Dependence on mobile devices among health science university students: a cross-sectional analytical study

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ABSTRACT: There are negative health consequences associated with dependence on mobile devices. To date, there is no study published in Colombia that would feature mobile phone dependence and its prevalence among university students. Hence, an observational, cross-sectional, analytical study was conducted on students from the Department of Health at Santiago de Cali University (Universidad de Santiago de Cali) in 2018, in the city of Cali, Colombia, with a population of 4,194 students. The sample size calculation indicated a total of 352 students (95% CI, 5% error) to be included in the study, selected according to stratified random sampling. About 70% of the students had some level (high, average or low) of dependence on mobile devices. From these, 25% had a high level of dependence. Programmes with the highest prevalence were speech therapy, dentistry, physiotherapy and medicine. While programmes with the highest prevalence of average and high dependency were physiotherapy and medicine. No significant differences in regard to gender were observed.

INTRODUCTION

The high level of technological development worldwide has had an impact on today's society, leading to changes in people's lives and the way they function [1][2]. Access to a wide and varied range of mobile devices has revolutionised the ways in which information is accessed, stored, transmitted and interacted within the media. Mobile devices have ceased to be a simple communication tool and become an item that provides instant access to information, allowing the planning and organising of activities, and accessing entertainment and new forms of human interaction through various platforms and social networks; all these activities such as work, school, occupational, and even recreational can be carried out in different environments [3][4].

The diversity in the use of mobile devices and their ubiquitous nature has created the need for users to stay connected for much longer. This means their use has become excessive, even compulsive; furthermore, this excessive use isolates and disconnects individuals from their environment [5]. Such a situation has been compared to a dependency or addiction, to an extent that it has been hypothesised that if the device is used for ≥ 6 h a day [3][6], the mental health of users could be affected [1]. The dependence on mobile devices has been recognised as one of the technological addictions by the *Diagnostic and Statistical Manual of Mental Disorders, 5th version* (DSM-5) [7], in which the processes of dependency and abuse are not from toxic substances but from behavioural activities.

The dependence on mobile devices is classified into three large groups based on the pattern of mobile phone use, considering the amount, intensity, frequency and degree of interference it causes in people's family, social and/or work relationships. Thus, normal or non-problematic use results in slight dependency because it does not entail any negative consequence; moderate dependency is the abuse or problematic use that interferes with the environment; and severe dependency involves use that is considered to be pathological because it leads to serious consequences in personal lives and the immediate environment [8].

One of the scenarios where dependence on mobile devices is most relevant is that of a university [9-11]. In this environment, mobile devices are used to access information, as well as are an expression of fashion, status and peer interaction. The level of dependency, frequency or type of use of the device depends on variables such as gender, age and field of study [9-11]. Moreover, the excessive use of mobile devices can have consequences on health, both physical and emotional [2][12].

This phenomenon has been little explored in Colombia. There is only one study that explored the use of smartphones and interpersonal relationships in university students; the study showed that the use of mobile device results in intra-family conflicts [13]. To date, there is no study in Colombia featuring dependence on mobile devices and its prevalence among university students, which is the aim of this study.

METHODOLOGY

Type of Study, Design, Population and Sample

This is an observational, cross-sectional, analytical study conducted on university students from the Department of Health at Santiago de Cali University (Universidad de Santiago de Cali), in the city of Cali, Colombia, with a population (N) of 4,194 students. The sample size calculation indicated a total of 352 students (95% CI, 5% error) to be included in the study, selected according to stratified random sampling, wherein the strata corresponded to each of the eight undergraduate programmes of this Department. For the sampling, the distribution by semester and gender was considered to take into account the proportionality for each of these variables.

Inclusion and Exclusion Criteria

Only daytime programmes were included in this study to control the selection biases. Evening programmes have different sociodemographic toward nomophobia that could have affected the results of the study. Participants who were financially and academically enrolled, aged >18 years, and who voluntarily signed the informed consent were included. Exclusion criteria took into account the incomplete forms, performance of sports or artistic activities in which the use of fingers could significantly interfere with the results (selection bias), such as artists who play guitar or perform manual arts and the competitive athletes playing basketball and volleyball.

Linking of Participants

The team of research assistants organised periodic visits to the classrooms with lists of the preselected participants, according to the sampling technique already described. In each case, an exhaustive explanation of the study objective was provided and the interest in participating in the study was determined. In cases where the selected participant was not present at the time of data collection, the next participant from the list was chosen, provided the participant met the inclusion criteria and was of the same gender. Then, the informed consent (from the participant and two witnesses) was signed prior to the application of the tools.

Pilot

A pilot test was conducted with 36 students to verify the understanding of questions, make adjustments to wording, organise the order of questions and determine the real time for completing the instruments. Once adjustments were made, the rest of the sampling was continued.

Test of Dependency to Mobile Devices and Sociodemographic Data

The mobile dependency test (MDT) tool described by Chóliz was used [14]. The test comprises 22 items on a Likert-type scale, subdivided into the following three factors:

1) tolerance and abstinence, represented by items 11-22;
2) abuse and difficulty in controlling the impulse, corresponding to items 2, 4, 5, 6, 8, 12 and 20;
3) problems caused by excessive use, represented by items 1, 3, 7, 9 and 10. This questionnaire was validated and linguistically adapted in 2016 for university students from a public and a private university, with a reliability for abstinence and tolerance ($\alpha = 0.901$), for abuse and difficulty controlling impulse ($\alpha = 0.8553$) and for problems caused by excessive use ($\alpha = 0.762$) [15]. Sociodemographic data, such as gender, age, marital status and socioeconomic status were recorded on a different form.

Data Analysis

Data was recorded by double entry in Epi-Info (v 7.0) [16]. The information from the two databases was compared and unmatched data was debugged, with verification at the primary source. Once the information was validated, descriptive and bivariate analyses were performed in Epi-Info. The quantitative variables were analysed using the measures of central tendency (mean, mode, median and standard deviation), and the qualitative variables were analysed for frequencies and general percentages and according to gender. Finally, a bivariate analysis was performed, where the dependent variable (dependence on mobile devices) was compared with the sociodemographic variables using chi-square test (χ^2) for the categorical data and the value was estimated considering an alpha of 0.05.

RESULTS

The pilot test indicated that the tools were used for 12-15 minutes by each student. Of the 352 participants, 18 (5.1%) were excluded because their forms were only partially completed or for reasons associated with excessive use of upper limbs in sports or professional activities, e.g. playing the guitar (Figure 1). However, this loss did not significantly affect the confidence and power of the sample. Representative and homogeneous groups were linked to the study according to Levene's homogeneity test, and the sample was comparable for age, gender, programme, semester and marital status (0.157-0.740) in 334 students from the eight professional careers offered by the Department (Figure 1).

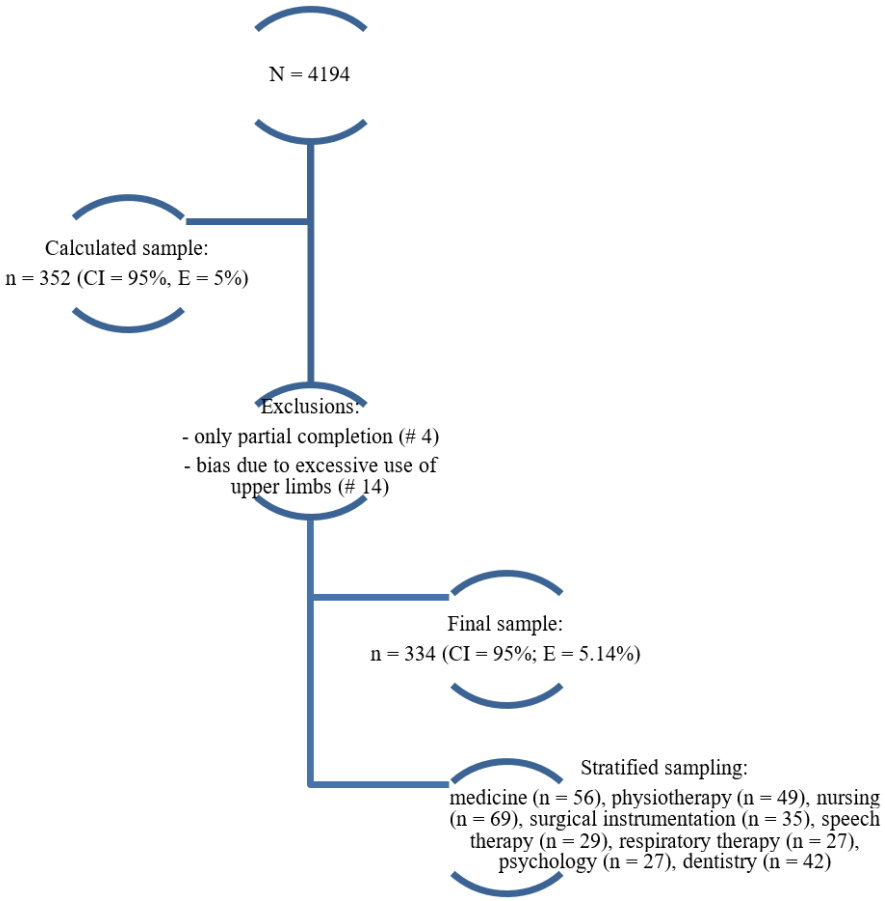

Figure 1: Flowchart of study participants.

The average age of each group of students linked to the study was within the first years of their second decade of life, with a range between 18 and 41 years (see Table 1, Appendix 1). The results show that one fifth of the investigated students were aged between 18 and 23 years (95% CI, error: 5.14%). According to the distribution by gender, in the entire sample, as well as in each group the predominant gender was female. The predominant marital status was single, in ratios of ≥85%, which contrasts with only 8.1% living with a partner (Table 1). About 27% of the students reside in socioeconomic strata 1 and 2 followed by 42% living in socioeconomic stratum 3. Furthermore, around 70% of the analysed student population was in the low and middle socioeconomic strata. Moreover, more than 80% of the sample belonged to strata 2, 3 and 4, with special predominance of stratum 3.

In Figure 2, the results of mobile device dependency analysis are plotted, according to the MDT tool [14]. In the sample, 74.3% (n = 248) students had some level of dependency (high, medium or low) with similar proportions to each other (Figure 2).

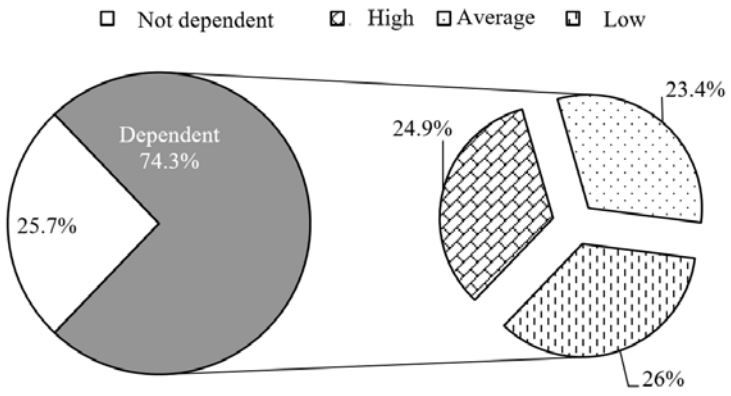

Figure 2: Distribution levels of general dependency.

Including the absence of dependency, the ratios of the four possible results were close to 25%. Further analysis revealed that the overall prevalence of dependency was higher in men than in women (Figure 3), which was replicated at low and medium dependency levels, but reversed in high dependency; however, these differences were not significant; therefore the analysis was not performed in a stratified way among the various programmes.

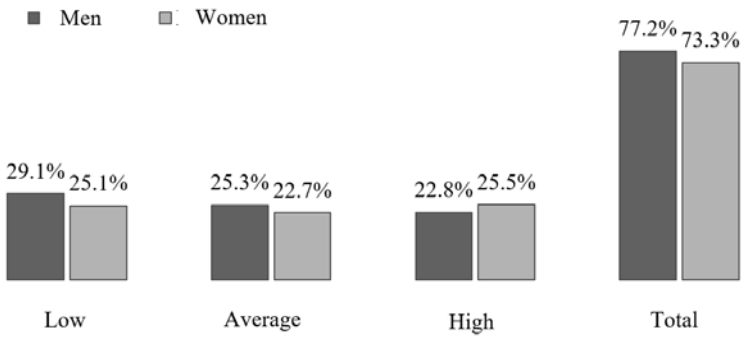

Figure 3: Distribution levels of general dependency by gender.

Table 2: Dependency level by programme.

Programme	Absence	Low	Average	High	Total
Nursing	35 (40.7)	17 (19.5)	11 (14.1)	6 (7.2)	34 (49.3)
Physiotherapy	6 (7.0)	12 (13.8)	13 (16.7)	18 (21.7)	43 (87.7)
Speech therapy	1 (1.2)	7 (8.0)	9 (11.5)	12 (14.5)	28 (96.7)
Surgical instrumentation	15 (17.4)	6 (6.9)	10 (12.8)	4 (4.8)	20 (57.1)
Medicine	10 (11.6)	17 (19.5)	12 (15.4)	17 (20.5)	46 (82.1)
Dentistry	4 (4.7)	17 (19.5)	13 (16.7)	8 (9.6)	38 (90.5)
Psychology	8 (9.3)	6 (6.9)	4 (5.1)	9 (10.8)	19 (70.4)
Respiratory therapy	7 (8.1)	5 (5.7)	6 (7.7)	9 (10.8)	20 (74.1)
Total	86 (25.7)	87 (26.0)	78 (23.4)	83 (24.9)	248 (100%)
Data is displayed in n (%) format. $X^2 = 64.806$, $p < 0.001$					

Table 2 shows the dependency levels for each academic programme. Physiotherapy and medicine programmes exceeded 20% of high level of dependency. At the medium level, physiotherapy, dentistry and medicine programmes stood out with levels of prevalence greater than 15%. The low level of dependency (> 19%) was more prevalent in nursing, medicine and dentistry programmes. The nursing programme had the highest prevalence of *absence of dependency*. Thus, the nursing, physiotherapy, speech therapy and dentistry programmes exceeded 80% prevalence of some type of dependency. The analysis of dependency levels with the year of the degree under study showed a tendency for high levels of dependency to occur preferably toward the fourth and fifth years of the degree; however, this data did not show statistical significance ($X^2 = 28.908$; $p = 0.365$).

DISCUSSION

Presently, mobile phones are part of daily life in most human populations. Various effects of the use of the device have been identified on the human behaviour, which are related to positive aspects, such as socioeconomic status, immediate communication, information searches, recreation and leisure. However, negative effects have also been identified that are associated with excessive, problematic use, which can be addictive and can lead to dependency [19]. However, although it is inferred as a behavioural addiction, it is not recognised in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) [20]. As described by Simó et al, this is due in part to: *…an evident lack of theoretical foundation to support this type of behavioural disorder, since there is no consensus on its inclusion within a given taxonomy* [21].

There is a high level of standardisation of tools to detect dependency and other similar concepts, such as nomophobia and excessive and problematic use. Each tool uses diagnostic criteria from different types of disorders considered within the DSM-5. A simple review was conducted in January 2020 using PubMed to access mainly the MEDLINE database of references and abstracts with the following search query: *(Nomophobia) OR (Mobile dependence) OR (Problematic use mobile) OR (Problematic use mobile phone*) AND (prevalence).*

This review identified 18 articles published between 2019 and 2020. When reviewing the methodologies, it was found that virtually all identified articles used a different tool. Other variables including age, culture, and even religious influence are important in determining the prevalence of dependency and/or nomophobia [22].

Thus, the instrument created by Chóliz et al was decided to be used in this study [5]. This tool, known as MDT, is consistent with the concept of dependency and is characterised by its good psychometric properties. Reliability: abstinence and tolerance ($\alpha = 0.901$), abuse and difficulty in controlling impulse ($\alpha = 0.853$), and problems related to excessive use ($\alpha = 0.762$), and its ability to discriminate between sexes and between age groups. In addition, the instrument was initially developed for adolescents, later being validated for university students, and culturally adapted to Latin American populations [15]. All this made it perfect to be used in this study.

To the best of the authors' knowledge, this is the first study on the dependence on mobile devices among university students of professional degrees related to human health conducted using the tool developed by Chóliz [14]. A large proportion (> 70%) of students had some level (high, medium or low) of dependence on mobile devices. From these, almost 25% had a high level of dependence. Programmes with the highest prevalence were speech therapy, dentistry, physiotherapy and medicine. While programmes with the highest prevalence of medium and high dependency were physiotherapy and medicine. The values in the present study are higher than those reported in other studies. Previous studies have determined dependency prevalence in various types of populations ranging between 5% and 40% [23-28].

Few studies have determined the prevalence of dependence on mobile devices among university students in professional degrees related to human health. A study conducted among medical students in India indicated a prevalence of 14.9% and 11.1% in men and women, respectively. Among them, 59.5% men and 40.5% women were classified in a high dependency category [29]. A previous study conducted similarly among medical students in India found that 18.5% were nomophobic [24]. In contrast, another study conducted among medical students in Paraguay found that 100% of the included students had some level of nomophobia, which was severe in 15.8% [30]. However, it should be noted that these studies used tools other than MDT.

On the other hand, many studies report differences in prevalence according to gender [23-28]. In the present study, a stratified analysis was conducted that was proportional to gender, in an attempt to control the selection bias. In all cases, except for the high level of dependency, the male gender predominated. However, no significant differences were noted. In addition, the prevalence of dependency did not behave in the same way in all the professional training programmes evaluated, with the highest prevalence of high dependency in physiotherapy and medicine.

A possible explanation for this is that there are programmes that demand clinical practice under aseptic and antiseptic conditions; therefore students in these degrees, e.g. surgical instrumentation and nursing, must comply with work standards under these conditions that do not allow them to make frequent use of their mobile devices. An additional reason is the interference that mobile devices cause in medical devices. On the other hand, in some programmes, the level of consultations via the Internet increases as the level of academic demand increases toward the end, e.g. medicine, speech therapy and physiotherapy. Therefore, more in-depth studies are needed to establish whether these are reproducible differences and whether there is any specific reason for it.

One of the strengths of the study is the approach of multiple professional training programmes in health sciences, which until now has not been done in any other published study. Sample size and gender-proportional stratified random sampling are two other strengths of the study to control possible biases. A limitation of the study is that it was conducted at one single university, which may possibly affect the results due to the characteristic sociodemographic differences of the study population.

The levels of mobile phone dependence and the differential trend regarding the vocational training programmes should be a call for concern for further studies to be performed on this problem, which is still poorly characterised in Colombia and many other countries in the world. This study corresponds to the first report of a larger study conducted at the Department of Health at Santiago de Cali University. The same study group will be further reporting similar findings from other departments, as well as the deeper characterisations of dependency and its musculoskeletal and behavioural effects.

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APPENDIX 1

Table 1: Sociodemographic characterisation of the sample.

Programmes and variables		EN[a]		MED[b]		FT[c]		OD[d]		IQ[e]		FON[f]		PSI[g]		TR[h]		All	
Age	X	22.8		21.6		21.8		22.2		20.4		20.9		21.6		22.1		21.8	
	SD	4.9		3.8		3.1		3.4		2.3		2.6		2.9		3.9		3.7	
		n	%	n	%	n	%	N	%	n	%	n	%	n	%	n	%	N	%
Gender	F[i]	55	79.7	36	64.3	34	69.4	32	76.2	29	82.9	26	89.7	22	81.5	21	77.8	255	76.3
	M[j]	14	20.3	20	35.7	15	30.6	10	23.8	6	17.1	3	10.3	5	18.5	6	22.2	79	23.7
Marital status	So[k]	59	85.5	51	91.1	46	93.9	39	92.9	33	94.3	26	89.7	24	88.9	26	96.3	304	91.0
	C[l]	2	2.9	2	3.6	-	-	2	4.8	1	2.9	2	6.9	-	-	-	-	9	2.7
	Se[m]	-	-	-	-	1	2.0	-	-	-	-	-	-	1	3,7	-	-	2	0.6
	V[n]	1	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.3
	UL[r]	7	10.1	3	5.4	2	4.1	1	2.4	1	2.9	1	3.4	2	7,4	1	3,7	18	5.4
Stratum	1	5	7.2	3	5.4	3	6.1	3	7.1	2	5.7	-	-	3	11.1	1	3.7	20	6.0
	2	20	29.0	9	16.1	12	24.5	6	14.3	11	31.4	4	13.8	3	11.1	4	14.8	69	20.7
	3	34	49.3	10	17.9	19	38.8	20	47.6	18	51.4	16	55.2	10	37.0	13	48.1	140	41.9
	4	5	7.2	15	26.8	10	20.4	11	26.2	3	8.6	7	24.1	8	29.6	4	14.8	63	18.9
	5	4	5.8	15	26.8	4	8.2	2	4.8	-	-	2	6.9	3	11.1	5	18.5	35	10.5
	6	1	1.4	4	7.1	1	2.0	-	-	1	2.9	-	-	-	-	-	-	7	2.1
Total		69	20.7	56	16.8	49	14.7	42	12.6	35	10.5	29	8.7	27	8.1	27	8.1	334	100

[a]Nursing, [b]medicine, [c]physiotherapy, [d]dentistry, [e]surgical instrumentation, [f]speech therapy, [g]psychology, [h]respiratory therapy, [i]female, [j]male, [k]single, [l]married, [m]separated, [n]widowed, [r]free union