

# Factor structure and validity of the nomophobia questionnaire (NMP-Q) among Indian college students: A multicenter evaluation

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## Summary

**Background:** Nomophobia is a psychological condition characterized by an individual's fear of being disconnected from smartphone connectivity. Nomophobia Questionnaire (NMP-Q) is the most used self-reported measure to assess nomophobia across the globe. Therefore, the present study aimed to assess the factor structure, reliability, and validity of NMP-Q among Indian undergraduate college students.

**Subjects and Methods:** Using a cross-sectional design, our study employed an exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), where data was collected from three centres across India. EFA was carried out to obtain factor structure and check the internal consistency among items. CFA was carried out to test the factor structure of NMP-Q. Convergent and discriminant validity were tested using bivariate correlation analysis.

**Results:** Exploratory factor analysis showed that the questionnaire has good internal consistency (Cronbach's alpha reliability coefficient = 0.952) with a three-factor pattern matrix. CFA explained three-factor structure which deemed to be the most tenable comprising of 20 items. NMP-Q fits good on almost all indices (CMIN/df = 3.01, CFI = 0.94, RMSEA = 0.07, TLI = 0.93, IFI = 0.93) for the three-factor structure. Moderate to excellent associations were noted for the convergent ( $r = 0.770$ ) and divergent validity ( $r = -0.972$ ) respectively. The NMP-Q demonstrated scores below 64 as no nomophobia; from 64-79 for mild nomophobia; 80-95 for moderate nomophobia and >95 indicated severe nomophobia for our population.

**Conclusion:** The Nomophobia Questionnaire (NMP-Q) is a valid, accurate and reliable instrument that can measure nomophobia in the Indian youth population.

**Keywords:** nomophobia questionnaire, reliability, validity, factor structure, India

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## INTRODUCTION

With advancements in technology and decreasing smartphone costs, global reliance on mobile devices has surged, driven by their wide-ranging applications in communication, education, and entertainment. Features like touch screens, internet connectivity, and GPS have made smartphones integral to daily life, profoundly altering routines. However, this reliance can lead to issues such as poor sleep quality, attention deficits, and strained relationships (Dasgupta et al., 2017). One significant concern is Nomophobia, a psychological condition which reflects an over-dependence on smartphones, causing distress over potential disconnection and associated with poor

quality of life (Ranjan et al., 2023). Although not placed in current nosological diagnostic classification, some researchers advocated for its inclusion in the DSM-5 as a specific phobia (Haug et al., 2015).

Nomophobia is a distinct construct related to problematic smartphone use. Research since 2010 has explored various psychological factors linked to nomophobia, including anxiety, depression, panic FOMO (Fear of missing out) among others (Leon-Mejia et al., 2021). As nomophobia is a relatively new construct, there were no specific instruments available to assess it until the introduction of the Nomophobia Questionnaire (NMP-Q) by Yildirim and Correia in 2015 (Yildirim & Correia, 2015), comprising 20 items scored on a 7-point likert scale. The questionnaire's development involved qualitative interviews

with problematic smartphone users, identifying 4 themes namely – not being able to communicate, losing connectivity, not being able to access information, giving up convenience. The items for the NMP-Q were developed on these dimensions. The NMP-Q was validated through a large sample, demonstrating strong reliability and concurrent validity (Rodriguez-Garcia et al., 2020). Nomophobia as a construct can be supported by social anxiety, in which people consider their smartphones to avoid worries and apprehensions. Anxious people tend to use smartphones very often and engage in problematic behaviour (Marks & Gelder, 1965; Lee & Stapinski, 2012).

Among the instruments being used to assess nomophobia, NMP-Q is the most used across the globe, with its psychometric properties thoroughly examined. Additionally, its adaptation into various languages establishes the NMP-Q as the most appropriate tool for future research and the only instrument that facilitates across cultural studies (Sunday et al., 2021). Thus, more research calls to probe nomophobia as a theoretical construct for including it in the current nosology as a diagnostic entity. Consequently, the need of hour is to gather relevant evidence on the NMP-Q's internal structure in Indian context, promoting its use by clinicians and researchers in India. Therefore, we aimed to assess the factor structure, reliability, and validity of NMP-Q among Indian undergraduate college students.

## SUBJECTS AND METHODS

### Study design, study population and eligibility

Our study goal was to administer NMP-Q among undergraduate students of three different locations of India. Further, our study aimed to validate the factor structure of NMP-Q with a large sample and examine the extent to which it secured reliable and valid scores in Indian context. Our study employed a cross-sectional design and we obtained and further examined the factor structure of NMP-Q as well as its convergent and divergent validity, with related measures among Indian undergraduate students. The research was carried out under collaborative aegis of three central government-funded institutions of India. Undergraduate students from various disciplines (Arts & Humanities, Science, Engineering, Commerce/Management, Medical & law), aged between 18-24 who possessed a smartphone and were willing to participate were included in this study.

### Sampling technique and sample size estimation

A non-probability, purposive sampling technique was used for our study. The sample size for quantitative validation (exploratory factor analysis and confirmatory factor analysis) was estimated based upon at least 20 respondents per items (Anthoine et al. 2014). We estimated to take at least 450 undergraduate college students for both exploratory factor analysis (EFA) (n=473) and confirmatory factor analysis (CFA) (n=475) when non-response and site variability were taken into consideration.

### Data collection

Undergraduate students were invited to participate voluntarily in the study through a brief in-class announcement, explaining the need and purpose of the study. After being introduced to the study, the students were asked to fill out the set of questionnaires that they had voluntarily agreed to take part in. The data was collected from January 2023 to April 2023.

### Instruments

**Nomophobia Questionnaire (NMP-Q):** The NMP-Q is developed by Yildirim and Correria in 2015 (Yildirim & Correria, 2015). There are 20 items in this questionnaire and the items are scored on a 7-point likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The NMP Q has a maximum possible score of 140, with the severity of nomophobia increasing in accordance with higher score.

**Mobile Phone Attachment Scale (MPAS):** The MPAS is developed by (Bock et al., 2016) and is used to assess the quality of individual's relationship with their mobile phones. It consists of 24 items. Response options ranged from 1 (not at all true) to 5 (extremely true). This Scale has a good internal consistency. We had incorporated only the anxious attachment domain to check the convergent validity.

**Mindful Attention Awareness Scale (MAAS):** The MAAS developed by (Carlson & Brown, 2005), consists of 15 items that assess a single dimension of the mindfulness trait. MAAS measures the frequency of open and receptive attention to, and awareness of, ongoing events and experiences. Responses are rated on a scale from 1 (almost never) to 6 (almost always). The scale demonstrates strong internal consistency with Cronbach's alpha values ranging from 0.89 to 0.93. We utilized this scale to evaluate Divergent Validity.

## Data analysis

To investigate and obtain the underlying factor structure of NMP-Q, exploratory factor analysis was performed on the data set ( $n=473$ ). A principal component analysis with promax rotation was carried out on the 20 items in the questionnaire. For the appropriateness of factorability of items, the Kaiser-Meyer Olkin (KMO) measure of sampling adequacy (Kaiser & Rice, 1974) and Bartlett's (1951) test for sphericity were utilized. Homogeneity and its internal consistency among items in NMP-Q were examined using Cronbach's alpha internal consistency reliability coefficient. Confirmatory factor analysis ( $n=475$ ) was used to test the factor structures of the NMP-Q for this sample. Model fit was assessed using the chi-square divide by its degree of freedom ( $CMIN/DF < 3$ ) with other recommended fit indices including the comparative fit index ( $CFI \geq 0.90$ ), Tucker-Lewis index ( $TLI \geq 0.95$ ), root mean squared error of approximation ( $RMSEA \leq 0.08$ ), as recommended by established guidelines (Hu & Bentler, 1998; Lance et al., 2000). A comparison of the one-factor and three-factor models was utilized using the chi-square difference test and other indices mentioned above. Convergent and divergent validity with other constructs were evaluated through bivariate correlations between the NMP-Q and its subscale scores versus all other measures. The median and interquartile range (IQR) was used to determine the cut-off scores for severity. Statistical analysis was performed using IBM SPSS AMOS Version 27.

## Ethical procedure

The study was conducted after getting approval from the respective institutional ethics committees of the lead site (IEC/2020/467) as well as all participating sites following ICMR's National Ethical Guidelines for Biomedical and Health Research Involving Human Participants. Written informed consent was obtained from every study participant before inclusion in the study.

## RESULTS

### Exploratory factor analysis (EFA) ( $n=473$ )

#### Socio-demographic profile and smartphone use

A group of 473 undergraduate students were evaluated for EFA. Data were collected from three govern-

ment-funded tertiary care referral hospitals situated in three different locations of India, with almost equal participation from all three centres (rural-urban 1= 33.12%, rural-urban 2=33.82% and urban 3=32.98%). The participants' socio-demographic data are presented, which shows that the sample consisted mostly of males with a mean age of 20 years. The average duration of checking their smartphones is approximately 284 minutes, the data consumption per month counted up to 49.36 GB and the average number of times of checking their smartphones is 42% (refer to Table 1).

#### Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) measure

The Bartlett's test of sphericity [ $\chi^2(190) = 6013.722$ ,  $p < .001$ ] and the KMO (0.946) coefficient (Minimum accepted value is greater than 0.60) showed that a significant correlation was present in the data and sample was adequate for factor analysis. In addition, principal component analysis (PCA) was performed on the 20 items before rotating the factors to assess the factorability of the correlation matrix and to estimate the number of factors.

#### Eigenvalue

Three factors were extracted that explained 58.3% of the variance, with eigenvalues greater than 1. The factors with eigenvalues greater than 1 are considered important and are retained because they account for a significant amount of variance (George & Mallery, 2018). Table 2 displays the eigenvalue and total variance explained by the factor before and after rotation. Similarly, the scree plot (see Figure 1) of the eigenvalues and factors suggested a three-factor structure because the eigenvalues began to decline below 1 after that point. It reveals that factor 1 accounted for 46.3% of item variance, followed by factor 2 with 6.1%, and factor 3 with 5.8% before rotation. Item variance changed to 22.1 % for factor 1, 19.4 % for factor 2 and 16.8 % for the factor 3 after rotation. Thus, the substantial percentage of variance accounted by each factor indicated their importance for the nomophobia construct.

#### Factor loading

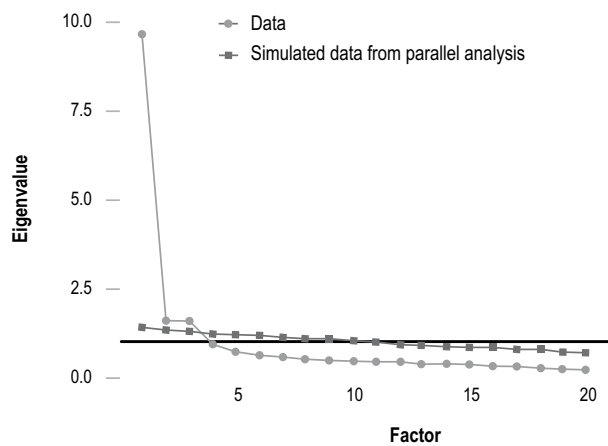
The loading of all items after promax rotation on each factor is depicted in Table 3. All 20 items are loaded on three factors. A factor loading of more than 0.3 was used as a cut-off value. Table 4 provides a summary of the results of EFA which include communality value. The communality values are reasonably satisfactory almost all the items suggesting that the items loaded on respective factors are adequate.

**Table 1.** Socio-demographic and smartphone use details of the participants

		EFA (n=473)		CFA (n=475)	
Age (yrs) Mean SD (range)		20.96 ± 2.05 (18-24)		21.08 ± 2.38 (18-24)	
		N	%	N	%
<b>Gender</b>	Male	215	45.45	271	57.05
	Female	258	54.54	203	42.7
	Transgender			1	0.21
<b>Centres</b>	RU1	157	33.12	134	28.26
	RU2	160	33.82	178	37.47
	U3	156	32.98	163	34.31
<b>Marital Status</b>	Married	11	2.32	28	5.89
	Unmarried	462	97.67	445	93.68
	Widow/widower	0	0.00	1	0.21
	Divorced	0	0.00	1	0.21
<b>Stream</b>	Arts & Humanities	146	30.86	82	17.26
	Science	117	24.73	97	20.42
	Engineering	54	11.41	139	29.26
	Commerce	25	5.28	82	17.26
	Medical	127	26.84	75	15.78
	Law	4	0.84	0	0.00
<b>Education of the head of the family</b>	Profession/ honours	90	19.02	109	22.94
	Graduate	220	46.51	170	35.78
	Intermediate/ diploma	48	10.14	49	10.31
	Primary school certiciate	73	15.43	84	17.68
	Middle school certificate	22	4.65	44	9.26
	High school certificate	15	3.17	16	3.36
	Illiterate	5	1.05	3	0.63
<b>Religion</b>	Hindu	433	91.54	436	91.78
	Muslim	34	7.18	36	7.57
	Christian	3	0.63	3	0.63
	Sikh	0	0.00	0.00	0.00
	Others	3	0.63	0.00	0.00
<b>Living settlements</b>	Urban	321	67.86	398	83.78
	Rural	152	32.13	77	16.21
<b>Smartphone use</b>	Duration of smartphone use (in minutes)	284.84		288.57	
	Data consumption	49.36 GB		49.08 GB	
	The average number of times checking the smartphone	42%		58%	

**Table 2.** Eigenvalues and total variance explained before and after rotation (NMP-Q)

Unrotated solution					Rotated solution		
	Eigenvalues	Sum sq. loadings	variance	Cumulative %	Sum sq. loadings	variance	Cumulative %
Factor I	9.674	9.265	0.463	0.463	4.412	0.221	0.221
Factor II	1.580	1.229	0.061	0.525	3.870	0.194	0.414
Factor III	1.555	1.156	0.058	0.583	3.368	0.168	0.583



**Figure 1.** Scree plot (EFA; n=473)

### Reliability analysis

Table 4 depicted the results of reliability analysis of the questionnaire. The analysis showed that the questionnaire has excellent internal consistency, as Cronbach's alpha reliability coefficient for internal consistency was .952. To assess the internal consistency of each factor separately, Cronbach's alpha was evaluated for each factor. The alpha coefficients of Factor I (9 items), Factor II (5 items), and Factor III (6 items) were .909, .909 and .912 respectively. In order to determine the reliability of each item, we calculated the corrected item-total correlation and Cronbach's alpha if item deleted values. All corrected item-total correlations were greater than .30 indicating that all items are correlated with the total. When we compared the Cronbach's alpha item if deleted to the

**Table 3.** Factor loadings of NMP-Q in EFA (n=473)

	Factor 1	Factor 2	Factor 3
4. I would be annoyed if I could not use my smartphone and/or its capabilities when I wanted to do so.	0.822		
2. I would be annoyed if I could not look information up on my smartphone when I wanted to do so.	0.813		
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	0.666		
5. Running out of battery in my smartphone would scare me.	0.662		
1. I would feel uncomfortable without constant access to information through my smartphone	0.658		
6. If I were to run out of credits or hit my monthly data limit, I would panic	0.657		
8. If I could not use my smartphone, I would be afraid of getting stranded somewhere.	0.619		
9. If I could not check my smartphone for a while, I would feel a desire to check it.	0.614		
3. Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous.	0.509		
16. I would be nervous because I would be disconnected from my online identity		0.955	
17. I would be uncomfortable because I could not stay up-to-date with social media and online networks.		0.873	
18. I would feel awkward because I could not check my notifications for updates from my connections and online networks.		0.807	
19. I would feel anxious because I could not check my email messages		0.720	
20. I would feel weird because I would not know what to do.		0.587	
13. I would be anxious because I could not keep in touch with my family and/or friends.			0.907
11. I would be worried because my family and/or friends could not reach me			0.834
12. I would feel nervous because I would not be able to receive text messages and calls.			0.807
15. I would feel anxious because my constant connection to my family and friends would be broken.			0.665
10. I would feel anxious because I could not instantly communicate with my family and/or friends			0.607
14. I would be nervous because I could not know if someone had tried to get a hold of me.			0.557

**Table 4.** Exploratory factor analysis and reliability analysis of items (n=473)

Items	Factor loading	Communality after extraction	Corrected item-total correlation	Cronbach's Alpha If Item Deleted	Cronbach's Alpha
<b>Factor I</b>					
Item 1	0.658	0.441	0.648	0.950	
Item 2	0.813	0.359	0.645	0.950	
Item 3	0.509	0.418	0.701	0.949	
Item 4	0.822	0.341	0.684	0.950	
Item 5	0.662	0.427	0.661	0.950	<b>0.909</b>
Item 6	0.657	0.393	0.654	0.950	
Item 7	0.666	0.429	0.662	0.950	
Item 8	0.619	0.389	0.715	0.949	
Item 9	0.614	0.455	0.635	0.950	
<b>Factor II</b>					
Item 10	0.607	0.323	0.706	0.949	
Item 11	0.834	0.271	0.584	0.951	
Item 12	0.807	0.222	0.736	0.949	<b>0.909</b>
Item 13	0.907	0.197	0.706	0.949	
Item 14	0.557	0.337	0.717	0.949	
Item 15	0.665	0.241	0.767	0.949	
<b>Factor III</b>					
Item 16	0.955	0.194	0.698	0.949	
Item 17	0.873	0.219	0.717	0.949	
Item 18	0.807	0.221	0.749	0.949	<b>0.912</b>
Item 19	0.720	0.337	0.650	0.950	
Item 20	0.587	0.332	0.722	0.949	

Factor loadings are > 0.3\*

Overall Cronbach's Alpha= 0.952

Cronbach's alpha reliability coefficient of the questionnaire (.952), we found that no item could be deleted to increase the Cronbach's alpha of all items (table 3).

### Confirmatory factor analysis (CFA) (n=475)

#### Socio-demographic profile and smartphone use

A total sample of 475 participants was selected for CFA analysis from the same centres (rural-urban 1= 28.26%, rural-urban 2= 37.47% and urban-3= 34.31%). Data set were different from EFA analysis. The mean age of the students was 21.08 which consisted of large number of male participants. The average duration of checking their smartphones is 288 minutes, the data consumption per month is 49.08 GB and the average number of times of checking their smartphones is 58% (refer Table 1).

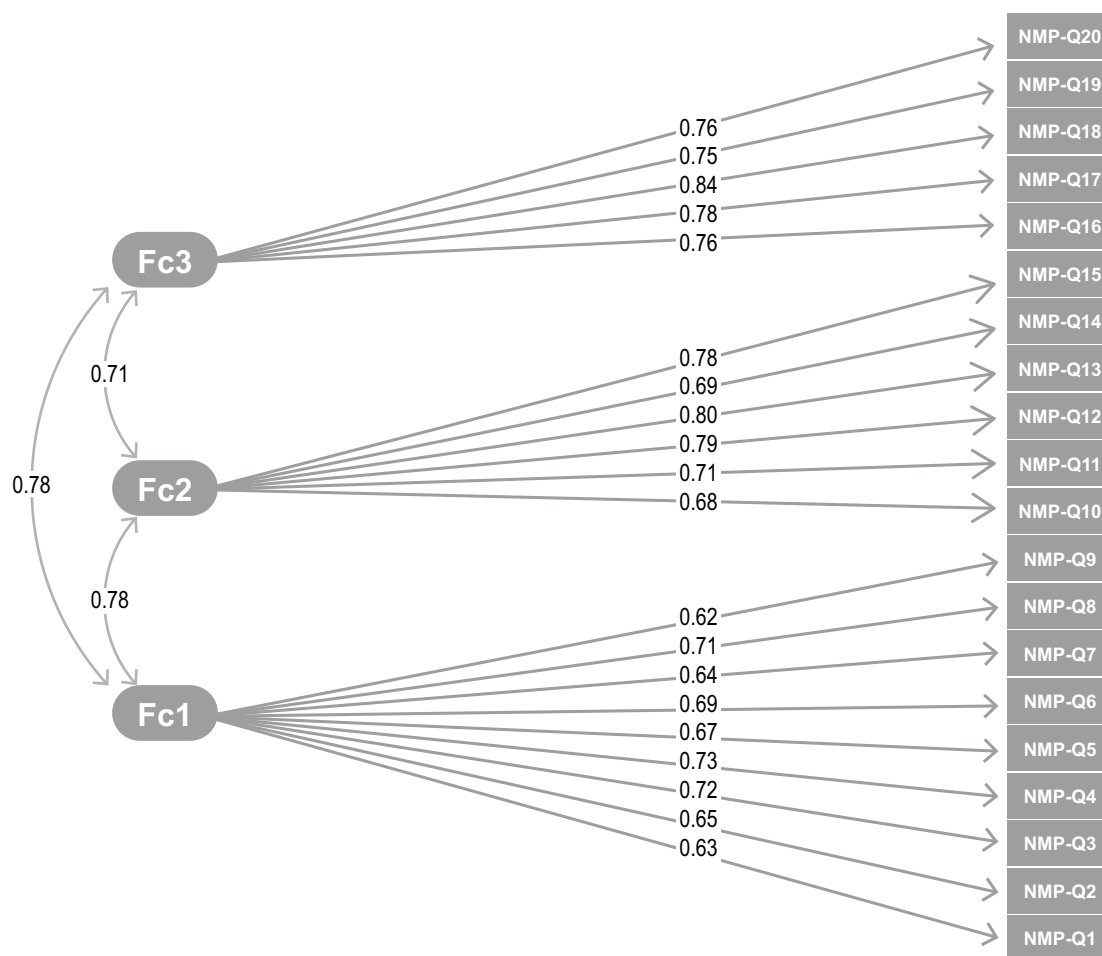
#### Structural validity: Three factor structure of NMP-Q

To validate our three-factor pattern matrix of NMP-Q obtained from EFA, we conducted Confirmatory Factor Analysis (CFA) using AMOS. Even after negating the covariance values, a three-factor solution for 20 items of NMP-Q demonstrated acceptable or reasonable fit for all fit indices (refer Figure 2). The three-factor solution (20 items) of NMP-Q exhibited acceptable values and good fit for all fit indices (CFI= 0.94, TLI=0.93, IFI=0.93) except CMIN/df (3.01) and RMSEA (0.07) which were reasonable and moderately fit respectively (table 5). Eventually a three-factor structure was established with 20 items namely: Information-Convenience Anxiety; Communication void; Digital Isolation (Please refer Table S1: Final validated NMP-Q in English language).

**Table S1.** Nomophobia questionnaire (NMP-Q)

**1. Strongly disagree; 2. Disagree; 3. Somewhat disagree; 4. Neither agree nor disagree; 5. Somewhat agree; 6. Agree; 7. Strongly agree**

Domains/ Items	1.	2.	3.	4.	5.	6.	7.
<b>I. Information-convenience anxiety</b>							
1. <i>I would feel uncomfortable without constant access to information through my smartphone</i>							
2. <i>I would be annoyed if I could not look information up on my smartphone when I wanted to do so.</i>							
3. <i>Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous.</i>							
4. <i>I would be annoyed if I could not use my smartphone and/or its capabilities when I wanted to do so.</i>							
5. <i>Running out of battery in my smartphone would scare me.</i>							
6. <i>If I were to run out of credits or hit my monthly data limit, I would panic</i>							
7. <i>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</i>							
8. <i>If I could not use my smartphone, I would be afraid of getting stranded somewhere.</i>							
9. <i>If I could not check my smartphone for a while, I would feel a desire to check it.</i>							
<b>II. Communication void/ Not being able to communicate if I did not have smartphone with me;</b>							
10. <i>I would feel anxious because I could not instantly communicate with my family and/or friends</i>							
11. <i>I would be worried because my family and/or friends could not reach me</i>							
12. <i>I would feel nervous because I would not be able to receive text messages and calls.</i>							
13. <i>I would be anxious because I could not keep in touch with my family and/or friends.</i>							
14. <i>I would be nervous because I could not know if someone had tried to get a hold of me.</i>							
15. <i>I would feel anxious because my constant connection to my family and friends would be broken.</i>							
<b>III. Digital isolation/ Losing Connectedness if I did not have smartphone with me;</b>							
16. <i>I would be nervous because I would be disconnected from my online identity</i>							
17. <i>I would be uncomfortable because I could not stay up-to-date with social media and online networks.</i>							
18. <i>I would feel awkward because I could not check my notifications for updates from my connections and online networks.</i>							
19. <i>I would feel anxious because I could not check my email messages</i>							
20. <i>I would feel weird because I would not know what to do.</i>							
<b>Total score = 140</b>							
<b>Score</b>	<b>Inference</b>	<b>Score</b>	<b>Inference</b>				
<64	No Nomophobia	80-95	Moderate Nomophobia				
64-79	Mild Nomophobia	>95	Severe Nomophobia				



**Figure 2.** Confirmatory factor analysis explained by structural equation model (SEM) for the three-factor structure of NMP-Q (Final 20 items, n= 475)

Fc1 – Information-convenience anxiety; Fc2 – Communication void; Fc3 – Digital isolation

### Construct validity (Convergent and divergent validity: correlation analysis)

Bivariate correlations between the NMP-Q total score, subscale scores, and other constructs are provided in Table 6. Good correlation with MPAS was noted for the convergent ( $r= 0.770$ ) and excellent correlation with MAAS was noted for discriminant validity ( $r= -0.972$ ) respectively.

### Cut-off scores for severity of nomophobia (NMP-Q) in our population

To establish cutoff values for nomophobia severity in the population of Indian students, we analysed the scores from the Nomophobia Questionnaire (NMP-Q). The median score was found to be 80, with the 1st quartile (Q1) at 64 and the 3rd quartile (Q3) at 95. Based on these statistical measures, we proposed the following cut-off

scores for nomophobia severity. Individuals scoring from the 1st quartile (Q1) to the median (64 to 80) are considered to exhibit mild symptoms of nomophobia. Those with scores ranging from the median to the 3rd quartile (80 to 95) display moderate levels of nomophobia. Finally, individuals scoring above the 3rd quartile (greater than 95) are categorized as having severe nomophobia.

## DISCUSSION

Two steps cross-sectional study design (quantitative validation- exploratory factor analysis followed by confirmatory factor analysis) was used to validate the dimensions of NMP-Q in Indian population in this study. NMP-Q was validated with a sample of undergraduate college students

**Table 5.** Fit indices for three factor structure in confirmatory factor analysis (n=475)

Model fit indices	Cut- off value	Fit indices value	Inference
CMIN/df	<3	3.01	Reasonable fit
RMSEA	<0.06	0.07	Moderately fit
CFI	>0.90	0.94	Acceptable, good fit
IFI	>0.90	0.93	Acceptable, good fit
TLI	>0.90	0.93	Acceptable, good fit

**Table 6.** Correlations between NMP-Q total and subscale scores and other relevant constructs

Variable	NMP-Q Total	Information-convenience anxiety	Communication void	Digital isolation
NMP-Q / Total		0.916	0.843	0.858
Information-Convenience Anxiety	0.916		0.663	0.663
Communication void	0.843	0.663		0.617
Digital Isolation	0.858	0.663	0.617	
MPAS	0.770			
MAAS	-0.972			

which revealed a three-factor structure (Information-Convenience Anxiety; Communication void; Digital Isolation) for the NMP-Q. To the best of our knowledge, our study is the first of its kind study which analysed the psychometric properties of NMP-Q and validated it among a non-clinical sample of Indian youths.

### Description of factor structure

The NMP-Q originally has a four-factor structure, however in our study a three- factor structure emerged. 'Not being able to access information' and 'Giving up convenience' emerged as single dimension or factor in our study. We renamed them as single factor 'Information-Convenience Anxiety'. 'Not being able to access information' refers to the discomfort experienced when individuals lose constant access to information via smartphones as well as their inability to retrieve or search for information using these devices. The immediate accessibility of information made possible by the smartphones,

constitute a fundamental aspect of smartphone utilization. 'Giving up convenience' refers to the experiences associated with sacrificing the convenience offered by the smartphones as well as the desire to maintain access to this convenience. It highlights individual's reliance on the convenience these devices have to offer. In both these dimensions, common prominent theme emerged as convenience, which smartphone offers now a days. 'Not being able to communicate' or 'Communication void' relates to the emotions associated with losing the ability for instant communication with others and being unable to access services that facilitate such interactions. The components within this theme are connected to the feelings of being unable to reach out to others or to receive communications from them. 'Losing Connectedness' or 'Digital Isolation' means losing the constant connectivity that smartphones offer and the sense of disconnection from one's online identity, particularly on social media. Notifications are regarded as a means of maintaining connectedness, receiving notifications indicated that they remained linked to their online identity and social networks.

## Comparison with existing literature

Our findings are consistent with those from a previous exploratory factor analysis (EFA) conducted on NMP-Q within Italian population (Adawi et al., 2018), where NMP-Q was validated as well as translated into Italian language. 403 participants were recruited through snowball sampling for this study. The eigenvalues and scree plot indicated a three-factor structure for the translated questionnaire. The NMP-Q exhibited a high overall Cronbach's alpha coefficient of 0.95, with specific values of 0.94, 0.89, and 0.88 for the three identified factors. The first factor accounted for 23.32% of the total variance, while the second and third factors explained 23.91% and 18.67% of the variance, respectively. Factor variance and reliability among items in our study are almost like Italian study. Furthermore, the total NMP-Q score demonstrated a significant correlation with the number of hours spent on mobile phone usage. NMP-Q was translated into Chinese through EFA and CFA on a sample of 966 college students. The findings indicated that a four-factor model with 20 items represented the optimal fit for the data collected from the sample (Ma & Liu, 2021). These findings provide support for the robustness of the structure of the NMP-Q through cross-cultural validation. The Persian version of NMP-Q also supported the four-factor structure of NMP-Q and was fit to be administered on Persian speaking adolescents and the four-factor structure was supported by Confirmatory Factor Analysis (Lin et al., 2018). In a systematic review the overall results showed women to be more nomophobic than men, while few (eight) studies showed men to be more vulnerable to nomophobia (Bragazzi & Del Puente, 2014). Majority of the studies where nomophobia was more prevalent in women were from Turkey and India, followed by European and American countries (Gezgin et al., 2018).

## EFA and CFA

NMP-Q reasonably fits as three-factor structure in all fit indices in our study population. NMP-Q demonstrated high internal consistency, and convergent and discriminant validity were good. In EFA, PCA with promax rotation was carried out to explore and obtain the dimensions of NMP-Q as we expected the factors to be correlated, similar to the approach used by Alavi (Alavi et al., 2020). The pioneer research study of NMP-Q (Yildirim & Correira, 2015) used PCA with varimax rotation with the assumption of no inter-correlations between components. Our study is based upon theoretical construct of

nomophobia (Attachment theory) unlike NMP-Q by Yildirim & Correira, 2015 which was an exploratory study. Study by Yildirim & Correira, 2015 had utilized only exploratory factor analysis for extraction of factor structure. We had performed confirmatory factor analysis for validation of theoretical construct of nomophobia in addition to exploratory factor analysis. We could find only one Indian study related to the nomophobia construct in which authors designed a semi-structured proforma for which test-retest reliability was conducted over two weeks and the Cronbach's alpha came to be 0.88 (Mohapatra et al., 2023).

## Implication of study findings

NMP-Q validated from our study may be of great clinical significance for Indian youths with problematic smartphone use. NMP-Q would measure the severity of Nomophobia among them. It would further help to explore possible associations with psychological disorders with nomophobia. Our study results have theoretical implications too. NMP-Q demonstrates adequate discriminant and convergent validity with mindfulness traits (Carlson & Brown, 2005) and attachment (Bock et al., 2016) with smartphones respectively. Overall, these findings substantiate the NMP-Q as a valid severity tool suitable for application within the Indian youth population. The NMP-Q identified cut-off values (64, 80, and 95) are robust, corresponding to the 1st quartile, median, and 3rd quartile NMP-Q scores of Indian youths. These thresholds are essential for categorizing participants and guiding interventions based on severity. The NMP-Q, with its cut-off point, could serve as a suitable screening and severity tool for nomophobia in our population and can be beneficial for future research. The critical cut-off point of the scale has the credibility to identify nomophobia among college students aged between 18 to 24. This can further facilitate future epidemiological studies on nomophobia in Indian Population. Finally, this threshold can enable clinicians or healthcare workers to discuss clinical cases related to nomophobia.

## Limitations

There are certain limitations in our study that are worth mentioning. Given that the study was carried out on undergraduate college students, the sample consisted of well-educated individuals. Therefore, our sample may not accurately represent much of the country population. Future research should investigate the validity of NMP-Q

in Indian adults with limited education and diverse strata and regions to confirm that the NMP-Q is fit to be applied to different groups, in Indian context. Additionally, our study population were undergraduate students, future study should be done to validate the factor structure of NMP-Q on the clinical population of nomophobic individuals from India. Our sampling strategy was purposive, non-probability sampling for EFA and CFA, therefore more robust design with a probability sampling technique is warranted for the generalizability of the study findings. Our assessment was done at one time for convergent and discriminant validity. A robust study design of prospective longitudinal study is warranted for assessing these measures. This standard approach will further help in the comprehensive understanding of the Nomophobia construct.

## CONCLUSION

The Nomophobia Questionnaire (NMP-Q) fits three factor model. It demonstrated high internal consistency, and good to excellent convergent and divergent validity. Overall, NMP-Q demonstrated good psychometric properties among Indian adults. Our findings provide a basis for the use of NMP-Q as a severity assessment tool in the Indian setting. It is a self-rated instrument of nomophobia, and holds huge potential for broader application in the field of nomophobia. With its accuracy and reliability, NMP-Q is expected to significantly contribute to the advancement of knowledge in this area.

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Authors confirmed the compliance with all relevant ethical regulations.

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