



Research article

The effect of emotion regulation strategies on nomophobia in college students: The masking role of resilience

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ABSTRACT

College students have a high prevalence of nomophobia. However, research on the effects of emotion regulation and resilience on nomophobia in China is lacking. This research investigated how cognitive reappraisal and expressive suppression strategies directly and indirectly affect nomophobia through resilience. Therefore, from March to May 2023, 756 university student volunteers (21.4 % men) were selected from a university in northeastern China for a questionnaire survey. Our findings suggest that college students' resilience has a masking effect on the relationship between cognitive reappraisal and nomophobia and can attenuate the negative effect of the frequency of using cognitive reappraisal strategies on nomophobia. The frequency of expressive suppression strategies directly and positively affected nomophobia. Early psychological interventions targeting resilience might be potentially effective in alleviating nomophobia among college students.

1. Introduction

Nowadays mobile phones have provided great convenience to our lives. However, excessive use of them can affect individuals' physical and mental health, leading to a range of mental disorders, such as insomnia [1,2], musculoskeletal injuries [3], depression [4], and impaired social functioning [5]. Simultaneously, problematic mobile phone use, such as nomophobia, mobile phone addiction, compulsive Internet use, and other behavioral disorders may be triggered. Studies have suggested that compulsive Internet use can lead to difficulties in emotion regulation and low levels of emotion regulation can predict problematic internet use [6,7]. Among college students, mobile phone addiction is negatively associated with psychological resilience [8]. Problematic phone use is also moderately associated with depression and mild-to-moderately associated with anxiety [4].

Concerning mobile phone use, researchers initially focused on the relationship between mobile phone addiction, problematic mobile phone use, and college students' mental health. For example, psychological resilience reduces the negative impact of mobile phone addiction on sleep quality [9]. However, nomophobia has increasingly received attention from researchers [10,11]. Nomophobia is an emerging concept closely tied to technological advances, referring to the irrational anxiety or fear that regular mobile phone users exhibit when their phone battery dies or is not immediately available due to the fear of missing messages or being unable to contact others [12]. It is also considered a behavioral disorder or problematic mobile phone use. With the development of the Internet, many students, especially women, prefer to create multiple accounts on social media and stay connected to their friends,

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leading to an over-reliance on mobile phones [13]. Furthermore, women are more likely to develop nomophobia when they cannot use their phones immediately [14].

A 2023 systematic review summarising 23 papers from 8 countries with approximately 11,300 participants showed that the prevalence of mild, moderate, and severe nomophobia was approximately 24 %, 56 % and 17 %, respectively [15]. The highest prevalence occurred in the university students population (97.38 %), among other groups, including the general adults, community adolescents and high school student [16]. A survey showed that 24.5 %, 56.8 %, and 18.2 % of pharmacy students had mild, moderate, and severe nomophobia [16]. Nomophobia affects academic performance, especially in medical students [17,18]. Accordingly, it is important to identify the risk and protective factors of nomophobia in college students to help parents, schools, and society take reasonable measures to ensure young adulthood mental health.

Emotional regulation is important for mental and behavioral regulation and is essential for maintaining physical and mental health [19,20]. Difficulties in emotion regulation are common in adolescence and are associated with poor social and mental health outcomes [21]. Notably, emotion regulation ability is becoming increasingly important nowadays, especially during and after the COVID-19 outbreak when negative emotions such as loneliness, depression, and anxiety are becoming more prevalent and attracting attention from researchers [22,23]. Poor emotion regulation predicts all addictive behaviors, including problematic mobile phone use, video game addiction, and gambling disorder [7]. People with mobile phone addiction are more likely to exhibit more difficulties in emotion regulation [24]. According to the emotion processing model of negative reinforcement, the addicts' inability to manage negative emotions associated with addiction leads to the maintenance of addiction [25]. Researchers have also suggested that individuals' inadequacy in regulating negative emotions leads to mobile phone addiction [26]. Enhancing teenagers' emotional regulation reduces screen time [27]. Previous studies on the effects of nomophobia on college students' mental health have focused on personality traits, impulsivity, various emotional difficulties, sleep quality and perceived stress [1,5,28–31]. Further research is required to determine whether emotion regulation strategies affect nomophobia. Emotional adaptation has been shown to have a significant impact on nomophobia, and individuals with nomophobia tend to adopt dysfunctional coping strategies [32,33]. Cognitive reappraisal is generally regarded as an adaptive strategy, and expressive suppression as a maladaptive coping strategy [34]. As such, maladaptive emotion regulation may cause behavioral disorders such as nomophobia, and adaptive emotion regulation strategies may alleviate nomophobia symptoms. Therefore, in this study, we propose the following hypotheses: **H1a**: cognitive reappraisal negatively predicts nomophobia, and **H1b**: expression suppression positively predicts nomophobia.

Resilience is another important psychological factor in young adulthood' development. It refers to individuals' ability to withstand high levels of disruptive change, or a process of adapting well amid adversity, or the ability to rebound amid difficult experiences [35, 36]. Emotional regulation is an important element of resilience [35]. Researches have shown that resilience is positively associated with positive reappraisal [37,38]. In contrast, resilience was negatively associated with expressive suppression [39]. Greater resilience was found to be associated with lower mood disturbances, greater use of cognitive reappraisal, and less use of expressive suppression strategies [36]. Thus, we propose the following hypothesize regarding the association between resilience and emotion regulation: **H2a**: cognitive reappraisal positively correlates with resilience. **H2b**: Expressive suppression is negatively correlated with resilience.

Resilience is an important psychological resource that helps maintain mental health [40]. Stressful life events affect coping styles and resilience, making people more likely to suffer adverse mental and psychological consequences [41]. When experiencing stress, resilience acts as a protective factor and reduces psychological distress [42]. Resilience is significantly and negatively associated with substance abuse and behavioral disorders [43]. However, the relationship between resilience and nomophobia remains unclear. We thus further hypothesize that psychological resilience negatively predicts nomophobia (**H2c**). Higher psychological resilience is associated with better positive coping styles [44]. Thus, Resilience may act as a protective factor mediating the effects of cognitive reappraisal and/or expressive suppression on nomophobia. Therefore, we propose hypothesis **H3a**: psychological resilience will negatively mediate the relationship between cognitive reappraisal and nomophobia, and **H3b**: psychological resilience negatively mediates the relationship between expressive suppression and nomophobia.

In summary, increasing mental resilience can mitigate the negative effects of mobile phone addiction, and increasing adaptive emotional processing strategies has been effective in controlling behavioral addiction. However, whether emotional regulation strategies and mental resilience are protective factors for nomophobia remains to be tested. Based on the above empirical studies, our research hypotheses are summarised as follows:

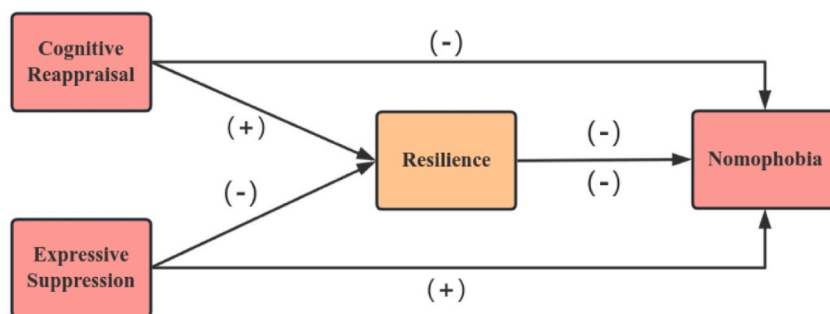


Fig. 1. The proposed mediation model.

- H1a.** Cognitive reappraisal negatively predicts nomophobia.
- H1b.** Expressive suppression positively predicts nomophobia.
- H2a.** Cognitive reappraisal is positively correlated with resilience.
- H2b.** Expressive suppression is negatively correlated with resilience.
- H2c.** Resilience is negatively associated with nomophobia.
- H3a.** Psychological resilience negatively mediates the relationship between cognitive reappraisal and nomophobia.
- H3b.** Psychological resilience negatively mediates the relationship between expressive suppression and nomophobia.

The research hypothesis model is shown in [Fig. 1](#).

Table 1
Descriptive statistics information (n = 756).

Group variable	Frequency	Percent
Gender		
Men	162	21.40 %
Women	594	78.60 %
Level of education		
Junior college	4	0.50 %
Undergraduate	737	97.50 %
Postgraduate	15	2.00 %
Grade		
Freshmen	434	57.40 %
Sophomore	200	26.50 %
Junior	95	12.60 %
Senior and above	27	3.60 %
Major		
Clinical medicine	314	41.50 %
Nursing	56	7.40 %
Medical technology	97	12.80 %
Pharmacy	20	2.60 %
Animal medicine	122	16.10 %
Else	147	19.40 %
Academic performance		
Average score <60	12	1.60 %
Average score [60–70) or GPA 1+	153	20.20 %
Average score [70–80) or GPA 2+	316	41.80 %
Average score [80–90) or GPA 3+	244	32.30 %
Average score [90–100) or GPA 4+	31	4.10 %
Daily duration of mobile phone use (hours)		
0~3	0	0
4~5	219	29.00 %
6~9	375	49.60 %
≥10	162	41.50 %
Starting age of smartphone use (years)		
≤6	15	2.00 %
7~12	159	21.00 %
13~15	347	45.90 %
16~18	176	23.30 %
≥19	59	7.80 %
Number of mobile phones		
1	587	77.60 %
2	143	18.90 %
≥3	26	3.40 %
NMP-Q		
No	109	14.40 %
Low	279	36.90 %
Medium	231	30.60 %
Severe	137	18.10 %
Resilience level		
Low	244	32.30 %
Medium	218	28.80 %
High	294	38.90 %

2. Methods

2.1. Participants

Participants were invited from a university in northeastern China via its college student mental health guidance center. First, the researchers contacted teachers at the mental health guidance center to inform them about the study and the issues to be aware of when distributing the questionnaires. After that, from March to May 2023, a recruitment notice was issued and online questionnaires were distributed to the volunteers using WeChat. A total of 856 students completed the questionnaires. Finally, the investigators carefully checked the recovered questionnaires and determined that 756 ones were included in the final analysis according to the inclusion and exclusion criteria. The inclusion criteria were college students older than 18 who volunteered to participate in the survey and used smartphones. When the lie-detecting items were answered improperly ($n = 97$), or the self-reported age was unreliable ($n = 3$), the questionnaires were regarded as ineffective. The effective recovery rate of the questionnaires was 88.3 %. The final participant sample consisted of 594 women (78.57 %) and 162 men (21.43 %) aged between 18 and 28 years, with a mean age of 19.77 ± 1.60 years. Additional details are provided in [Table 1](#).

This study was approved by the Research Ethics Committee of Jinzhou Medical University (approval no. JZMULL2022111). All the participants provided informed consent before answering the questionnaire.

2.2. General information

The questionnaire contained nine general demographic variables and three mobile phone use profiles: age, gender, level of education, grade, major, academic performance, starting age of smartphone use, daily duration of mobile phone use, and number of mobile phones they own.

2.3. Nomophobia questionnaire (NMP-Q)

The Nomophobia Questionnaire (NMP-Q) assesses the severity of nomophobia symptoms among university students. The questionnaire was originally developed by Yildirim and Correia, and the present study used a 18-item Chinese version [45,46]. This instrument contains four dimensions: inability to access information, abandonment of convenience, inability to communicate, and loss of connection [47–50]. Each item is rated on a 7-point Likert scale. A higher NMP-Q score indicated more severe nomophobia. In this study, the total score of each participant was converted into a Z-score in the sample, where a Z-score below -1 , ≥ -1 to the mean, \geq mean to 2, and greater than 2 indicated absent, low, medium, severe, and extremely severe nomophobia, respectively. The scale is suitable for Chinese young adults and has good reliability and validity in this population. In this study, Cronbach's α of the total scale was 0.955, and those for its four subscales were 0.873, 0.876, 0.931, and 0.932, respectively.

2.4. Emotion regulation questionnaire (ERQ)

The emotion regulation questionnaire measured the frequency with which the students used emotional regulation strategies [51]. The 10 items on the scale were divided into cognitive reappraisal and expressive suppression, rated on a 7-point Likert scale. Higher scores indicated that students used corresponding emotion regulation strategies more frequently. The scale is suitable for Chinese young adults and has good reliability and validity [52]. In this study, Cronbach's α of the total scale and its two subscales were 0.845, 0.894 and 0.830, respectively.

2.5. The resilience scale-14 (RS-14)

The resilience scale-14 was used to measure student resilience levels. The 14 items on the scale were divided into two dimensions: individual ability and acceptance of self and life. They were rated on a 7-point Likert scale with a total score of 14~98. Higher scores indicated stronger psychological resilience. RS-14 scores of ≤ 63 , 64–73, and ≥ 74 indicated that students had lower, moderate, and higher psychological resilience, respectively. The scale has good reliability and validity among Chinese young adults [53–55]. In this study, Cronbach's α of the total scale was 0.957, and those for its subscales were 0.943 and 0.846, respectively.

2.6. Data analysis

All data analyses were performed using SPSS 25.0. Only when all the inquiries were responded, can the questionnaires be successfully submitted. Thus, no missing data needs to be addressed in this study. Categorical variables were expressed as frequencies and percentages. Continuous variables were represented as means and standard deviations. One-way analysis of variance or t -test was used to compare the demographic difference in nomophobia. Pearson's correlation analysis was used to examine correlations between nomophobia, cognitive reappraisal, expressive suppression, and resilience. The SPSS macro PROCESS 4.0 was used to test the mediating role of resilience between emotion regulation strategies (cognitive reappraisal and expressive suppression) and nomophobia. Bootstrap sampling method with 5000 iterations was performed for mediating effect analysis. No zero within the 95 % confidence interval (CI) indicated statistical significance ($p < 0.05$).

3. Results

3.1. Common method deviation analysis

In this study, measures such as anonymity were adopted to control for common method bias, and Harman's single-factor test was employed to evaluate common method bias in the data. The results indicated that the eigenvalues of the six factors exceeded 1, with the primary factor accounting for 26.39 % of the total variance. There was no apparent presence of common method bias.

3.2. Descriptive analyses

In total, 756 participants were included in the final analysis. The study results showed that 85.6 % of Chinese university students had varying degrees of nomophobia, with 279 (36.90 %), 231 (30.60 %), and 137 (18.10 %) at low, medium, and severe levels, respectively. University students with low, medium, and high levels of mental resilience in this sample were 244 (32.3 %), 218 (28.80 %), and 294 (38.90 %), respectively. The vast majority of the participants (97.50 %, 737/756) were undergraduates. More demographic information is presented in [Table 1](#).

3.3. T-test or one-way analysis of variance results

According to the results shown in [Tables 2 and 3](#), the nomophobia score was statistically different with gender, major, and daily duration of mobile phone use. Women had higher NMP-Q total scores than men (men: $M = 71.94$, $SD = 24.60$; women: $M = 80.44$, $SD = 22.49$; $t_{(756)} = 3.83$, $p = 0.00$). Women scored higher than men on all dimensions of the NMP-Q. Nursing and medical technology students had higher NMP-Q scores than other medical majors ($t_{(756)} = 20.22$, $p = 0.00$). Longer duration of mobile phone use was associated with more severe nomophobia ($t_{(756)} = 19.58$, $p = 0.00$). Regarding emotion regulation strategies, women used cognitive

Table 2

Between-group difference of mean NMP-Q total scores for various demographic variables (n = 756).

Group variable	N	M	SD	t/F	P
Gender				3.83	0.00
Men	162	71.94	24.60		
Women	594	80.44	22.49		
Level of education				5.44	0.07
Junior college	4	73.50	5.45		
Undergraduate	737	78.40	23.33		
Graduate	15	90.53	16.15		
Grade				4.66	0.20
Freshmen	434	78.64	23.66		
Sophomore	200	80.58	22.59		
Junior	95	75.95	21.52		
Senior and above	27	73.04	25.32		
Major				20.22	0.00
Clinical medicine	314	77.82	23.05		
Nursing	56	85.46	20.14		
Medical technology	97	85.38	21.72		
Pharmacy	20	76.40	23.79		
Animal medicine	122	76.40	23.79		
Else	147	74.78	23.49		
Academic performance				0.68	0.95
Average score <60	12	76.33	33.23		
Average score [60–70) or GPM 1 +	153	77.41	23.33		
Average score [70–80) or GPA2 +	316	78.76	22.75		
Average score [80–90) or GPA 3 +	244	79.57	22.68		
Average score [90–100) or GPA 4 +	31	76.39	27.66		
Daily duration of mobile phone use (hours)				19.58	0.00
0–3	0				
4–5	219	73.95	21.84		
6–9	375	78.98	22.61		
≥10	162	84.07	25.14		
Starting age of smartphone use (years)				8.34	0.08
≤6	15	82.80	29.42		
7–12	159	81.82	24.44		
13–15	347	78.98	20.93		
16–18	176	77.18	24.20		
≥19	59	71.05	26.35		
Number of mobile phones				0.49	0.78
1	587	78.47	23.41		
2	143	78.62	21.82		
≥3	26	81.81	26.51		

Table 3
Gender differences in sub-dimension scores for each scale (n = 756).

Group variable	Men	Women	t	P	Lower	Upper
Nomophobia	71.94 ± 24.60	80.44 ± 22.49	-4.18	0.00	-12.49	-4.5
Unable to access information	15.12 ± 5.90	16.74 ± 5.71	-3.19	0.00	-2.63	-0.63
Abandonment of convenience	21.42 ± 7.19	24.10 ± 6.79	-4.40	0.00	-3.88	-1.48
Inability to communicate	17.41 ± 6.67	19.77 ± 5.68	-4.51	0.00	-3.39	-1.33
Loss of connection	17.99 ± 8.10	19.82 ± 7.75	-2.64	0.01	-3.19	-0.47
Cognitive Reappraisal	29.39 ± 7.30	30.57 ± 5.67	-2.21	0.03	-2.24	-0.13
Expressive Suppression	16.60 ± 5.31	15.40 ± 4.82	2.76	0.01	0.35	2.06
Resilience	70.11 ± 15.96	70.57 ± 13.66	-0.36	0.72	-2.92	2.01

reappraisal strategies more frequently (men: $M = 29.39$, $SD = 7.30$; women: $M = 30.57$, $SD = 5.67$; $t_{(756)} = -2.21$, $p = 0.03$). Men used expressive suppression strategies more frequently (men: $M = 16.60$, $SD = 5.31$; women: $M = 15.4$, $SD = 4.82$; $t_{(756)} = 2.76$, $p = 0.01$). There was no difference in resilience between men and women ($p = 0.72$).

3.4. Correlation analysis between various variables

In the present study, we found a significant positive correlation between nomophobia and use of cognitive reappraisal ($r = 0.15$, $p < 0.01$) and expressive suppression ($r = 0.29$, $p < 0.01$). Resilience was significantly and positively correlated with use of cognitive reappraisal ($r = 0.55$, $p < 0.01$). More detailed information is provided in Table 4.

3.5. Mediating effect test

Table 5 presents the mediation effect of resilience between two different emotion regulation strategies and nomophobia. For cognitive reappraisal, cognitive reappraisal positively predicted nomophobia ($\beta = 0.54$, $p < 0.001$) in the first step. In the second step, cognitive reappraisal also positively predicted resilience ($\beta = 1.29$, $p < 0.001$). In the third step, cognitive reappraisal positively predicted nomophobia ($\beta = 0.80$, $p < 0.001$), while resilience had a significant negative impact on nomophobia ($\beta = -0.20$, $p < 0.01$). This indicates that resilience had a significant masking effect between cognitive reappraisal and nomophobia. Similarly, in the fourth step, expressive suppression positively predicted nomophobia ($\beta = 1.42$, $p < 0.001$). In the fifth step, expressive suppression was found not significantly associated with resilience ($p > 0.05$). In the sixth step, expressive suppression positively predicted nomophobia ($\beta = 1.43$, $p < 0.001$), while resilience had an insignificant negative impact on nomophobia ($p > 0.05$).

As shown in Table 6, the bootstrap technique was used to examine the mediating role of resilience in the model. The value of the total effect of cognitive reappraisal on nomophobia was 0.54, with a confidence interval of [0.28, 0.80]. The direct effect value was 0.80, with a confidence interval of [0.48, 1.11]. The indirect effect of resilience in the relationship between cognitive reappraisal and nomophobia was -0.26, with a confidence interval of [-0.47, -0.05], excluding the value of 0. This further indicates that resilience mediates the relationship between cognitive reappraisal and nomophobia.

The conclusion is drawn that this is a masking effect ($ab/c = 32.5\%$), because the indirect effect and the direct effect have opposite signs. Similarly, the value of the total effect of expressive suppression on nomophobia was 1.42, with a confidence interval of [1.12, 1.73]. The direct effect value was 1.43, with a confidence interval of [1.12, 1.74]. The indirect effect of resilience on the association between expressive suppression and nomophobia was 0.00, with a confidence interval of [-0.02, 0.02], including 0. Thus, expressive suppression directly predicts nomophobia without the mediating role of resilience. Therefore, Hypothesis H3a, but not H3b, is supported. A diagram of the mediation effect pathway analysis is shown in Fig. 2.

4. Discussion

The results of this study showed that 85.60 % of Chinese university students suffered from varying levels of nomophobia symptoms, indicating a high prevalence. This is comparable to the prevalence rates reported in other countries [28]. A recent systematic review also showed a high prevalence of mild to moderate nomophobia [15]. A study in Lebanon showed that 1089 (48.3 %) participants had moderate nomophobia, while 349 (15.5 %) had severe nomophobia [56].

Table 4
The means, standard deviation, and correlations coefficients (r) among cognitive reappraisal, expressive suppression, resilience and nomophobia (n = 756).

	M	SD	1	2	3	4
1. Nomophobia	78.62	23.20	1			
2. Resilience	70.47	14.17	-0.02	1		
3. Cognitive Reappraisal	30.32	6.07	0.15 ^a	0.55 ^a	1	
4. Expressive Suppression	15.66	4.95	0.29 ^a	0.01	0.27 ^a	1

^a $p < 0.01$.

Table 5
Stepwise regression analysis in predicting nomophobia (n = 756).

Steps	Dependent Variables	Independent variable	R	R ²	F	β	t
Step 1	Nomophobia	Cognitive Reappraisal	0.30	0.09	14.43 ^b	0.54	4.03 ^b
Step 2	Resilience	Cognitive Reappraisal	0.56	0.31	67.13 ^b	1.29	18.08 ^b
Step 3	Nomophobia	Cognitive Reappraisal	0.31	0.10	13.58 ^b	0.80	5.00 ^b
		Resilience				-0.20	-2.93 ^a
Step 4	Nomophobia	Expressive Suppression	0.40	0.16	28.45 ^b	1.42	9.04 ^b
Step 5	Resilience	Expressive Suppression	0.09	0.01	1.25	0.03	0.32
Step 6	Nomophobia	Expressive Suppression	0.40	0.16	23.70 ^b	1.43	9.03 ^b
		Resilience				-0.02	-0.32

^a p < 0.01.

^b p < 0.001.

Table 6
The mediating role of resilience on the relationship between cognitive reappraisal and expressive suppression and nomophobia (n = 756).

Independent variable	Paths	Effect	LLCI	ULCI	Proportion of relative effect
Cognitive reappraisal	Total Effects	0.54	0.28	0.80	
	Direct Effects	0.80	0.48	1.11	
	Indirect Effects	-0.26	-0.47	-0.05	32.50 %
Expressive suppression	Total Effects	1.42	1.12	1.73	
	Direct Effects	1.43	1.12	1.74	
	Indirect Effects	0.00	-0.02	0.02	

Total effect = direct effect + indirect effect.

Direct effect: cognitive reappraisal or expressive suppression → nomophobia.

Indirect effect: cognitive reappraisal or expressive suppression → resilience → nomophobia.

Total: controlling for gender, daily duration of mobile phone use, level of education and starting age of smartphone use.

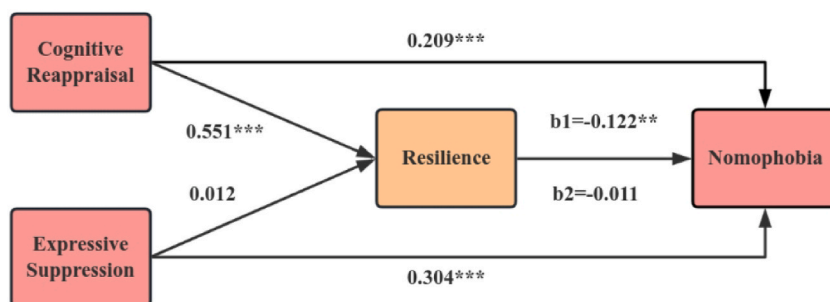


Fig. 2. Normalized path coefficients of the mediation model.

p < 0.01. *p < 0.001.

No age differences were found in nomophobia in our sample. Previous studies have also shown that the prevalence of nomophobia is not related to age [2]. People of all ages widely use mobile phones, and they are necessary for study, work, entertainment, hospital visits, travel, and so forth. However, other studies have shown a negative correlation between age and nomophobia, with older students scoring lower on nomophobia since younger people are more familiar with online technology [56]. A larger sample size is warranted in order to verify the relationship between these two variables. Our study observed that women scored higher on nomophobia than men. Previous studies on hard-of-hearing youths have shown similar results to ours [28]. This difference may be related different leisure style between genders. Women prefer to use their phones to socialize and stay connected with their friends during their free time, while men prefer outdoor sports to mobile phones to kill time [28]. However, some studies have found no gender differences in the prevalence of nomophobia, probably because they collected data during the pandemic [2]. The frequency of mobile phone use was similar between the men and women during this period. Our findings suggest that longer daily mobile phone use was significantly associated with nomophobia. In line with our finding, a bidirectional relationship between nomophobia and duration of daily mobile phone use was also seen previously [57,58].

Subsequently we focused on the relationships among emotion regulation strategies, resilience, and nomophobia. We found that the severity of nomophobia was significantly positively associated with the use of emotion regulation strategies, including cognitive reappraisal and expressive suppression, and significantly negatively associated with resilience. Expressive suppression, as a maladaptive emotion regulation strategy, was expected to positively predict nomophobia. However, cognitive reappraisal as an adaptive emotion regulation strategy also positively predicted nomophobia, which was surprising. This finding suggests that university

students, regardless of the emotion regulation strategy used, regulate their emotions by seeking help from their mobile phones when encountering difficulties. A recent study found that those who tend to use cognitive reappraisal strategies have higher levels of smartphone addiction [59]. They suggested that this may depend on environmental changes and individual coping preferences, as well as the fact that cognitive reappraisal strategies rationalise mobile phone use and lead to addiction [59].

Although people with high resilience tend to choose adaptive emotion regulation strategies, expressive suppression seems not always maladaptive. Some scholars have suggested that expressive suppression plays a relatively positive role in collectivist cultures [59]. Specifically, the social goal of a collectivist culture is interpersonal harmony, and this emotion management strategy effectively promotes interpersonal harmony. Therefore, Asians prefer to expressive suppression [60]. Western groups tend to use emotional expressions because their social goal is to protect themselves, and emotional expressions can express their own will and establish deeper emotions with others. Inhibition is mainly related to social contexts and goals, such as when non-close partners are present or when there are interpersonal goals, expressive inhibition strategies are used more often to avoid conflicts [61]. According to the recently proposed framework for emotion regulation, they promote the development of resilience as long as appropriate emotion regulation strategies are used to regulate emotions [35]. In a study on Chinese university students' well-being and online learning, cognitive reappraisal and expressive suppression strategies positively predicted university students' well-being [62]. A research investigated 71 European and American students from Hong Kong and 100 Chinese students and showed that expressive suppression was associated with poor psychological functioning in Europe and the United States but not in Chinese participants [63]. A previous study has shown that the correlation between expressive suppression and negative mental health indicators was stronger in the Western cultural values than in the Eastern cultural values [64]. In contrast, no similar cultural differences were found in studies on cognitive reappraisal. Therefore, moderating variables such as cultural differences should be considered in the follow-up investigation regarding the relationship between emotional regulation and mental health.

Resilience negatively mediated the relationship between cognitive reappraisal and nomophobia and attenuated the effect of cognitive reappraisal on nomophobia, suggesting that resilience is a potential protective factor. Increasing resilience might be a promising regimen to alleviate nomophobia symptoms caused by emotion dysregulation. According to the psychological resilience framework theory, psychological resilience is an important protective factor for problematic behaviour and personal mental health [65]. Originally described as a protective factor against risk, the concept has been extended [66]. Mental resilience and positive mental health are directly proportional [67]. Students' resilience can be enhanced by promoting personal attributes, effective relational support, and positive psychological support [68]. In our study, resilience did not mediate the effect of expressive suppression on nomophobia. We thus reckon that loneliness might be the potential mediator, as a previous research has shown expressive suppression may lead to increased loneliness [29]. This assumption needs further confirmation.

5. Limitations

The present study has several limitations. First, the study was cross-sectional; therefore, obtaining a clear causal relationship between the major variables was difficult. Second, all data were self-reported, which could have caused information bias. Third, although many control variables were included in this study, additional confounding variables should be considered in future studies to better understand the complicated relationships between the study variables. These variables include personality, family background, academic pressure, and social initiative.

6. Conclusion

This study contributes to our understanding of the mechanisms by which emotion regulation strategies affect nomophobia among university students. Based on our findings, early psychological interventions targeting resilience might be potentially effective in alleviating nomophobia among college students.

Ethics approval

This study was reviewed and approved by the Research Ethics Committee of the Jinzhou Medical University (approval number: JZMULL2022111). All the participants provided informed consent to participate in the study.

Data availability statement

No research-related data are stored in publicly available repositories, and the data will be made available on request.

CRedit authorship contribution statement

Mengjie Cui: Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Conceptualization. **Suyan Wang:** Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Ye Gao:** Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Yuanyuan Hao:** Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Hongliang Dai:** Writing – review & editing, Validation, Software, Investigation, Conceptualization.

Declaration of competing interest

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

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e30075>.

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