Nomophobia Questionnaire (NMP-Q): Factorial structure and cut-off points for the Spanish version

Cuestionario de Nomofobia (NMP-Q): Estructura factorial y puntos de corte de la versión española

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Abstract

Nomophobia is a situational phobia leading to a deep, irrational, and disproportionate fear of not being able to use the smartphone. An instrumental study on the Spanish version of the *Nomophobia Questionnaire* (NMP-Q) was carried out. The objectives were: 1) To analyse its factor structure and reliability; 2) to test for the invariance of sex and age groups, and 3) to obtain specific cut-off points by sex and age non-existent to date. Sampling was incidental and non-probabilistic with 5012 participants (57.9%, females) aged 12-24 years (M = 18.04, SD = 3.3). The confirmatory factor analysis revealed a hierarchical model with four correlated factors explained by a general second-order factor. The internal validity and reliability values of the NMP-Q dimensions are satisfactory, ranging between .78, .85, .86, and .92 (Omega ω). A multigroup analysis confirmed the invariance across sex and age groups. Building on the NMP-Q scores, we calculated 3 cut-off points using percentiles 15th, 80th and 95th (unnomophobic, at risk of nomophobia, and nomophobic). Females aged 12-15 years had the highest nomophobic scores. We can conclude that the proposed sex and age cut-off points will allow us to better identify nomophobic problems from a clinical point of view.

Keywords: Nomophobia; Cut-off points; Smartphone; Internet; Behavioural addiction.

Resumen

La nomofobia es una fobia situacional en la que se experimenta un miedo intenso, irracional y desproporcionado a no poder usar el smartphone. Se realizó un estudio instrumental de la versión española del cuestionario de Nomofobia (NMP-Q) con los objetivos de: 1) analizar su estructura factorial y fiabilidad; 2) analizar su invarianza con relación al sexo y la edad, y 3) obtener puntos de cortes específicos para distintas edades y sexo. El muestreo fue incidental y no probabilístico. Hubo 5012 participantes (57.9%, mujeres) de 12-24 años (M = 18,04, SD = 3,3). El análisis factorial confirmatorio mostró un modelo jerárquico de 4 factores correlacionados y explicados por uno general de segundo orden. Los índices de fiabilidad de las dimensiones del NMP-Q fueron satisfactorios oscilando entre ,78, ,85, ,86 y ,92 (Omega ω). Un análisis multigrupo confirmó la invarianza por sexo y edad. A partir de las puntuaciones del NMP-Q se calcularon 3 puntos de corte siguiendo los percentiles 15, 80 y 95 (sin nomofobia, riesgo de nomofobia, y nomofóbico). Las mujeres de 12-15 años tuvieron las puntuaciones más altas en nomofobia. Podemos concluir que el NMP-Q nos permite identificar problemas de nomofobia por sexo y edad desde un punto de vista clínico.

Palabras clave: Nomofobia; Puntos de corte; Smartphone; Internet; Adicción conductual.

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Introduction

The digitalization of society has profoundly transformed the way we socially interact, allowing us to communicate, obtain information, develop ideas, generate synergies, and maximize opportunities in forms we never before dreamed of. However, despite numerous advantages, these changes also entails challenges and risks, especially for young people, giving rise to new psychosocial pathologies (Kirwan, 2016). In this sense, it is unclear whether we are facing a new behavioral addiction or a problem of a psychosocial and environmental nature (Pedrero Pérez et al., 2018).

In particular, Spain, along with Asian countries, tops the list of worldwide countries that have greater access to Internet via their smartphones, more specifically 92% of the respondents (Google/TNS, 2017; Statista, 2017). In addition, 99% of young Spaniards access the Internet every day through their mobile phones (Ditrendia, 2017). On the other hand, people have their own mobile at increasingly early ages, with a current mean age between 10-12 years (Garmendia-Larrañaga, Jiménez-Iglesias, Casado & Mascheroni, 2016; González-Cabrera, Balea, Vallina, Moya & Laviana, 2017).

In the light of these data, it is not surprising that nomophobia (acronym for no-mobile-phobia) is receiving increasing attention in Spain and globally. This is because it relates to a contemporary phenomenon that is characteristic of our societies, i.e., the need to connect online (Walsh, White & Young, 2010) or *digital connectedness*, which can be defined as the urge to be in constant contact with social networks through Internet and personal devices and laptops that allow us to be constantly connected with others. In addition, given the digital changes we are going through, the concept of the *extended self* proposed by James (1890) is also undergoing a profound transformation. In this sense, avatars, profiles, contacts, comments and messages circulating in the social networks, emails, etc., have become part of our inner "self" (Belk, 2016), changing the processes of self-presentation and self-monitoring implied by Internet. This online reality affects the establishment of one's self-concept and core identity (Carter & Grover, 2015; Davis, 2013; Walsh et al., 2010) in ways we are still trying to understand.

Therefore, Internet and smartphones have not only changed our socio-communicative needs, but also our habits and social behavior. The dysregulation of certain behavioral patterns can produce distress and anxiety in some individuals, generating harmful and dysfunctional outputs (Dongre, Inamdar & Gattani, 2017; King et al., 2013; Taneja, 2014). Among these behavioral problems, the conceptualization of nomophobia as an anxiety disorder has recently attracted attention. In the field of psychology and psychiatry, it is defined as a disorder resulting from people's interaction with the information and communication technologies, which produces anxiety and distress (King et al., 2013). More specifically, it is considered a situational and social phobia that makes individuals experience a deep, irrational, and disproportionate fear of not being able to use the mobile phone or of running out of coverage and/or battery and, therefore, having to temporarily relinquish their social identity, that is, the personality that communicates and expresses itself on the social network accessed through the mobile phone (Bragazzi & Del Puente, 2014; González-Cabrera, León-Mejía, Calvete & Pérez-Sancho, 2017; Han, Kim & Kim, 2017; King et al., 2013; Yildirim & Correia, 2015). It is also related to other mental problems, such as generalized anxiety disorder, panic, agoraphobia, depression, social phobia, obsessive compulsive disorder, post-traumatic stress, and anorexia (King, Guedes, Pedro Neto, Guimaraes & Nardi, 2017). Regardless of the lack of agreement on how we label or conceptualize the problematic use of smartphones (phobia vs. addictions), we need to better understand this phenomenon as well as to improve the way we psychosocially intervene to prevent and treat it (Ruiz-Ruano, López-Salmerón & López-Puga, 2020).

Assessment tools and at-risk groups

The existence of a technological generation gap allows us to differentiate between people who have experienced the digital communicative social change (and some of its possible pernicious effects) in their adult life –with their basic personality already formed–, and people who are already growing up and socializing as digital natives and early adopters of technology. This is of great interest for the study of nomophobia, as everything seems to indicate that adolescents and young people (especially young females) are at higher risk (González-Cabrera et al., 2017; Securenvoy, 2012). However, in order to reach valid conclusions about at-risk groups, it is essential to have data on scores that reliably indicate a nomophobic problem, and to determine whether these scores are really sensitive to individuals' sex and age.

Since nomophobia is a relatively new concept, we had no specific tools to evaluate it until the NMP-Q was proposed by Yildirim and Correia (2015). Afterwards, different linguistic adaptations have been made to Spanish, Italian, Persian or Chinese (Adawi et al., 2018; Bragazzi et al., 2016; González-Cabrera et al., 2017; Lin, Griffiths & Pakpour, 2018; Ma & Liu, 2018), and most surely others adaptations are ongoing. However, to date few studies have identified cut-off points to establish problematic levels of nomophobia (González-Cabrera et al., 2017), and due to the relative novelty of the construct, normative data on nomophobia is still needed. Consequently, our objectives are: 1) to obtain indicators of validity and reliability of the Spanish version of the Nomophobia Questionnaire (NMP-Q), including the confirmatory study of its factor structure; 2) to test whether the questionnaire works equally in both men and

women, as well as in adolescences and young adults of different ages, and 3) to obtain specific cut-off points by sex and age.

We formulated the following hypotheses: (a) Nomophobia will be higher in females than in males; (b) Regarding age, the scores will be higher in the younger groups, with the range of greatest concern between 14 and 18 years; (c) Confirmatory factor analysis (CFA) will confirm the four-dimension model that other authors have reported (Lin et al., 2018) and the original model of Yildirim and Correia (2015).

Material and methods

Participants

We conducted an instrument validation study (Montero & León, 2007) between November and December 2017 in Spain, the purpose of which was to confirm the factor structure of a tool already adapted to Spanish and to study in depth its psychometric properties. The initial sample comprised 5380 participants from the entire national territory, but the final sample was made up of 5012 people, after eliminating incomplete questionnaires (one or more unanswered items or containing response errors) as well as questionnaires that were completed in less than 4 minutes. Sampling procedure was non-probabilistic and incidental, but the sample included participants from the 17 regions of Spain, including Ceuta and Melilla (see Table 1).

Of these participants, 2902 (57.9%) were female and 2110 (42.1%) were male, with ages ranging between 12 and 24 years (mean= 18.04, SD= 3.3). Regarding the age of participants, there were 252 (5%) participants between 12-13 years of age, 1171 (23.4%) between 14-15 years, 1155 (23%) between 16-17 years, 727 (14.5%) between 18 and 19 years, 703 (14%) between 20-21 years, and 1004 (20%) between 21 and 24 years of age.

Table 1. *Distribution of participants according to their Region/city (n = 5012).*

Region/city	Frequency (%)	Region/city	Frequency (%)	Region/City	Frequency (%)
Andalucía	785 (15.7%)	Castilla la Mancha	186 (3.7%)	Madrid	1425 (28.4%)
Aragón	117 (2.3%)	Castilla y León	360 (7.2%)	Region of Murcia	128 (2.6%)
Principality of Asturias	112 (2.2%)	Cataluña	541 (10.8%)	Statutory Community of Navarre	51 (1%)
Balearic Islands	80 (1.6%)	Extremadura	100 (2%)	Basque Country	224 (4.5%)
Canary Islands	182 (3.6%)	Galicia	201 (4%)	Valencia Community	259 (7.2%)
Cantabria	80 (1.6%)	La Rioja	59 (1.2%)	Ceuta & Melilla	Ceuta 6 (.1%) Melilla 16 (.3%)

Note. Spain is composed of 17 regions and two cities with a special regimen (Ceuta and Melilla).

Assessment instrument

Initially, participants were asked about their sex (male/female), age (participant's age at the time of assessment) and region or city of residence. Subsequently, they completed the Spanish version of the Nomophobia Questionnaire (NMP-Q) adapted by González-Cabrera et al. (2017), who also conducted exploratory factor analyses (α-value of .95).This tool assesses four dimensions: 1) Not being able to access information (4 items): the hassle of losing immediate access to information through the smartphone and the possibility of finding what you want immediately. 2) Giving up convenience (5 items): feelings of comfort and psychological peace provided by having control of the smartphone, especially in relation to the battery, coverage, and credit. 3) Not being able to communicate (6 items): Feelings about loss of an immediate communication and about not being able to use the available services for that purpose. 4) Loss of connection (5 items): Emotions related to the loss of ubiquity after losing connectivity. This is related to the disconnection with one's online identity, especially on social networks. The response format follows a seven-point Likert scale, ranging from 1 *(strongly disagree)* to 7 *(strongly agree)*. There are no inverse items, and the total score ranges between 20 and 140 points, meaning that the higher the score, the higher nomophobia is.

Procedure

The application was made through the online Survey Monkey® Platform, where an online questionnaire was created specifically for this study. It was introduced in a well-known Spanish social media whose sphere of influence covers the entire national territory. The study was conducted with the approval of the Institution to whom the social media web belonged. Following ethical principles of the American Psychological Association (APA) for research (APA, 2017), in the first page of the online form participants were informed about the purpose of the research, including the advance in knowledge about the prevalence of nomophobia in Spain, expected duration, and content of the questionnaire. They were informed about their right to decline to participate and to withdraw from the survey anytime without

any consequence and about the confidentiality of the information, which was warranted due to the anonymous nature of the survey. Finally, they were informed about whom to contact for questions about the research. After reading this information, in case they agreed to participate, they should indicate their acceptance and then went to the survey. This study has been evaluated by the Research Ethics Committee of the International University of La Rioja (PI 009/2019). There were no exclusion criteria other than to own and use a smartphone with Internet.

Statistical Analyses

First, we calculated the descriptive statistics of the NMP-Q scores according to sex and age (recoded into three groups: 12-15, 16-20, and 21-24 years). We used these groups in order to be consistent with the psycho-evolutionary stages inherent in initial adolescence (12-15), mid and late adolescence (16-20) and early youth (21-24) (Salmera-Aro, 2011). Quantitative variables were expressed as mean and standard deviation (SD). The mean difference between the qualitative variables of two categories was analyzed with Student's T-test for independent samples. In the case of more than two categories, results were compared using ANOVA. Pairwise post hoc comparisons were examined using the Bonferroni test.

Cohen's *d* was also calculated to provide the effect size. Regarding internal validity, an analysis of the psychometric properties of each item was conducted, indicating the arithmetic mean, standard deviation, item-total correlation, skewness, and kurtosis (see Table 2). The structure of the NMP-Q was analyzed by means of CFA. We used the robust maximum likelihood (RML) method, which requires an estimate of the asymptotic covariance matrix of the sample variances and covariances and includes the Satorra-Bentler scaled χ^2 index (S-Bχ^2).

The hypothesized model consisted of a correlated four-factor structure: Not being able to access information (4 items); Giving up convenience (5 items); Not being able to communicate (6 items); and Loss of connection (5 items). This model was compared with several alternative models: (1) a one-dimensional model, in which all items were allowed to be explained by a single factor; (2) an uncorrelated four-factor model, where covariances between the four nomophobia factors were fixed to 0; and (3) a hierarchical model with one second-order factor explaining the four nomophobia factors. In all models, items were constrained to load on one factor only. Following the recommendations of Hu and Bentler (1999), goodness of fit was assessed by the comparative fit index (CFI; values of .95 or greater indicate that the model adequately fits the data), the root mean squared error of approximation (RMSEA; values of .06 or less indicate excellent fit and values up to .08 indicate moderate fit), and the standardized root-mean-square residual (SRMR; values of .08 or less indicate that the model adequately fits the data). To compare models, we used the corrected Chi-squared difference test (Crawford & Henry, 2003). To determine the internal consistency of the instrument, we estimated the Cronbach's alpha coefficient (Cronbach, 1951), the Ordinal alpha coefficient (Elosua & Zumbo, 2008), McDonald's Omega (1999), the GLB of Woodhouse and Jackson (1977), and the GLB algebraic algorithm (GLBa) of Moltner and Revelle (2015).

To examine if the NMP-Q can be used with both men and women, as well as with people of different ages, we tested the invariance of the structural model across sex and age groups (under and above 17). In the first step, we estimated the model separately in males, females, participants between 12 and 17 years, and participants between 18 and 24 years. Secondly, configural invariance was tested. This implies that the relations between each indicator and its construct have the same pattern of fixed and free loadings for each group. Thirdly, this model was compared with a more restrictive model (weak factorial invariance), in which first-order factor loadings within constructs were specified as equal for both groups. In the fourth step, we examined whether the intercepts were invariant across groups (strong factorial invariance). With this aim, the intercepts were added to the previous model. Finally, we examined whether second-order factor loadings were equivalent across groups. Given that Chi-Square is very sensitive to large samples and non-normality conditions, it is assumed that the model is invariant if the ΔCFI is not above 0.01 (Cheung Rensvold, 2002).

To classify the cut-off points, we used the 15th, 80th, and 95th percentiles, which correspond to: nonnomophobic, at risk of nomophobia, and nomophobic. This classification is based on other areas of research, such as pathological gambling or the problematic use of mobile phones, yet it has been adapted to the uniqueness of the nomophobic problem presented herein (González-Cabrera et al., 2017; López-Fernández, Freixa-Blanxart & Honrubia-Serrano, 2013). These cut-off points will be analyzed according to the variables sex and age, distributed in 3 age groups: 12-15, 16-20, and 21-24 years.

In order to perform the data analysis, we used the statistical package IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp.), LISREL 9.2 (Jöreskog & Sörbom, 2013), R version 3.5.0 (R Core Team, 2013) and psych package (Revelle, 2019). The graphic representation was performed with yEd-Graph©.

Results

Sex and age differences

There were significant sex differences in the total scores of the NMP-Q (males: $M = 52.37$ and $SD = 19.62$; females: $M = 59.66$ and $SD = 22.54$; $t = -11.931$, $p < .001$, $d = .34$), and these sex differences were observable in all dimensions of

the questionnaire: 1) Not being able to access information (males: M = 12.81 and SD = 4.86; females: M = 13.77 and SD = 5.09; t = -6.720, $p < .001$, d = .20); 2) Giving up convenience (males: M = 11.54 and SD = 5.46; females: M = 12.72 and SD = 6.26; t = -6.943, $p < .001$, d = .20); 3) Not being able to communicate (males: M = 14.68 and SD = 6.95; females: M = 17.75 and SD =7.96; t = -14.238, $p < .001$, d = .41) and 4) Loss of connection (males: M = 13.34 and SD = 5.44; females: M = 15.42 and SD = 6.09; t = -12.452, $p < .001$; d = .36).

In terms of age, the 12-15 age-group presented a mean and standard deviation of 57.76 and 22.50, respectively. The 16-20-year-olds obtained M = 55.14 and SD = 20.47; and the 21-24 age-group obtained M = 53.54 and SD = 20.80. There were significant differences between the three age groups in the total score, $F_{(5, 5006)}$ = 10.521, $p < .001$, η^2 = 0.01). The differences between the 16-20 and the 12-15 age-groups were statistically significant ($p < .001$). Scores were also higher and statistically significant in the groups of 21-24 and 12-15 ($p < .001$). The correlation between age and the total NMP-Q score was negative and statistically significant (r = -.091, p <.001).

Validity Evidence of the NMP-Q scores

Table 2 depicts various psychometric indicators for each of the items of the NMP-Q, specifically the mean, standard deviation, skewness, kurtosis and the item-total correlations. The lowest mean score (1.85) was found in Item 15 (dimension "Not being able to communicate"), which focuses on people's anxiety if constant connection to their family and friends were broken. Conversely, the items with the highest scores were found in the dimension "Not being able to access information," in Item 2, which asks the extent to which people would be annoyed if looking up information on the smartphone was not possible whenever they wanted (3.67), Item 4, which asks how annoyed people would be if it was impossible to use the smartphone when they so wished (3.59), and Item 1, which asks how uncomfortable people would be if they did not have constant access to information through the smartphone (3.43). Skewness and kurtosis values showed that, in general, the curve was asymmetrically negative, and the distribution was leptokurtic. Item 15 was the most anomalous. Discrimination indexes of all items were acceptable and above the critical value of .30, ranging from .48 and .76.

Table 2. *Mean, Standard Deviation, Item-Total Correlation, Kurtosis and Skewness for the 20 items of the NMP-Q (n = 5012).*

Item		M	SD	I-T	Kurt	Skew
1.	I would feel uncomfortable without constant access to information through my smartphone.	3.43	1.5	.68	-.406	.111
2.	I would be annoyed if I could not look information up on my smartphone when I wanted to do so.	3.67	1.48	.63	-.370	-.008
3.	Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous.	2.53	1.45	.58	-.011	.737
4.	I would be annoyed if I could not use my smartphone and/or its capabilities when I wanted to do so.	3.59	1.52	.66	-.421	.088
5.	Running out of battery in my smartphone would scare me.	2.83	1.64	.62	-.501	.573
6.	If I were to run out of credits or hit my monthly data limit, I would panic.	2.17	1.39	.59	.843	1.152
7.	If I did not have a data signal or could not connect to Wi-Fi, then I would constantly check to see if I had a signal or could find a Wi-Fi network.	3.03	1.63	.65	-.517	.476
8.	If I could not use my smartphone, I would be afraid of getting stranded somewhere.	3.20	1.74	.48	-.825	.307
9.	If I could not check my smartphone for a while, I would feel a desire to check it.	2.98	1.61	.69	-.547	.441
10.	I would feel anxious because I could not instantly communicate with my family and/or friends.	2.85	1.59	.74	-.343	.324
11.	I would be worried because my family and/or friends could not reach me.	3.20	1.62	.64	-.618	.324
12.	I would feel nervous because I would not be able to receive text messages and calls.	2.64	1.54	.76	-.039	.754
13.	I would be anxious because I could not keep in touch with my family and/or friends.	2.92	1.54	.75	-.403	.494
14.	I would be nervous because I could not know if someone had tried to get a hold of me.	2.52	1.44	.74	.215	.824
15.	I would feel anxious because my constant connection to my family and friends would be broken.	1.85	1.26	.69	2.918	1.707
16.	I would be nervous because I would be disconnected from my online identity.	2.72	1.53	.73	-.196	.653
17.	I would be uncomfortable because I could not stay up-to-date with social media and online networks.	2.43	125	.66	.139	.894
18.	I would feel awkward because I could not check my notifications for updates from my connections and online networks.	2.18	1.44	.72	.927	1.212
19.	I would feel anxious because I could not check my email messages.	2.19	1.40	.60	.816	1.153
20.	I would feel weird because I would not know what to do.	2.5	1.54	.63	-.103	.818

Note. This table shows the 20 items of the NMP-Q along with their mean (M), standard deviation, (SD) the item-total correlations (IT), Kurtosis (Kurt) and skewness (Skew). The twenty items correspond to 4 dimensions: Not being able to access information (4 items, 1-4); Giving up convenience (5 items, 5-9); Not being able to communicate (6 items, 10-15) and Loss of connection (5 items, 16-20).

Table 3 presents the fit indexes for all the models. As can be seen, the hypothesized model consisting of four correlated factors obtained good fit indexes. We performed a second-order model, which also had adequate indexes.

Models 2 and 3 increased chi square significantly and presented poorer fit indexes. However, Model 4, although it also increased chi square significantly, presented very similar fit indexes. This hierarchical model has the advantage of estimating a total score for the NMP-Q, together with the partial scores of the subscales. The factor loadings of the first-order factors on the second-order factor were .84, .99, .79, and .95, respectively for Not being able to communicate, Loss of connection, Not being able to access information, and Giving up convenience.

Figure 1 presents hierarchical model (four first-order factors explained by one second-order factor), whose loadings

Table 3. *Fit Indexes for the Models (n = 5012).*

Model	S-Bχ^2	RMSEA	CI	CFI	NNFI	SRMR	Comparison with the hypothesized model
Four correlated factors (hypothesized model)	S-Bχ^2(163) = 4356	.072	(90% CI [.070, .073])	.980	.977	.062	
Model 2. Four uncorrelated factors	S-Bχ^2(169) = 14144	.128	(90% CI [.127, .130])	.935	.926	.379	ΔS-Bχ^2(6, n = 5012) = 9788, p < .001
Model 3. One factor	S-Bχ^2(169) = 13452	.125	(90% CI [.123, .127])	.938	.930	.071	ΔS-Bχ^2(6, n = 5012) = 7574, p < .001
Model 4. Hierarchical model (four first-order factors explained by one second-order factor)	S-Bχ^2(165) = 4387	.72	(90% CI [.070, .073])	.980	.977	.063	ΔS-Bχ^2(2, n = 5012) = 29, p < .001

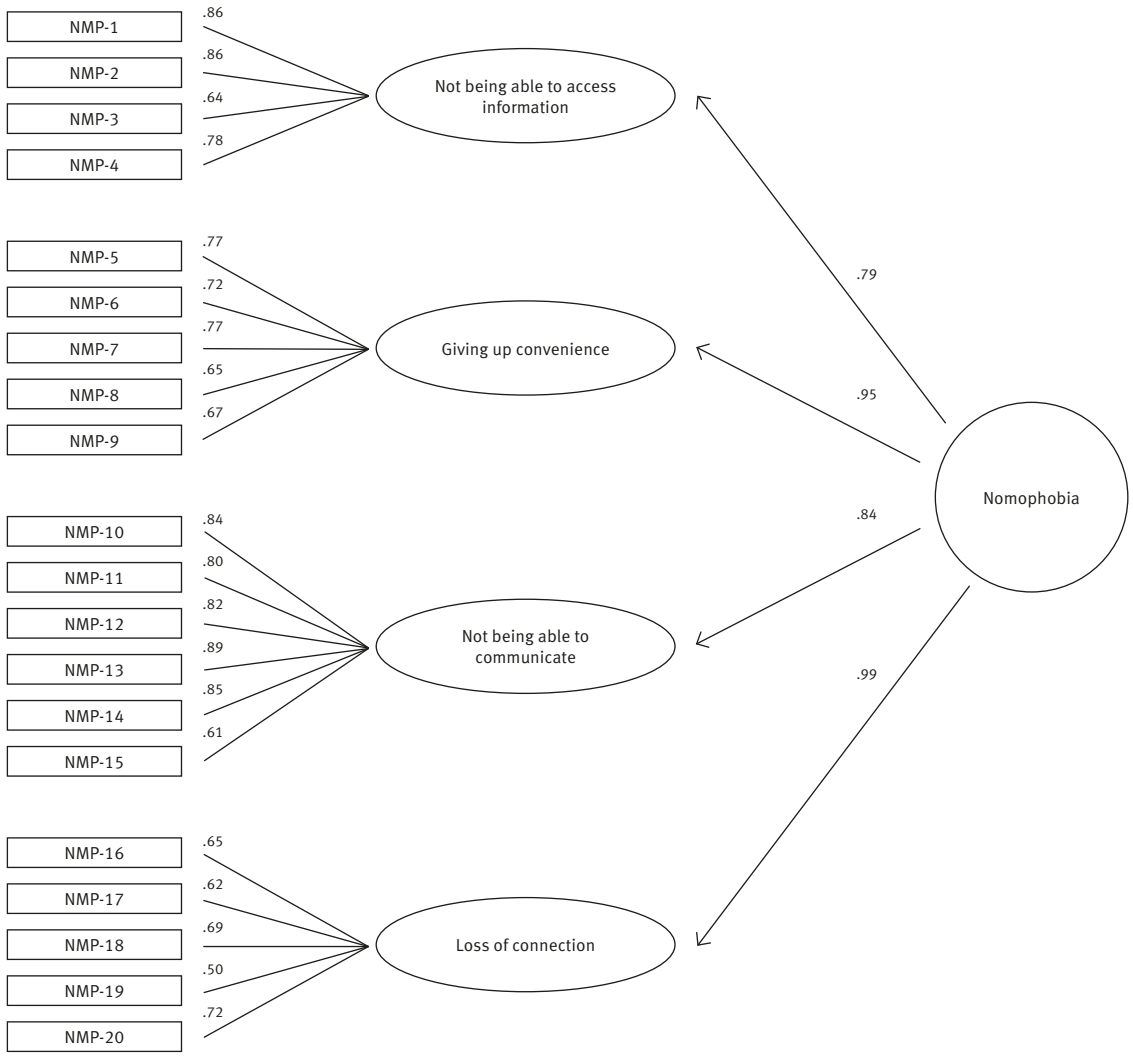

Figure 1. Hierarchical model (four first-order factors explained by one second-order factor) for the NMP-Q.

Table 4. *Cronbach Alpha (α), Ordinal, and Omega (ω) Coefficients for the four Dimensions and confidence interval (CI), the Greatest Lower Bound (GLB) and the GLB.algebraic (GLBa) of the NMP-Q.*

Dimensions	A (CI)	Ordinal (CI)	ω (CI)	GLB	GLBa	Number of items
Not being able to communicate	.91 [.91, .92]	.93 [.93, .94]	.92 [.92, .93]	.94	.94	6
Loss of connection	.85 [.84, .86]	.88 [.87, .88]	.85 [.84, .86]	.86	.86	5
Not being able to access information	.86 [.85, .87)	.88 [.87, .89]	.86 [.86, .0.87]	.87	.87	4
Giving up convenience	.77 [.76, .78)	.81 [.80, .81]	.78 [.76, .79]	.82	.81	5

Table 5. *Invariance analyses across sex and age (with strict comparisons using S-B χ^2).*

	Model	S-Bχ^2	df	RMSEA	RMSEA 90% CI	SRMR	NNFI	CFI	Compared models	ΔCFI
	Sex									
1	Men	2320	165	.067	[.065, .070]	.062	.977	.980		
2	Women	2213	165	.077	[.074, .079]	.066	.977	.980		
3	Configural model	4536	330	.071	[.070, .073]	.062	.977	.980		
4	First-order factor loadings invariance	4603	346	.070	[.068, .072]	.060	.977	.979	3-4	.001
5	Strong invariance	4664	362	.069	[.067, .071]	.060	.978	.979	4-5	.000
6	Second-order factor loadings invariance	4710	366	.069	[.067, .071]	.073	.978	.979	5-6	.000
	Age									
7	≤ 17 years	2418	165	.073	[.070, .075]	.066	.977	.980		
8	≥ 18 years	3444	165	.070	[.068, .073]	.061	.977	.980		
9	Configural model	4562	330	.072	[.070, .072]	.061	.977	.980		
10	First-order factor loadings invariance	4671	346	.071	[.069, .072]	.071	.977	.979	9-10	.001
11	Strong invariance	4733	362	.069	[.068, .071]	.071	.978	.979	10-11	.000
12	Second-order factor loadings invariance	4761	366	.069	[.068, .071]	.080	.978	.979	11-12	.000

Note. S-Bχ^2 = Satorra-Bentler χ^2; df = Degrees of freedom; RMSEA =Root Mean Square Error of Approximation; CI = Confidence Interval; SRMR= Standardized Root Mean Squared Residual; CFI: Comparative Fit Index; NNFI = Non-Normed Fit Index; ΔCFI = differences in Comparative Fit Index.

were higher than .50 in all cases. The Cronbach alpha, Ordinal, and Omega coefficients are shown in Table 4 along with the fit indexes. As shown, all values of each dimension were adequate, ranging from .78 to .92 (Omega ω).

Measuring invariance across sex and age

We estimated the hierarchical model in separate subsamples by sex and age. Fit indexes were adequate for each subsample. Tests of invariance indicated that both factor-loadings and intercepts could be assumed to be invariant because change in CFI was lower than .01 in all cases.

Cut-off points of the Spanish Version of the NMP-Q as a function sex and age

The mean score and standard deviation for the NMP-Q was of 55.44 and 21.21, respectively, within a range of 20-140. The 15th, 80th, and 95th percentiles correspond to nonnomophobic, at risk of nomophobia, and nomophobic, respectively. Following this criterion, the cut-off points are 34, 72 and 94 for the above-mentioned classifying categories. The distribution for males is 32, 68, and 87, and for females, it is 36, 78, and 100. Table 6 presents the different scores for the percentiles as a function of sex for the age groups of 12-15, 16-20, and 21-24 years.

Discussion

This work contributes to the knowledge and identification of nomophobia, a new problem that has not yet been explored in depth at the clinical level, due to its lack of recognition in the *Diagnostic and Statistical Manual of Mental Disorders-5th edition DSM-5* (American Psychiatric Association, 2013) and to the diversity of the theoretical approaches to this recent construct. Regarding the first objective of the manuscript, i.e., to assess the structure and reliability of the Spanish version of the Nomophobia Questionnaire (NMP-Q), we confirm the hypothesized four-factor correlated model (see Table 3) and provide evidence for the existence of a broader second-order factor that would explain the associations between the four dimensions of nomophobia. These data are consistent with those found in other adaptations, such as that of Lin et al. (2018), and they constitute a validation of previous exploratory works (González-Cabrera et al., 2017; Yildirim & Correia, 2015).

Table 6. *Scores for the Percentiles of the NMP-Q as a Function of Sex and Age (n = 5012)*

	Scores					
	Males			Females		
Percentiles	12-15 n = 809	16-20 n = 1276	21-24 n = 817	12-15 n = 614	16-20 n = 929	21-24 n = 567
1	20	20	20	21	21	21
5	25	25	23	29	27	25
10	31	30	27	34	32	29
15	34	33	30	38	37	32
20	36	36	32	41	40	37
25	39	39	36	44	43	41
30	41	41	39	47	46	44
35	43	43	41	50	49	47
40	45	45	44	53	53	50
45	48	48	47	57	55	53
50	51	50	49	60	57	57
55	54	53	52	65	59	60
60	58	55	55	67	62	63
65	61	58	58	70	66	64
70	65	61	61	73	69	68
75	68	64	63	77	73	72
80	71	67	66	82	77	75
85	*75*	*71*	71	87	82	80
90	82	76	76	94	88	85
95	92	84	86	107	101	95
99	121	110	103	129	126	124
M	54.27	52.11	50.90	62.37	59.29	57.33
DT	20.88	18.68	16.68	23.71	22.04	21.77

Note. Gray indicates the 15th (No Nomophobia), 80 (Risk of Nomophobia), and 95 (Nomophobia) percentiles.

Additionally, we provide a hierarchical model with four first-order factors and a general second-order factor, which allow us to provide both a total score and three cut-off points, making it possible not only to determine whether a nomophobic problem exists but also its severity.

There are currently few studies on the prevalence of nomophobia, and even fewer with a large and geographically representative sample of all the regions of the same country. To date, no work has established clear cut-off points to identify different levels of a nomophobic problem. The only work that suggests cut-off points was performed by González-Cabrera et al. (2017), using the 15th, 80th, and 95th percentiles according to sex and age of their participants. However, the sample of that study had major limitations due to the small size and its representativeness. In addition, the cut-off points were conceptualized as casual user (P15), at-risk user (P80), and problematic user (P95). In this manuscript, we adapted these categories coming from the game disorder literature to the singularity of the nomophobia construct, indicating absence of nomophobia (P15), being at risk of developing nomophobia (P80), and the existence of a nomophobic problem (P95). Besides, our present study was conducted with a large Spanish sample, general (not just students) and with representation of all regions of the country (see Table 1), whereas the former study of González-Cabrera et al. (2017) were done with smaller and student samples. The new cut-off points suggested here are, in general, lower than those of González-Cabrera et al. (2017), but they maintain the same tendency of the exploratory study, as females (at any age) presented greater levels of nomophobia and, among them, females of the 14-15 and 16-17 age groups presented the highest scores.

Regarding the hypotheses that sex and age nomophobic differences do exist (Arpaci, Baloglu, Kozan & Kesici, 2017; Dasgupta et al., 2017; Gezgin & Çakır, 2016; Gezgin, S¸umuer, Arslan & Yildirim, 2017; González-Cabrera et al., 2017; King et al., 2017; Prasad et al., 2017), this study has come to confirm that females score higher in the NMP-Q (and in all four dimensions) than males. However, other works have not reported these differences (Lin et al., 2018) or have indicated that they are nonsignificant (Farooqui, Pore & Gothankar, 2017; Madhusudan, Sudarshan, Sanjay, Gopi & Fernandes, 2017; Müge & Gezgin, 2016; Uysal, Özen & Madeno˘glu, 2016). Some works have even found males to have higher levels of nomophobia and mobile dependence (Dongre et al., 2017; Nawaz, Sultana, Amjad & Shaheen, 2017). These differences may be due to cultural or religious issues, which may have more explanatory value than the variable sex itself, as it has been suggested in other studies on problematic Internet use and mobile phone (Baron & Campbell, 2011; Yudes-Gómez, Baridon-Chauvie & González-Cabrera, 2018). In addition, data from the present study support the hypothesis that nomophobia scores decrease with age, more specifically after 18 years old. This is convergent with the work of Gezgin et al. (2017), who argue that, as age increases, the levels of nomophobia decrease, and it is somehow in line with the findings of Dasgupta et al. (2017), although in this latter study the age that makes a different it is not placed in the 18 years old but in the 21, being younger than this age a predictor of nomophobia. Similarly, age differences between those who are younger than 20 and those who are older have also been reported (Adawi et al., 2018; Yildirim, Sumuer, Adnan & Yildirim, 2015). Finally, some other works have also provided different age ranges for at-risk groups, being the more problematic groups those of 18-29 years (King et al., 2017) and 22-24 years (Sharma, Sharma, Sharma & Wavare, 2015).

This study also presents some methodological limitations. Firstly, the NMP-Q is a self-reporting questionnaire, so there may be response and desirability biases. For this reason, some participants may have answered some questions untruthfully, under-reporting the severity or frequency of nomophobia symptoms to minimize their problems. Albeit more unlikely, they may also have exaggerated their answers to make their mobile problems seem worse. Despite the fact that, due to the characteristics of this research, we did not use any mechanism to detect dishonesty, participants were given their nomophobia scores. Therefore, it is reasonable to assume that the online question-

naire was only answered by readers who were interested in the topic and in knowing their scores. We believe that this incentive, which is not so common in research, served to reduce the aforementioned problems associated with self-reports. Also, the short time that it took to complete the 20-item questionnaire (7 minutes on average), along with the fact that there were no reverse items, may have reduced problems related to poor attention or boredom. We also eliminated the questionnaires that were completed in less than 4 minutes. This study could be improved in the future by using complementary measures to self-report.

Secondly, sampling was not random, although the sample size ensures that the participants come from in all the Spanish regions and cities, and there was high sociodemographic diversity. More importantly, extrapolating these results should be done with caution, and they should be understood as a first approximation carried out with a large sample and as a first attempt of providing normative criteria for interpreting the NMP-Q scores in Spain. We recommend replicating these results following the cut-off points established herein for sex and age in randomized samples. We also encourage intercultural comparative studies among Spanish-speaking countries. In addition, we consider that the use of this tool with diagnostic purposes should be employed alone with a clinic interview or with any other complementary clinical assessment, but we do not recommend using it as a single measure. We did not evaluate additional nomophobia-related problems, such as time spent online and/or on the phone, FoMO (fear of missing out), etc., precluding us from conducting other statistical analyzes aimed at evaluating the diagnostic accuracy of the NMP-Q. This was not possible due to circumstances beyond our research design control and the requirements of the media that posted the online questionnaire. Also, this study has not examined the relationship between nomophobia and other constructs to analyze the external and internal validity of the NMP-Q, but this has been done in other works, particularly in the Spanish adaptation of González-Cabrera et al. (2017), as well as in other adaptation studies (Adawi et al., 2018; Lin et al., 2018; Yildirim & Correia, 2015). Finally, we did not explore sociodemographic variables such as ethnicity, type of degree, socio-economic status, time spent using the mobile, etc., which would be worth studying in future research.

In conclusion, this study confirms the factor structure of the Spanish version of the NMP-Q of Gonzalez-Cabrera et al. (2017) and the original four-factor model of Yildirim and Correia (2015). In addition, we also show that there is a broader second-order factor that would explain the associations between the four dimensions of nomophobia and that provides a first standardization of nomophobia scores according to sex and age (between 12 and 24 years). This work can be useful for pediatric and psychological care units, as well as for those in charge of school orientation in schools. All the above information is also of special interest to parents, since education and parental supervision can play a very important role in the prevention of the problems associated with the information and communication technologies.

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