a total sample of $n = 2780$ nursing students. The I^2 value was 84.7% indicating a high heterogeneity. The sensitivity analysis showed that the results of the study did not vary significantly when one of the included studies was deleted.

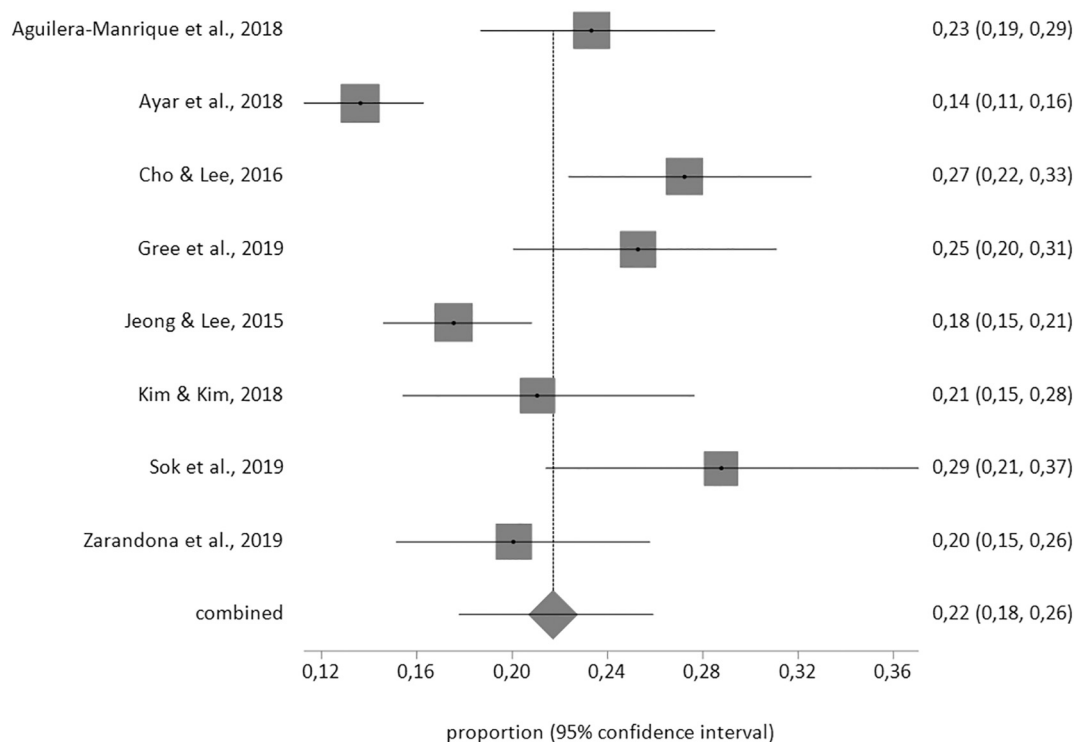
5. Discussion

The aim of this systematic review and meta-analysis was to estimate the prevalence of nomophobia in nursing students, as well as to identify the adverse effects and related factors.

The date of publication of the studies included in the systematic review indicates that it is a recent problem, which is beginning to study and to know their characteristics and peculiarities (Carbonell et al., 2018; Kim et al., 2018; Kuss et al., 2018; Lopez-Fernandez et al., 2018; Mei et al., 2018; Rozgonjuk et al., 2018). All of the studies included in this work present a cross-sectional descriptive design, it is advisable to start with designs of this type when the study problem is new, since the first thing that is needed is the description of the phenomenon of study. At a later time, other studies should be proposed or conducted not only to study the incidence or prevalence of nomophobia, but to go a step further and plan strategies for preventing addiction to smartphones (Arpaci et al., 2019; Tateno et al., 2019).

Regarding the prevalence of nomophobia in nursing students, a prevalence of 22% has been estimated. So, almost a quarter of the studied population meets the criteria of nomophobia. These values are worrying, both because of the prevalence rate and because of the consequences that it may have on the daily lives of students with nomophobia. The prevalence data estimated in this meta-analysis are practically the same as those found in another meta-analysis of nomophobia in children and youth (Sohn et al., 2019) and recent prevalence studies (Kaviani et al., 2020).

Although nomophobia is a recent study phenomenon there are several measuring instruments developed specifically to measure nomophobia and these instruments work well in different places (Cho and Lee, 2016; Kwon, Kim et al., 2013; Kwon, Lee et al., 2013; National Information Society Agency, 2011; Yildirim and Correia, 2015). For



Graphic 1. Forest plot, prevalence of smartphone addiction in nursing student's meta-analytical estimation.

studies in which the instruments were applied in places or languages other than the one in which they were created, prior validation studies of the instruments had been done. Reliable, valid and sensitive measuring instruments are essential to be able to make safe decisions on the data obtained by the instruments. It is essential to develop research focused on understanding the problematic use of smartphones, which will help to develop assessment tools that can effectively measure the nomophobia phenomenon (Harris et al., 2020).

One aspect that is of great concern to the health community is the use of smartphones during nurses' working hours, resulting in more distractions in their daily work practice. The nurse tasks require concentration in order to properly perform their work, and there are no mistakes or second opportunities. Most nursing students indicated that it is not necessary to implement restrictive measures on the use of the smartphone during the shift (Cho and Lee, 2016; Greer et al., 2019). However, in view of the results found in this study, which are in line with the results found in registered nurses, it is essential to control by the health authorities the use of the smartphone during the working hours (Sergeeva et al., 2016). Excessive smartphone use or nomophobia can reduce communication between patients and healthcare professionals and reduce the quantity and quality of healthcare personnel (Bülbüloğlu et al., 2019).

Other review studies on nomophobia not focused specifically on the nursing population have been done (Rodríguez-García et al., 2020; Sohn et al., 2019). Therefore, this work presents the added value of studying the particularities that can cause excessive use or addiction to the smartphone in nursing students. Once the problem has been identified, it will be possible to design programs to prevent the excessive use of the smartphone for nurses. The ban on the use of the smartphone during the working hours, cannot be the only measure to take, since the restrictions have a limited effect. If the effect on today's Society of this new addiction wants to be limited, strategies to prevent this addiction are essential.

5.1. Strengths/limitations

Among the advantages of systematic reviews or meta-analyses is the total sample size (Rodríguez-García et al., 2020). This systematic review presents data from almost 7000 nursing students. The large sample sizes favor the generalisation of results.

As it is a recent phenomenon, studies started to be published until 2015, further research is needed on the phenomenon of Nomophobia. Both to estimate its prevalence, and to identify which personal variables are present in people who spend more hours a day on their smartphones (Gonçalves et al., 2020; Harris et al., 2020; Kaviani et al., 2020).

5.2. Implications for nursing education

Those responsible for training future nurses need to take into account the massive use of smartphones and work with them on guidelines to identify contexts and times when smartphones cannot be used during clinical practice (Aguilera-Manrique et al., 2018). Further research is needed to identify risk and protective factors and addiction to smartphones. The identification of risk and protective factors of Nomophobia behaviour will help in the creation of Nomophobia prevention programmes applied to Health Science professionals.

5.3. Implications for nursing practice

Nursing students who show high levels of nomophobia regularly use their smartphones during their clinical practice (Aguilera-Manrique et al., 2018). The relationship between dependence on smartphones and distractions and its consequences in the clinical environment needs to be studied. The excessive use of smartphones by Health Professionals reduces the quality and quantity of service received by patients (Bülbüloğlu et al., 2019).

5.4. Recommendations for future research

Studies are needed in countries and settings where the prevalence of

Nomophobia has not yet been estimated. Estimating the global prevalence will provide insight into the actual number of people who have a problem with smartphone addiction.

Knowledge of the personal characteristics associated with the excessive use of smartphones will allow the development of effective programmes for preventing the excessive use of smartphones for health professionals.

6. Conclusion

About 22% of nursing students present smartphone addiction. Most of them use the smartphone during the clinical practices and have seen other students using it. The main use is communication with other people and some of them indicate that it can be a distraction. Some variables related to the excessive use in nursing students are lower sleep quality, lower self-esteem, higher social distress, lower perceived social support or lower communication skills between others.

Ethical approval

Not applicable.

Funding statements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

None.

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