Mobile phone addiction and Non-Suicidal Self-Injury among Adolescents in China

Rui Wang [Equal first author, 1, 2], Runxu Yang [Equal first author, 1, 2], Hailiang Ran [3], Xiufeng Xu [1, 2], Guangya Yang [4], Tianlan Wang [4], Yusan Che [4], Die Fang [4], Jin Lu [Corresp., 1, 2], Yuanyuan Xiao [Corresp. 3]

1 Psychiatric Department, The First Affiliated Hospital of Kunming Medical University, Kunming, Yunnan, China

2 Yunnan Clinical Research Center for mental health, Kunming, Yunnan, China

3 Department of Epidemiology and Health Statistics, School of Public Health, Kunming Medical University, Kunming, Yunnan, China

4 Psychiatric Department, Lincang Psychiatric Hospita, Lincang, Yunnan, China

Corresponding Authors: Jin Lu, Yuanyuan Xiao
Email address: Jinlu2000@163.com, 33225647@qq.com

Background. Non-suicidal self-injury (NSSI) has been widely discussed in recent years. Independently, mobile phone addiction has also attracted academic attention. A few studies have investigated the association between the two. However, there is insufficient understanding to characterize this association fully. This study aims to further explore the correlation between mobile phone addiction and NSSI, specifically repeated and severe NSSI.

Method.A population-based cross-sectional survey was conducted among 3,150 adolescents in Lincang, Yunnan. The mobile phone addiction index (MPAI) and the Modified Adolescents Self-Harm Survey (MASHS) were administered in combination. Both univariate and multivariate logistic regression models were used to assess the association between the MPAI and NSSI, and both repeated and severe NSSI.

Results. The prevalence of NSSI was 47.11% (95% CI: 36.2%-58.0%), and the detection rate of mobile phone addiction was 11.11% (95% CI: 6.7%-18.0%). The prevalence of NSSI among those with mobile phone addiction was 4.280 times (95% CI: 3.480-5.266) that of respondents not exhibiting mobile phone addiction. In addition, all subscales of the MPAI, except for the feeling anxious and lost subscale, were positively correlated with NSSI. Risk factors, represented by odds ratios, of repeated NSSI with the inability to control cravings subscale, the feeling anxious and lost subscale, and the withdrawal subscale were 1.052 (95% CI: 1.032, 1.072), 1.028 (95% CI: 1.006-1.051), and 1.048 (95 % CI: 1.019-1.078) respectively. Risk factors of these same three subscales for severe NSSI, had odds ratios of 1.048 (95% CI: 1.029-1.068), 1.033 (95% CI: 1.009-1.057), and 1.045 (95% CI: 1.018-1.073).

Conclusion. Mobile phone addiction was shown to be a risk factor for NSSI in adolescents. Repeated and severe NSSI was found to be more likely to occur in individuals showing high scores in the inability to control cravings subscale, the withdrawal subscale, and the feeling anxious and lost subscale. Therefore, early evaluation using the MPAI to inform the need for intervention can help predict and prevent NSSI.

Mobile Phone Addiction and Non-Suicidal Self-Injury among Adolescents in China

Rui Wang[1,2], Runxu Yang[1,2*], Hailiang Ran[3], Xiufeng Xu[1,2], Guangya Yang[4], Tianlan Wang[4], Yusan Che[4], Die Fang[4], Jin Lu[1,2], Yuanyuan Xiao[3]

[1] Psychiatric Department, The First Affiliated Hospital of Kunming Medical University, Kunming, Yunnan, China

[2] Yunnan Clinical Research Center for mental health, Kunming, Yunnan, China

[3] Department of Epidemiology and Health Statistics, School of Public Health, Kunming Medical University, Kunming, Yunnan, China

[4] Psychiatric Department, Lincang Psychiatric Hospital, Lincang, Yunnan, China

Corresponding Author:

Jin Lu[1,2]

295 Xichang Road, Kunming, Yunnan, 650032, China

Email address: Jinlu2000@163.com

Yuanyuan Xiao[3]

1168 Chunrong West Road, Kunming, Yunnan, 650500, China

Email address: 33225647@qq.com

Abstract

Background: Non-suicidal self-injury (NSSI) has recently widely discussed. Independently, mobile phone addiction has also attracted academic attention. A few research have examined the correlation between the two. However, there is inadequate knowledge to characterize this relationship altogether. This study further explores the correlation between mobile phone addiction and NSSI, specifically repeated and severe NSSI.

Method: A population-based cross-sectional survey was conducted among 3,150 adolescents in Lincang, Yunnan. The mobile phone addiction index (MPAI) and the Modified Adolescents Self-Harm Survey (MASHS) were administered in combination. The connection between the MPAI and NSSI, as well as both repeated and severe NSSI, was studied using univariate and multivariate logistic regression models. (The copyright holders have permitted the authors to use the MPAI and the MASHS)

34   **Results:** The prevalence of NSSI was 47.11% (95% CI: 36.2%-58.0%), and the detection rate of
35   mobile phone addiction was 11.11% (95% CI: 6.7%-18.0%). The prevalence of NSSI among
36   those with mobile phone addiction was 4.280 times (95% CI: 3.480-5.266) that of respondents
37   not exhibiting mobile phone addiction. In addition, all subscales of the MPAI, except for the
38   feeling anxious and lost subscale, were positively correlated with NSSI. Risk factors, represented
39   by odds ratios, of repeated NSSI with the inability to control cravings subscale, the feeling
40   anxious and lost subscale, and the withdrawal subscale was 1.052 (95% CI: 1.032, 1.072), 1.028
41   (95% CI: 1.006-1.051), and 1.048 (95 % CI: 1.019-1.078) respectively. Risk factors of these
42   same three subscales for severe NSSI, had odds ratios of 1.048 (95% CI: 1.029-1.068), 1.033
43   (95% CI: 1.009-1.057), and 1.045 (95% CI: 1.018-1.073).
44   **Conclusion:** Mobile phone addiction was shown to be a risk factor for NSSI in
45   adolescents.Individuals with high scores on the unable to manage cravings subscale, the
46   withdrawal subscale, and the feeling anxious and lost subscale were more prone to experience
47   repeated and severe NSSI.As a result,early assessment using the MPAI to determine the need for
48   intervention can contribute to the prediction and prevention of NSSI.

49

Introduction

51   Non-suicidal self-injury (NSSI) is defined as deliberate repetitive self-harm including that by
52   cutting, burning, or scratching the skin, hitting or banging the wall, or by drug overdose without
53   the intention of committing suicide. This behavior is typically not accepted by society (Lang &
54   Yao, 2018; Muehlenkamp et al., 2012). Research to date has shown that adolescents have the
55   highest incidence of NSSI, with an international prevalence of known cases ranging from 7% to
56   37.2%, and from 10.1% to 22.37% domestically (Kwok et al., 2014; Lang & Yao, 2018; Zhang
57   et al., 2016). Within one of the largest epidemiological studies of adolescents to date in the U.S.
58   (n = 61,767), Taliaferro and colleagues reported a 12-month prevalence estimate of 7.3% for
59   NSSI(Muehlenkamp et al, 2012).Asian countries have a greater overall lifetime prevalence of
60   NSSI (32.6%) than Western countries (19.4%)(Lim et al., 2019). This studies among community
61   samples have found that most people have at least one non suicidal self-injury behavior in their
62   life, but the incidence varies among regions, which may potentially reveal different protection
63   and risk factors for self-injury in different regions .The fast pace of society, the rapid
64   development of the internet and social media, increasing amounts of stress, as well as the
65   mainstream visibility of NSSI have all contributed to an upward trend in its incidence (Morgan,
66   Webb & Carr, 2017). Current studies on NSSI have demonstrated associations with depression,
67   anxiety, low self-esteem, and impulsivity, along with factors in the domestic and social

68　environment(Liu et al., 2018). NSSI is also seen as a significant risk factor for suicide attempts
69　and suicide deaths (Hawton et al., 2020).When compared to the clinical sample research results
70　of adolescent patients who choose to come to a psychiatric department or seek emergency
71　treatment because of self-injury, it is discovered that the incidence of NSSI is much higher than
72　that of the general population, and that there is a higher risk of suicide. (Plener et al., 2015). This
73　may be related to the combination of specific psychiatric disorders. In the USA, adolescents
74　hospitalized due to NSSI are 37.2 times more likely to commit suicide in the following year than
75　their healthy peers (Olfson et al., 2019), suggesting that adolescents exhibiting repeated and
76　severe self-injury are at higher risk of suicide. Therefore, NSSI attracts much attention as a sign
77　of serious mental health problems, and it is imperative to develop a more comprehensive
78　understanding that can be used in suicide prevention.
79　Mobile phones have become a requirement in most facets of life due to the rapid expansion of
80　information technology and the continual innovation of mobile phone applications. While mobile
81　phones have made many people's lives more convenient, provided entertainment and stress
82　relief, and provided many students with the tools to maintain a connection with classmates and
83　expand their social circles, mobile phone addiction has become a health concern(Coskun &
84　Karayagiz, 2019), mobile phone addiction has consequently become a health concern.Research
85　on mobile phone addiction was first established by YouGov PLC Research Institute in the UK in
86　2001. Different sources use the synonyms "mobile phone dependence" "mobile phone
87　addiction"and "problematic mobile phone use". At present, mobile phone addiction has not been
88　included in　the DSM, so there is no unified definition, However, its central manifestation is the
89　excessive use of a mobile phone, such as the use of the phone constantly to attain a sense of
90　fulfillment, which disrupts personal and social activities and causes mood swings if access to the
91　phone is prohibited(Huang et al. 2022). The prevalence of mobile phone addiction among
92　Chinese college students is 21.3%, and that among British teenagers is 10%(Long et al., 2016;
93　Lopez-Fernandez et al., 2014).
94　People who are addicted to their cellphones not only experience physical symptoms like
95　headaches, tinnitus, fatigue, and insomnia, but also withdrawal-like symptoms like frustration,
96　feeling lost, and lonely, which can lead to psychological and behavioral issues like anxiety,
97　depression, aggression, and suicide, according to studies (Augner and Hacker, 2012; Yang et al.,
98　2010).Numerous research identified quality of life, social self-efficacy, and self-esteem as
99　predictors of cell phone addiction.Adverse childhood experiences (ACES) and addiction have
100　also been associated in several studies(Kumcagiz., 2018;Kim and Koh., 2018; Levenson., 2016).
101　NSSI and mobile phone addiction have been associated with factors affecting the mental health
102　of adolescents, such as emotions, personality changes, and their environment. Several studies
103　have investigated the nature of this association. One study demonstrated an independent

104   correlation between NSSI and mobile phone addiction. They found that many students reported

105   using their phones in the evening and after lights out. Phone use during this time has been shown

106   to affect sleep patterns and quality of sleep, which can, in turn, cause psychological and

107   psychiatric issues. Interestingly, NSSI was still associated with mobile phone addiction even

108   after controlling for sleep-related confounds (Li et al., 2019; Oshima et al., 2012). Most existing

109   studies investigating NSSI and mobile phone addition have done so in a population of college

110   students, meaning that there is a lack of research in adolescents. The mobile phone addiction

111   index (MPAI) in China is extensively utilized in similar investigations.The full scale can be

112   divided into 4 subscales: the inability to control cravings subscale, the feeling anxious and lost

113   subscale, the withdrawal and escape subscale, and the productivity loss subscale.

114   This study uses a cross-sectional design to address the lack of research on the relationship

115   between NSSI and mobile phone addiction using the MPAI with a cross-sectional study design in

116   a sample of students from Lincang. We make the following hypotheses: 1) mobile phone

117   addiction will have a positive linear association with NSSI and its rate of recurrence and

118   severity; 2) all subscales in the MPAI will also have a positive linear association with NSSI and

119   its rate of recurrence and severity. If these hypotheses are proven positive, a proper and tailored

120   preventive guideline is needed to reduce the risk of NSSI and subsequent suicide in adolescents.

121   ## Materials & Methods

122   Study setting

123   The study was approved by the Ethics Committee of Lincang Psychiatric Hospital (The Third

124   People's Hospital of Lincang,Approval number: 2019-01) and conducted in accordance with the

125   principles of the Declaration of Helsinki. All participants, and their legal guardians, gave written

126   informed consent prior to participating in the study.

127   A cross-sectional survey was conducted in Lincang, a southwestern prefecture in Yunnan, China,

128   between December 1 and 13, 2019. A three-stage random cluster sampling was used. In the first

129   stage, Linxiang district was randomly selected from 8 districts and counties in Lincang. In stage

130   two, 5 primary schools, 5 middle schools, and 4 high schools were randomly selected. In the

131   final stage, either 3 or 4 classes were randomly selected from each school, based on the required

132   sample size. All eligible studentsliving in the survey area for at least 6 months per year were

133   preliminarily included in the sample pool, but any student who was not aged between 10 and

134   18,or with a hearing or communication impairmentwas excluded from the study. This study had

135   been approved by the Ethics Committee of Kunming Medical University. It was conducted in

136   accordance with the principles of the Declaration of Helsinki. All participants had been signed

137   off by both them and their legal guardians prior. It is important to emphasize that children too

138   young may not accurately understand the meaning of self-harm and suicide(Mishara, 1999), so

139   we set the lower age limit at 10 years or older.. The method of a self-administered questionnaire
140   was selected in order to ensure that all information collected was as genuine as possible while
141   protecting the privacy of participants. We explained the purpose and content of the research to all
142   participants before undertaking the survey. The mean time for completing questionnaires was 40
143   minutes. To minimize data errors and missing data, each questionnaire was double-checked by
144   two trained quality control personnel on-site once completed. zhikong   were either
145   undergraduate students recruited from Yunnan Western University, a local college in Lincang, or
146   graduates majoring in Psychiatry or Public Health from Kunming Medical University. A total of
147   55 quality control staff received centralized training on November 30, 2019. Specific information
148   such as study design, calculation of sample size,and participant information has been previously
149   published(Ran et al., 2020).
150   **Participant information**
151   The questionnaire captured general personal information about the individual such as their
152   gender, grade, type of school attended, ethnicity, level of attendance, social support, parental
153   marital status, parental labor migration status, and family income bracket.
154   **Modified Adolescents Self-Harm Survey (MASHS)**
155   The MASHS was developed by Feng(2008) to measure the way and severity of self-harming
156   behavior in an adolescents' life time.. It included 18 items and 1 open question to evaluate the
157   times of self-harm over 4 levels (0 times, 1 time, 2-4 times, and 5 times and above), and the
158   degree of physical injury over 5 levels (none, mild, moderate, severe, and extremely severe),
159   using a scoring system ranging from 0 to 4. Repeated NSSI was defined as a score of between 2
160   and 4. The severity of NSSI was divided into two levels: mild and moderate(The first 63.4% of
161   NSSI total severity score) and severe(The last 36.6% of NSSI total severity score).We first
162   wanted to explore the possible influences of NSSI as a behavior rather than a diagnosis. At the
163   same time, early intervention of such behaviors has important value for adolescent mental health.
164   Therefore, we expanded the scope of NSSI to some extent, by defining NSSI when participants
165   had at least one previous self-injurious behavior.
166   **Mobile phone addiction index (MPAI)**
167   The mobile phone addiction index (MPAI) was revised by Leung et al(2014) to diagnose cell
168   phone addiction in adolescents and college students. It comprises 17 items, each scored on a
169   scale of 1 to 5, with a higher score indicating a higher degree of mobile phone addiction. The full
170   scale can be divided into 4 subscales: the inability to control cravings subscale, the feeling
171   anxious and lost subscale, the withdrawal and escape subscale, and the productivity loss
172   subscale. The inability to control cravings subscale assesses the individual's capability to control
173   the amount of time they spend on their mobile phone. The feeling anxious and lost subscale
174   assesses the individual's ability to adapt to the adverse emotional reactions towards not having a

175 normal level of access to their mobile phone. The withdrawal and escape subscale assesses the

176 individual's use of their mobile phone to immerse themselves in the cyber world and escape

177 reality. The productivity loss subscale assesses the degree to which their ability to work or study

178 is decreased due to their excessive mobile phone use. In addition, the item 3- 6, and item 8, 9, 14,

179 15 are also mobile phone addiction screening questions. So we divided mobile phone addiction

180 into two groups: (1) none (a cumulative score over these 8 questions of 3 points or less); (2) yes

181 (a cumulative score over these 8 questions of more than 3 points).

182 **Statistical analysis**

183 Data were checked using Epidata 3.0 for double entry and consistency. Statistical analyses were

184 conducted using R software (version 3.3.3). Participant demographic characteristics were

185 explored using descriptive analysis. An unequal probability sampling weight adjustment method

186 was used to account for the possibility of interrelationships among the participants introduced by

187 cluster sampling. To adjust for the effect of clustering, the'survey'and'lavaan.survey' R packages

188 were used.

189 A single factor logistic regression model was used to explore the factors associated with NSSI,

190 repeated NSSI, and severe NSSI.The univariate logistic regression analysis utilized a lower

191 threshold of $p \leq 0.1$ to avoid omitting important factors. Associations between scores obtained in

192 the MPAI and its four subscales and NSSI were measured using a multivariate binary logistic

193 regression model. Two-tailed significance was considered at a level of $p < 0.05$.

Results

195 **General participant characteristics**

196 A total of 3150 participants completed the survey. Of whom, 4 were excluded because their age

197 was less than or equal to 10 years and 427 were excluded due to unclear or missing information

198 on parental educational level or marital status. The final sample size was 2719, making the

199 response rate 86.3%. Table 1 shows the characteristics of the participants. The average age was

200 13.42±2.7 years. A total of 1281 participants reported NSSI experience, making the prevalence

201 47.11% (95%CI: 36.2%-58.0%), of whom 65.26% (95%CI: 58.2%-72.0%) had repeated NSSI

202 and 469 (36.61%) had severe NSSI. Further, 302 students, accounting for 11.11% (95%CI:

203 6.7%-18.0%) of the sample, were found to have mobile phone addiction. The average score of

204 each MPAI subscale varied from the productivity loss subscale (5.36±2.79) to the inability to

205 control cravings subscale (16.79±7.36).

206 **Prevalence and associations of NSSI**

207 Table 2 lists the results of the univariate and multivariate logistic regression of NSSI. All factors

208 aside from ethnicity and paternal education level (less than college) were found to be potentially

209 associated with NSSI, as evidenced by a significance of $p < 0.05$. After multivariate adjustment,

210 the associations between NSSI and age, gender, parental marital status, and mobile phone

211 addiction were still statistically significant. Participants who were found to have a mobile phone

212 addiction were 4.280 times (95%CI：3.480-5.266) more likely to also have NSSI. A

213 multivariate logistic regression model was further used to include the four MPAI subscales.

214 These results suggest that the four MPAI subscales, except for the feeling anxious and lost

215 subscale, were associated with NSSI.

216 **Univariate and multivariate analysis of repeated NSSI**

217 We analyzed the association between the MPAI score and the score obtained on each of the four

218 MPAI subscales and both repeated NSSI and severe NSSI. Taking repeated NSSI as the

219 dependent variable and other possible covariates into consideration, Figure 1 demonstrates that

220 the inability to control cravings subscale, the feeling anxious and lost subscale, and the

221 withdrawal and escape subscale were all statistically significantly and positively correlated with

222 NSSI. In other words, for every 1 point increase in subscale score, the risk of NSSI increases by

223 1.052. (inability to control cravings; 95%CI：1.032, 1.072), 1.028 (feeling anxious and lost;

224 95%CI：1.006, 1.051), and 1.048 (withdrawal and escape; 95%CI：1.019, 1.078).

225 **Univariate and multivariate analysis of the severity of NSSI**

226 The total severity score produced by the NSSI was divided into two categories (0 and 1) based

227 on percentiles to form a regression model, such that 0 = first 63.4% and 1 = last 36.6%. Figure 2

228 shows that with each increasing point on the same three subscales, the risk rate of severe NSSI

229 increases by 1.048 (inability to control cravings; 95%CI：1.029, 1.068), 1.033 (feeling anxious

230 and lost; 95%CI：1.009, 1.057), 1.045 (withdrawal and escape; 95%CI：1.018, 1.073).

231 ## Discussion

232 The results of this study illustrated that the lifetime prevalence of NSSI was 47.11% (95%CI:

233 36.2%-58%), which was similar to the results of a study conducted in the USA, and the findings

234 of Feng et al. (Burke et al., 2015; Feng, 2008) using the same index, but higher than the results of

235 a domestic meta-analysis (16.6%) and some other international studies (7% - 13%) (Portzky,

236 Wilde & Heeringen, 2008). These differences are likely to be due to the use of different scales

237 and evaluation criteria.The high prevalence in our study is due to the NSSI definition: the

238 presence of one or more episodes of self-harm behaviour in any way. Although the

239 recommended diagnostic criterion in the DSM-5 is at least five episodes of NSSI in the past year.

240 However, NSSI has not yet been formally included in the DSM as a separate psychiatric

241 disorder, so this study used lower inclusion criteria to increase sensitivity to self-harm in children

242 and adolescents so that prevention and intervention could be provided earlier.

243 Nevertheless, these findings reflect the high prevalence of NSSI among adolescents. Our study

244 has revealed that 65.26% of the adolescents with a history of NSSI had repeated NSSI, and

245   36.61% had severe NSSI. Those with severe NSSI are more likely to be re-admitted to hospital
246   due to self-harm and attempted suicide, or even suicide death, in the future. These two high-risk
247   factors also were applied to psychological risk assessment. This may suggest that individuals
248   with a history of self-harm are more likely to exhibit other psychiatric disorders such as anxiety,
249   emotional disorder, and borderline personality disorder, needing further diagnosis and treatment
250   (Gardner et al., 2019; Knipe et al., 2019). Therefore, further research is needed to understand the
251   mechanisms of NSSI to better prevent and control it.
252   This study also found that the prevalence of NSSI increases with age.It could be because the
253   participants ranged in age from prepubescent to adolescent (i.e., students aged 10 to
254   18).Steinberg et al. reported that "impulsive choices" are most common in early- to mid-puberty,
255   which may influene the prevalence of NSSI in puberty (Steinberg et al., 2008). Also, girls were
256   found to be more susceptible to NSSI than boys, which is consistent with the findings of multiple
257   meta-analyses conducted by Lang and Bresin & Schoenleber (2015). The reasons for this gender
258   difference have not yet been fully confirmed. Girls may be more likely to experience frustration
259   and depression than boys, and need emotional management. NSSI, as an emotion regulation
260   strategy, is often used to alleviate negative emotions (Albores-Gallo et al., 2014). As a result,
261   different intervention tactics may be employed more frequently by people of different genders.
262   NSSI was also suggested to be associated with parental marital status.Compared with children
263   from stable families, those with divorced, widowed, or remarried parents are more likely to have
264   a history of NSSI, which is consistent with previous findings (Hawton, Saunders & O'Connor,
265   2012; Lan et al., 2019). The parental relationship is an indispensable environmental factor in
266   adolescent development as well as an underlying cause of many behavioral problems. A
267   dysfunctional family environment could play a crucial role in adolescent NSSI through
268   impacting self-esteem, impulse control, emotional regulation, interpersonal communication, and
269   creating the need for coping mechanisms (Cassels et al., 2018; Kelly, 2000). Improving family
270   relations may serve to reduce NSSI in later years, so it may be crucial to focus on the family
271   environment and intervention to improve it in order to reduce NSSI in adolescents.
272   The popularity and customizability of mobile phones has made them a necessity for young
273   people, facilitating everyday social interaction and providing a source of entertainment. Modern
274   smartphones allow apps to be downloaded in order to use them for more work and study related
275   tasks such as online courses and information exchange with schools, which in turn raises the
276   perception of the necessity of their use in modern society.
277   Many international academics have identified this dependence as an addiction (Beard & Wolf,
278   2001; Billieux, Linden & Ceschi, 2007), which is manifested as the excessive use of mobile
279   phones, resulting in an adverse effect on work, study, and life, as well as a series of physical and
280   psychological reactions signifying discomfort and withdrawal if mobile phone use is prohibited.

281 As such, the misuse of mobile phones by young people and the associated problems of mobile

282 phone addiction must be explored. This study aims to better understand the relationship between

283 repeated NSSI and severe NSSI by investigating the influence of the four MPAI subscales and

284 offering preventive ways to guide students in appropriate mobile phone use.The prevalence of

285 mobile phone addiction in this study was 11.11%, which is lower than that reported by Ge & Zhu

286 (2014). This may be due to the study location being a poverty-stricken area where mobile phone

287 ownership among young people is lower than that of more developed cities.We also included

288 students living on campus, where cell phone use is prohibited in school. This may also lower the

289 rates of phone use and phone dependence.

290 There is still no universally accepted standard scale for assessing or diagnosing mobile phone

291 addiction, and the results vary widely from study to study. More uniform and large-scale studies

292 are needed in this area. In our study, mobile phone addiction was strongly associated with the

293 prevalence of NSSI. Mobile phone addiction, and other addictions such as alcohol, tobacco and

294 substance abuse, have been positively associated with NSSI. People who are dependent on

295 mobile phone use show withdrawal symptoms when denied access to their phones, leading to

296 anxiety, depression and negative emotions. In addition, mobile phone addiction itself can have a

297 negative impact on mood.

298 The stress from interpersonal problems can lead to depression (Oshima et al., 2012), thereby

299 increasing the risk of NSSI. Meanwhile, people with depression may use mobile phones as an

300 escape mechanism to relieve negative emotions and symptoms by obtaining a sense of security

301 (Park et al., 2019). The interaction between mobile phone addiction and depression as well as

302 each factor independently can increase the risk of NSSI. Individuals experiencing issues with

303 interpersonal social interaction, for instance, social isolation or a lack of social support, are more

304 inclined to use mobile phone games, videos, and other applications to kill time, escape reality,

305 and seek recognition or validation on social media to combat loneliness. The motives for self-

306 harm also include escape from unbearable social situations and using NSSI as a means of

307 showing others their degree of suffering to gain attention or recognition (Hawton, Saunders &

308 O'Connor, 2012). As a result, cell phone addiction and NSSI may share similar motivations,

309 resulting in a significant correlation between the two. The coincidence of repeated and severe

310 NSSI can signify the presence of more serious mental health problems (Hawton et al., 2020).

311 This, in turn, helps to explain the significant association between severe NSSI and high scores on

312 the withdrawal and escape subscale and the feeling anxious and lost subscale. High impulsivity

313 has also been positively correlated with mobile phone addiction in previous studies, reflecting

314 that individuals with high impulsivity are less likely to control the urges to use their mobile

315 phones, resulting in a higher score on the inability to control cravings subscale (Mitchell &

316 Hussain, 2018). Our findings suggest that a high score on the inability to control cravings

317   subscale is significantly associated with repeated and severe NSSI. This may also be related to

318   poor levels of impulse control in adolescents.Studying impulsivity's effect was outside the scope

319   of the current investigation, but it will be investigated in future research.

320   Our primary finding is that mobile phone addiction is not only associated with NSSI, but is

321   predominantly manifested on two subscales of the MPAI, namely "inability to control cravings"

322   and "withdrawal and escape". Both subscales were significantly associated with the occurrence

323   of NSSI, repetitive NSSI and severe NSSI. If mobile phone addiction and NSSI are underpinned

324   by the same factors, it would be useful to examine the role of mediating and interacting factors

325   associated with these two behaviours. Children and adolescents aged 10 to 18 years were

326   recruited for this study, highlighting that these findings should alert the government and schools

327   to pay closer attention to potential problems associated with inappropriate mobile phone use,

328   such as NSSI, which may have a greater impact on younger students and younger pupils. There

329   may be a need to establish a monitoring system for NSSI, with regular monitoring, screening and

330   intervention when needed. In establishing intervention methods, more targeted measures can be

331   developed based on different factors affecting different populations, such as improving impulse

332   control in adolescents, making adjustments for depression and anxiety, or understanding the

333   causes and consequences of adopting an avoidant approach to social stress. In addition,

334   interventions should emphasise the importance of developing coping strategies that are more

335   positive than self-harm.

Conclusions

337   This cross-sectional study demonstrates that the prevalence of NSSI is relatively high. Mobile

338   phone addiction is an important risk factor, specifically, the MPAI subscales for the inability to

339   control cravings, withdrawal and escape, and feeling anxious and lost were all strongly

340   associated with repeated and severe NSSI. These findings indicate that monitoring and

341   intervention for mobile phone addiction may partially reduce the prevalence of NSSI, repeated

342   NSSI, and severe NSSI.

343   **Limitations:** The survey was conducted in Lincang, with cross-sectional recruitment and data

344   collected using a self-reported questionnaire. In the sample, there could be an influence of

345   personal memory bias. As a result, significant relationships between behaviors and survey

346   subscales must be substantiated before being accepted. To investigate the causal links between

347   these parameters, more longitudinal follow-up is required. Because no formal measurement of

348   mobile phone usage duration or frequency was included in the study, mobile phone use was

349   judged subjectively, resulting in an unreliable assessment of mobile phone addiction. Further

350   longitudinal research is required to confirm the association between mobile phone use frequency,

351   total duration of use, and mobile phone addiction.Finally, the motivations behind mobile phone

352   addiction and NSSI were discussed, and the possible commonality between these mechanisms
353   has not yet been addressed.
354

Acknowledgements

Competing Interests

357   The authors declare that they have no competing interests.
358   Author Contributions
359   Rui Wang and Runxu Yang performed the experiments, analyzed the data, prepared figures
360   and/or tables,authored or reviewed drafts of the paper, and approved the final draft.
361

362   Jin Lu, Yuanyuan Xiao, and Xiufeng Xu conceived and designed the experiments, performed the
363   experiments, analyzed the data, prepared figures and/or tables, authored or reviewed drafts of the
364   paper, and approved the final draft.
365

366   Hailiang Ran and Guangya Yang performed the experiments, analyzed the data, prepared figures
367   and/or tables, and approved the final draft.

Human Ethics

369   The following information was supplied relating to ethical approvals (i.e., approving body
370   and any reference numbers):
371   The Third People's Hospital of Lincang Ethics Committee approved this research (2019-01).
372

References

374   Albores-Gallo L, Mendez-Santos JL, Xochitl-Garcia OA, Delgadillo-Gonzalez Y, Martinez OL.
375   2014. Nonsuicidal self-injury in a community sample of older children and adolescents of
376   Mexico City. Actas Espaolas de Psiquiatria 42(4):159-168.
377   Augner C, Hacker GW. 2012. Associations between problematic mobile phone use and
378   psychological parameters in young adults. International of Journal of Public Health 57:437-441.
379   doi:10.1007/s00038-011-0234-z
380   Beard KW, Wolf EM. 2001. Modification in the Proposed Diagnostic Criteria for Internet
381   Addiction. Cyberpsychology Behavior 4:377–383. doi:10.1089/109493101300210286
382   Billieux J, Linden M, Ceschi G. 2007. Which subscales of impulsivity are related to cigarette
383   craving? Addictive Behavior 32:1189-1199. doi:10.1016/j.addbeh.2006.08.007

384   Bresin K, Schoenleber M. 2015. Gender differences in the prevalence of nonsuicidal self-injury:

385   A meta-analysis. Clinical Psychology Review 38:55-64. doi:10.1016/j.cpr.2015.02.009

386   Burke TA, Hamilton JL, Abramson LY, Alloy LB. 2015. Non-suicidal self-injury prospectively

387   predicts interpersonal stressful life events and depressive symptoms among adolescent girls.

388   Psychiatry Research 228:416-424. doi:10.1016/j.psychres.2015.06.021

389   Cassels M, van Harmelen AL, Neufeld S, Goodyer I, Jones PB, Wilkinson P. 2018. Poor family

390   functioning mediates the link between childhood adversity and adolescent nonsuicidal self-

391   injury. Journal of Child Psychology Psychiatry 59:881-887.

392   Coskun S, Karayagiz G. 2019. Investigation of Problematic Mobile Phones Use and Fear of

393   Missing Out (FoMO) Level in Adolescents. Community Mental Health Journal 55:1004-1014.

394   doi:10.1007/s10597-019-00422-8

395   Feng Y. 2008. The relationship between adolescents' self-harm behavior and individual emotions

396   and family environment. Central China Normal University.

397   Gardner W, Pajer K, Cloutier P, Currie L, Colman I, Zemek R. 2019. Health outcomes

398   associated with emergency department visits by adolescents for self-harm: a propensity-matched

399   cohort study. Canadian Medical Association Journal 191:E1207-E1216.

400   doi:10.1503/cmaj.190188

401   Ge XH, Zhu ZH. 2014. The relationship between mobile phone addiction and adult attachment in

402   adolescent students. Chinese Journal of public health 30:95-97.

403   Hawton K, Bale L, Brand F, Townsend E, Ness J, Waters K. 2020. Mortality in children and

404   adolescents following presentation to hospital after non-fatal self-harm in the Multicentre Study

405   of Self-harm: a prospective observational cohort study. The Lancet Child & Adolescent Health

406   4:111-120. doi:10.1016/S2352-4642(19)30373-6

407   Hawton K, Saunders KEA, O'Connor RC. 2012. Self-harm and suicide in adolescents. The

408   Lancet 379:2373-2382. doi:10.1016/S0140-6736(12)60322-5

409   Huang H, Niu LY, Zhou CY, Wu HM. 2014. Testing of validity and reliability of Chinese

410   version of mobile phone dependence index among college students. Chinese Journal of Clinical

411   Psychology 22:835-838.

412   Huang H, Wan X, Lu G, Ding Y, and Chen C. 2022. The Relationship Between Alexithymia and

413   Mobile Phone Addiction Among Mainland Chinese Students: A Meta-Analysis. Front Psychiatry

414   13:754542. doi:10.3389/fpsyt.2022.754542

415   Kelly JB. 2000. Children's Adjustment in Conflicted Marriage and Divorce A Decade Review of

416   Research. Journal of American Academic Child Adolescents Psychiatry 39.

417   doi:10.1097/00004583-200008000-00007

418   Kim, E, Koh, E. 2018. Avoidant attachment and smartphone addiction in college students: the
419   mediating effects of anxiety and self-esteem. Comput. Hum. Behav 84, 264–271. doi:
420   10.1016/j.chb.2018.02.037
421   Knipe D, Metcalfe C, Hawton K, Pearson M, Dawson A, Jayamanne S. 2019. Risk of suicide
422   and repeat self-harm after hospital attendance for non-fatal self-harm in Sri Lanka: a cohort
423   study. The Lancet Psychiatry 6:659-666. doi:10.1016/S2215-0366(19)30214-7
424   Kumcagiz, H. 2018. Quality of life as a predictor of smartphone addiction risk among
425   adolescents. Technol. Knowl. Learn 24, 117–127. doi: 10.1007/s10758-017-9348-6
426   Kwok CL, Yip PS, Gunnell D, Kuo CJ, Chen YY. 2014. Non-fatal repetition of self-harm in
427   Taipei City, Taiwan: cohort study. British Journal of Psychiatry 204:376-382.
428   doi:10.1192/bjp.bp.113.130179
429   Lan T, Jia X, Lin D, Liu X. 2019. Stressful Life Events, Depression, and Non-Suicidal Self-
430   Injury Among Chinese Left-Behind Children: Moderating Effects of Self-Esteem. Frontiers in
431   Psychiatry 10:244. doi:10.3389/fpsyt.2019.00685
432   Lang J, Yao Y. 2018. Prevalence of nonsuicidal self-injury in chinese middle school and high
433   school students: A meta-analysis. Medicine (Baltimore) 97:e12916.
434   doi:10.1097/MD.0000000000012916
435   Levenson, J. 2016. Adverse childhood experiences and subsequent substance abuse in a sample
436   of sexual offenders: implications for treatment and prevention. Victims Offenders 11, 199–224.
437   doi: 10.1080/15564886.2014.971478
438   Li D, Yang R, Wan Y, Tao F, Fang J, Zhang S. 2019. Interaction of Health Literacy and
439   Problematic Mobile Phone Use and Their Impact on Non-Suicidal Self-Injury among Chinese
440   Adolescents. International Journal of Environmental Research Public Health 16(13).
441   doi:10.3390/ijerph16132366
442   Lim KS, Wong CH, McIntyre RS, Wang J, Zhang Z, Tran BX, Tan W, Ho CS, Ho RC. 2019.
443   Global lifetime and 12-month prevalence of suicidal behavior, deliberate self-harm and
444   non-suicidal self-injury in children and adolescents between 1989 and 2018: a meta-analysis.
445   International Journal of Environmental Research and Public Health
446   16(22):4581.doi:10.3390/ijerph16224581.
447   Lin MJ, Li P, Lu QH. 2018. The current research status of adolescents non-suicidal self-injury.
448   Journal of Psychiatry 31:67-70.
449   Liu ZZ, Chen H, Bo QG, Chen RH, Li FW, Lv L. 2018. Psychological and behavioral
450   characteristics of suicide attempts and non-suicidal self-injury in Chinese adolescents. Journal of
451   Affective Disorders 226:287-293. doi:10.1016/j.jad.2017.10.010

452 Long J, Liu TQ, Liao YH, Qi C, He HY, Chen SB, and Billieux J. 2016. Prevalence and
453 correlates of problematic smartphone use in a large random sample of Chinese undergraduates.
454 BMC Psychiatry 16:408.doi: 10.1186/s12888-016-1083-3
455 Lopez-Fernandez O, Honrubia-Serrano L, Freixa-Blanxart M, and Gibson W. 2014. Prevalence
456 of problematic mobile phone use in British adolescents. Cyberpsychol Behav Soc Netw 17:91-98.
457 doi:10.1089/cyber.2012.0260
458 Mitchell L, Hussain Z. 2018. Predictors of Problematic Smartphone Use: An Examination of the
459 Integrative Pathways Model and the Role of Age, Gender, Impulsiveness, Excessive Reassurance
460 Seeking, Extraversion, and Depression. Behavior Science (Basel) 8.
461 Mishara BL. 1999. Conceptions of death and suicide in children ages 6–12 and their implications
462 for suicide prevention. Suicide and Life Threatening Behavior 29:105–118.doi:10.1111/j.1943-
463 278X.1999.tb01049.x.
464 Morgan C, Webb R, Carr M. 2017. Incidence, clinical management and mortality risk following
465 self harm among children and adolescents: cohort study in primary care. British Dental Journal
466 223:841-841. doi:10.1136/bmj.j4351
467 Muehlenkamp JJ, Claes L, Havertape L, Plener PL. 2012. International prevalence of adolescent
468 non-suicidal self-injury and deliberate self-harm. Child Adolescent Psychiatry Mental Health
469 6:10. 10.1186/1753-2000-6-10
470 Olfson M, Wall M, Wang S, Crystal S, Bridge J. 2018. Suicide After Deliberate Self-Harm in
471 Adolescents and Young Adults. The Pediatrics 141(4). doi:10.1542/peds.2017-3517
472 Oshima N, Nishida A, Shimodera S, Tochigi M, Ando S, Yamasaki S. 2012. The suicidal
473 feelings, self-injury, and mobile phone use after lights out in adolescents. Journal of Pediatric
474 Psychology 37:1023-1030. doi:10.1093/jpepsy/jss072
475 Park SY, Yang S, Shin CS, Jang H, Park SY. 2019. Long-Term Symptoms of Mobile Phone Use
476 on Mobile Phone Addiction and Depression Among Korean Adolescents. International Journal
477 Environmental Research Public Health 16. doi:10.3390/ijerph16193584
478 Portzky G, Wilde EJ, Heeringen K. 2008. Deliberate self-harm in young people: differences in
479 prevalence and risk factors between the Netherlands and Belgium. European Child Adolescents
480 Psychiatry 17:179-186. doi:10.1007/s00787-007-0652-x
481 Plener PL, Schumacher TS, Munz LM, Groschwitz RC. 2015. The longitudinal course of non-
482 suicidal self-injury and deliberate self-harm: a systematic review of the literature. Borderline
483 Personality Disorder and Emotion Dysregulation 2(1):2 DOI 10.1186/s40479-014-0024-3.
484 Ran H, Cai L, He X, Jiang L, Wang T, Yang R, Xu X, Lu J, Xiao Y. 2020. Resilience mediates
485 the association between school bullying victimization and self-harm in Chinese adolescents.
486 Journal of Affective Disorders 277(Suppl 2):115–120.doi:10.1016/j.jad.2020.07.136.

487   Steinberg L, Albert D, Cauffman E, Banich M, Graham S, Woolard J. 2008. Age differences in

488   sensation seeking and impulsivity as indexed by behavior and self-report: evidence for a dual

489   systems model. Developmental Psychology 44:1764-1778. doi:10.1037/a0012955

490   Yang YS, Yen JY, Ko CH, Cheng CP, Yen CF. 2010. The association between problematic

491   cellular phone use and risky behaviors and low self-esteem among Taiwanese adolescents. BMC

492   Public Health 10:217. doi:10.1186/1471-2458-10-217

493   Zhang SC, Tao FB, Wu XY, Tao SM, Fang J. 2016. Low health literacy and psychological

494   symptoms potentially increase the risks of non-suicidal self-injury in Chinese middle school

495   students. BMC Psychiatry 16:327. doi:10.1186/s12888-016-1035-y.

496

Table 1(on next page)

General sample characteristics (n = 2719 students in Lincang Yunan).

NSSI: Non-suicidal self-injury ; MPAI: Mobile phone addiction index; Repeated NSSI was defined as a score of between 2 and 4. NSSI severity: mild and moderate(The first 63.4% of NSSI total severity score) and severe(The last 36.6% of NSSI total severity score)

1   Table 1: General sample characteristics (n = 2719 students in Lincang Yunan).

Variable	N（%）	Mean（standard deviation）
Age		13.42（2.17）
Gender		
Boys	1246（45.83）	
Girls	1473（54.17）	
Minority		
Han	1816（66.78）	
Other ethnic groups	280（10.30）	
Yi	320（11.77）	
Dai	185（6.80）	
Lahu	118（4.34）	
Educational level		
Primary School	918（33.76）	
Middle School	939（34.53）	
High school	862（31.70）	
Residency		
Urban	1268（46.63）	
Rural	1451（53.37）	
Level of Attendance		
Day school	1059（38.95）	
Boarding school	1660（61.05）	
Parental marital status		

Married	2456（90.33）	
Divorced/Widowed	163（5.99）	
Re-married	100（3.68）	
Mobile phone addiction		
No	2417（88.89）	
Yes	302（11.11）	
MPAI		
Inability to control cravings		16.79（7.36）
Feeling anxious and lost		6.82（3.92）
Withdrawal and escape		7.22（3.74）
Productivity loss		5.36（2.79）
NSSI		
No	1438（52.89）	
Yes	1281（47.11）	
Repeated NSSI		
No	445（34.73）	
Yes	836（65.26）	
NSSI severity		
Mild and moderate	812（73.39）	
Severe	469（36.61）	

NSSI: Non-suicidal self-injury ;

MPAI: Mobile phone addiction index;

Repeated NSSI was defined as a score of between 2 and 4.

NSSI severity: mild and moderate(The first 63.4% of NSSI total severity score) and severe(The last 36.6% of NSSI total severity score)

2

Table 2(on next page)

Univariate and Multivariable logistic regression model for NSSI.

Model 1: Multivariate logistic regression analyses on associations of mobile phone addiction with NSSI,controlling for age, gender, residency, grade, parental marital status, parental education level, level of attendance, mobile phone addiction;

Model 2: Multivariate logistic regression analyses on associations of the four specific dimensions of mobile phone addiction with NSSI, controlling for age, gender, residency, grade, parental marital status, parental education level, level of attendance, each of the four MPAI subscales

*P<0.05

1 Table 2: Univariate and Multivariable logistic regression model for NSSI

Covariate	Univariate	Model 1	Model 2
	OR（90%CI）	OR（95%CI）	OR（95%CI）
age（+1）	1.275（1.198-1.357）*	1.136（1.014-1.271）*	1.110（0.982-1.254）
Gender(Ref: Boys)	1.347（1.232-1.474）*	1.251（1.147-1.365）*	1.228（1.132-1.332）*
Residency (Ref: Town)	1.716（1.393-2.114）*	1.040（0.798- 1.354）	1.024（0.790-1.328）
Grade(Ref:Primary school)			
Middle school	2.479（1.488-4.130）*	1.867（0.680-5.128）	1.396（0.555-3.516）
High school	3.662（2.560-5.237）*	2.005（0.733-5.486）	1.228（0.491-3.069）
Ethnicity	1.017（0.817-1.266）		
Parental marital status (Ref: married)			
Divorced/Widowed	1.196（1.003-1.426）*	1.324（1.042-1.683）*	1.238（1.017-1.507）*
Re-married	1.528（1.228-1.901）*	1.521（1.116-2.073）*	1.375（0.967-1.954）
Father's education level (Ref: Primary school)			
Middle school	0.892（0.711-1.119）	1.007（0.771-1.314）	1.051（0.825-1.339）
High school	0.693（0.469-1.024）	0.972（0.695-1.360）	1.071（0.791-1.452）
College and above	0.639（0.482-0.847）	0.863（0.594-1.254）	0.931（0.651-1.330）
Mother's education level (Ref:Primary school)			
Middle school	0.807（0.709-0.919）	0.970（0.878- 1.073）	0.979（0.855-1.121）
High school	0.624（0.436-0.892）	0.838（0.630-1.116）	0.893（0.658-1.210）
College and above	0.623（0.451-0.860）	0.968（0.763-1.228）	1.089（0.860-1.379）

Level of attendance (Ref: Day school)	2.436（1.744-3.401）*	0.785（0.562-1.096）	0.757（0.570-1.006）
Mobile phone addiction	5.471（4.382-6.832）*	4.280（3.480-5.266）*	
Inability to control cravings (+1 point)			1.071（1.060-1.083）*
Feeling anxious and lost (+1 point)			1.033（0.997-1.071）
Withdrawal and escape (+1 point)			1.055（1.040-1.070）*
Productivity loss (+1 point)			1.071（1.033-1.111）*

Model 1: Multivariate logistic regression analyses on associations of mobile phone addiction with NSSI,controlling for age, gender, residency, grade, parental marital status, parental education level, level of attendance, mobile phone addiction;

Model 2: Multivariate logistic regression analyses on associations of the four specific dimensions of mobile phone addiction with NSSI, controlling for age, gender, residency, grade, parental marital status, parental education level, level of attendance, each of the four MPAI subscales

*$P<0.05$

2

Figure 1

Adjusted OR of repeated NSSI

Fig 1.Multivariate logistic regression model for repeated NSSI.Controlling for age, gender, level of attendance, each of the four MPAI dimensions.
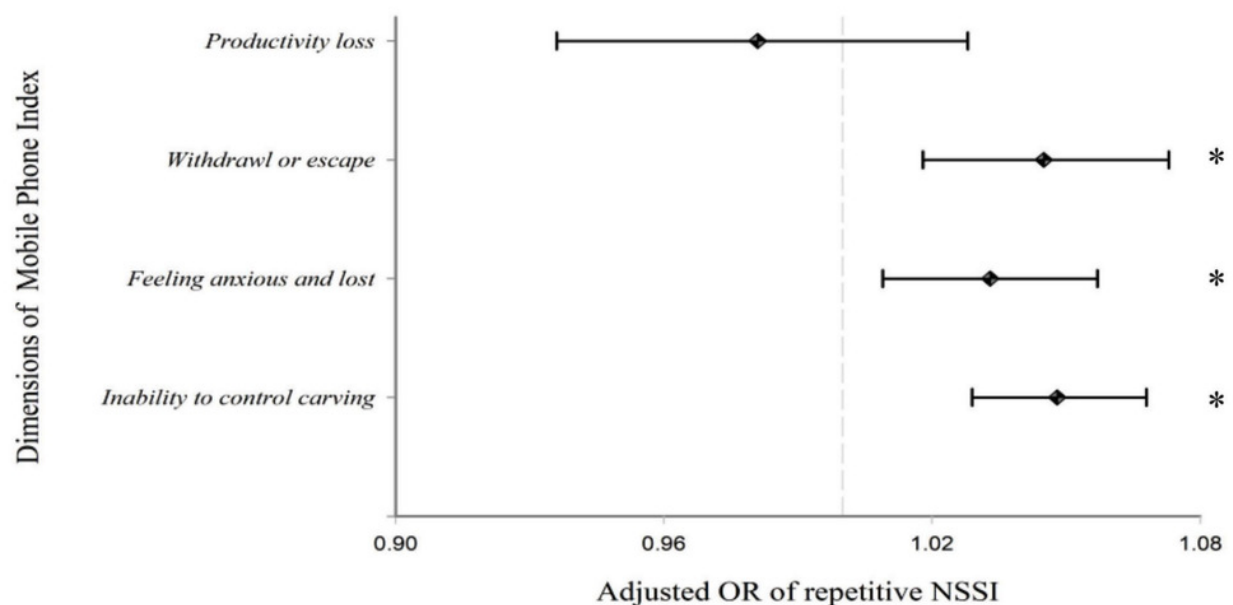
Figure 2

Adjusted OR of severe NSSI

Fig 2:Multivariate logistic regression model for NSSI severity.Controlling for gender,parental marital status,parental education level,level of attendance, each of the four MPAI dimensions