The prevalence of fatigue among Chinese nursing students in post-COVID-19 era

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Background: Due to the COVID-19 outbreak, all teaching activities in nursing schools were suspended in China, and many nursing students were summoned to work in hospitals to compensate for the shortage of manpower. This study examined the prevalence of fatigue and its association with quality of life (QOL) among nursing students during the post-COVID-19 era in China. **Methods**: This was a multicenter, cross-sectional study. Nursing students in five Chinese universities were invited to participate. Fatigue, depressive and anxiety symptoms, pain and QOL were measured using standardized instruments. **Results**: A total of 1,070 nursing students participated. The prevalence of fatigue was 67.3% (95%CI: 64.4%-70.0%). Multiple logistic regression analysis revealed that male gender (P=0.003, OR=1.73, 95%CI=1.20-2.49), and being a senior nursing student (second year: OR=2.20, 95%CI=1.46-3.33, P<0.001; third year: OR=3.53, 95%CI=2.31-5.41, P<0.001; and fourth year OR=3.59, 95%CI=2.39-5.40, P<0.001) were significantly associated with more severe fatigue. In addition, participants with more severe depressive (OR=1.48, 95%CI=1.22-1.78, P<0.001) and anxiety symptoms (OR=1.12, 95%CI=1.05-1.20, P=0.001), and more severe pain (OR=1.67, 95%CI=1.46-1.91, P<0.001) were significantly associated with more severe fatigue. After

controlling for covariates, nursing students with fatigue had a lower overall QOL score compared to those without (F $_{(1, 1070)}$ =31.4, $P<0.001$). **Conclusion**: Fatigue was common among nursing students in the post-COVID-19 era. Considering the negative impact of fatigue on QOL and daily functioning, routine physical and mental health screening should be conducted for nursing students. Effective stress-reduction measures should be enforced to assist this subpopulation to combat fatigue and restore optimal health.

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7   <u>Running head</u>: fatigue of nursing students

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Abstract

Background: Due to the COVID-19 outbreak, all teaching activities in nursing schools were suspended in China, and many nursing students were summoned to work in hospitals to compensate for the shortage of manpower. This study examined the prevalence of fatigue and its association with quality of life (QOL) among nursing students during the post-COVID-19 era in China.

Methods: This was a multicenter, cross-sectional study. Nursing students in five Chinese universities were invited to participate. Fatigue, depressive and anxiety symptoms, pain and QOL were measured using standardized instruments.

Results: A total of 1,070 nursing students participated. The prevalence of fatigue was 67.3% (95%CI: 64.4%-70.0%). Multiple logistic regression analysis revealed that male gender (P=0.003, OR=1.73, 95%CI=1.20-2.49), and being a senior nursing student (second year: OR=2.20, 95%CI=1.46-3.33, P<0.001; third year: OR=3.53, 95%CI=2.31-5.41, P<0.001; and fourth year OR=3.59, 95%CI=2.39-5.40, P<0.001) were significantly associated with more severe fatigue. In addition, participants with more severe depressive (OR=1.48, 95%CI=1.22-1.78, P<0.001) and anxiety symptoms (OR=1.12, 95%CI=1.05-1.20, P=0.001), and more severe pain (OR=1.67, 95%CI=1.46-1.91, P<0.001) were significantly associated with more severe fatigue. After controlling for covariates, nursing students with fatigue had a lower overall QOL score compared to those without ($F_{(1, 1070)}$ =31.4, P<0.001).

Conclusion: Fatigue was common among nursing students in the post-COVID-19 era. Considering the negative impact of fatigue on QOL and daily functioning, routine physical and mental health screening should be conducted for nursing students. Effective stress-reduction measures should be enforced to assist this subpopulation to combat fatigue and restore optimal health.

87 **Keyword**: fatigue, quality of life, nursing students, COVID-19 pandemic

88

89

Introduction

Fatigue refers to abnormal exhaustion following normal activities (Cavanaugh Jr, 2002; Shapiro et al., 2005). Fatigue is associated with lifestyle factors (e.g., physical exertion, lack of sleep, medication use (e.g., antidepressants), physical health problems (e.g., anemia, autoimmune disorders, and chronic obstructive pulmonary disease), and mental health problems (e.g., sleep disorders, anxiety, and depression) (De Venter et al., 2017; Friedberg et al., 2016). All of these factors could lead to additional detrimental outcomes such as headache, faintness, shortness of breath, and increased risk of suicidality (Zhu et al., 2019).

The prevalence of fatigue varies in different populations. For instance, the prevalence of fatigue ranged from 15% to 30% in teenagers (Findlay, 2008; Ghandour et al., 2004); 11.9% in adults, with 8.5% in men, and 14.9% in women (Wendt et al., 2019). The prevalence of fatigue was usually more common in certain subpopulations. For instance, the Australian Medical Association found that out of 716 doctors, 53% were at higher risk of fatigue whilst on duty (Australian Medical Association, 2017). In another study, around 85% of patients with head and neck cancer experienced fatigue (Bossi et al., 2019). In addition, college students, particularly those enrolled in health-related subjects, often suffered from fatigue (Dol, 2016; Pallant et al., 2020; Shim et al., 2019). For example, one study found that the prevalence of fatigue was 16.5% among medical students (Tanaka et al., 2008), while the corresponding figure was even higher among nursing students (39.1%) (de Moraes Amaducci et al., 2010).

Coronavirus Disease 2019 (COVID-19) was first reported in Wuhan, China in December, 2019 (Huang et al., 2020) and then found in more than 200 countries and territories (World Health Organization, 2020). Since April 2020,

117   COVID-19 has been well-contained in China (National Health Commission of

118   China, 2020). To lower the risk of contagion between students, the spring

119   semester was postponed in all universities in China in early 2020. Further, all

120   classroom teaching was suspended, and replaced by online teaching and

121   learning (Xinhuanet, 2020a, 2020b). Due to lockdown measures, outdoor/

122   physical activities were prohibited in many areas of China. In addition to

123   sudden changes of traditional face-to-face learning modes, students were

124   exposed to high level of academic stress (Brooks et al., 2020; Wang et al.,

125   2020a), which may trigger negative health outcomes including fatigue (Elhai

126   et al., 2020; Király et al., 2020; Miao et al., 2020a; Miao et al., 2020b).

127   Compared to those enrolling in other non-health related subjects, students in

128   health-related majors, such as nursing, may be at higher risks of fatigue due

129   to higher curriculum demand and academic workload from the faculty of

130   nursing.

131   In order to reduce the likelihood of negative health outcomes caused by

132   fatigue, it is important to understand its prevalence and associated factors. To

133   date, however, fatigue among nursing students in the post- COVID-19 era has

134   not been investigated. Therefore, the aims of this study were to: 1) examine

135   the prevalence of fatigue among nursing students in the post COVID-19 era

136   in China and 2) explore the association between fatigue and quality of life

137   (QOL) among nursing students.

138

139   **Methods**

140   *Participants and study settings*

141   This was a multicenter, cross-sectional study conducted between September

142   14 and October 7, 2020 across five university nursing schools (Peking

143   University, Capital Medical University, Jilin University, Lanzhou University, and

144 Wuhan University) in China. In order to avoid contagion during the COVID-19

145 pandemic, face-to-face interviews were not plausible. Consistent with other

146 studies (Bo et al., 2020; Ma et al., 2020), data were collected using the

147 Questionnaire Star Application embedded in WeChat, which is a widely used

148 social communication application with over 1 billion users in China. WeChat

149 had been used as a teaching tool in the participating nursing schools,

150 therefore, all students were WeChat users. Nursing students in the

151 participating nursing schools were consecutively invited to participate in this

152 study, and those who electronically signed the online written informed consent

153 could access the assessment. To be eligible, participants were 1)

154 undergraduate nursing students, 2) aged between 15 and 28 years, 3) able

155 to understand the content of the assessments, and 4) able to provide written

156 informed consent. The study protocol (No:2020-10) was approved by the

157 Institutional Review Board (IRB) at Beijing Anding Hospital of Capital Medical

158 University and all collaborating university nursing schools.

159

160 *Measurement tools*

161 Basic socio-demographic data, such as gender, age, year of study, perceived

162 economic status were collected based on self-report. COVID-19 related

163 experiences were asked using standardized questions, including 1) whether

164 they were volunteers in clinical settings during the COVID-19 pandemic; 2)

165 whether they had negative experiences (e.g., such as verbal abuse and

166 threats) during the COVID-19 pandemic; 3) whether they experienced

167 economic loss during the COVID-19 pandemic; 4) whether they used social

168 media frequently to obtain relevant information during the COVID-19

169 pandemic; and 5) economic status and perceived health status were also

170 asked using standardized questions.

171 Fatigue was measured using the numeric rating scale (NRS), scoring from

172 "0" (not suffering from fatigue) to "10" (unbearable suffering from fatigue)

173 (Berger et al., 2010). Higher scores indicated more severe fatigue, and a score

174 of ⩾4 was considered "clinically relevant fatigue" ("having fatigue" hereafter)

175 (Oldenmenger et al., 2013). Another NRS was adopted to evaluate severity of

176 overall body pain (pain hereafter)(Haefeli and Elfering, 2006), which was

177 scored from "0" (no pain) to "10" (worst pain imaginable), with a higher score

178 indicating more severe pain (Li et al., 2009; Li et al., 2007; Liu and Li, 2004).

179   The Chinese version of the Patient Health Questionnaire (PHQ-2) was used

180 to measure depressive symptoms (Chen et al., 2015; Kroenke et al., 2001) in

181 the past week. Each item scored from 0 (not at all) to 3 (nearly every day).

182 The total score ranged from 0 to 6, with a higher score representing more

183 severe depressive symptoms. The Chinese version of the Generalized Anxiety

184 Disorder scale seven items (GAD-7) was used to assess anxiety symptoms.

185 Each item scored from 0 (absolutely no) to 3 (almost every day), with a higher

186 score indicating more severe anxiety symptoms (He et al., 2010; Spitzer et

187 al., 2006). The overall QOL was measured using the first two items on overall

188 QOL of the World Health Organization Quality of Life-brief version (WHOQOL-

189 BREF) (Fang, 1999; Harper et al., 1998; Xia et al., 2012), with higher scores

190 indicating greater QOL.

191

192 *Statistical analysis*

193 Data were analyzed using the IBM Statistical Package for Social Science

194 (SPSS) program, version 24.0. The comparisons between nursing students

195 with and without fatigue were conducted using two independent samples t

196 tests, Mann-Whitney U Tests, and Chi-square tests, as appropriate. Analysis

197 of covariance (ANCOVA) was conducted to examine the independent

198 association between fatigue and QOL, after adjusting for variables with

199 significant group differences in univariate analyses. Binary logistic regression

200 analysis with the "enter" method was performed to test the independent

201 correlates of fatigue, with fatigue as the dependent variable, and those with

202 significant group differences in the univariate analyses as independent

203 variables. Significance level was set at 0.05 (two-tailed).

204

205 **Results**

206 Altogether, 1,121 nursing students were consecutively invited to participate

207 in this study; of whom, 1,070 met the study criteria and completed the

208 assessment, yielding a response rate of 95.5%. The prevalence of fatigue was

209 67.3% (95%CI: 64.4%-70.0%). There were significant differences between

210 fatigue and no fatigue groups in terms of gender, age, year of study, economic

211 loss during COVID-19 pandemic, financial perception, health perception, and

212 the PHQ-2, GAD-7, and pain total scores (Table 1). After controlling for

213 covariates, nursing students with fatigue had lower QOL (F $_{(1,\ 1070)}$=31.4,

214 P<0.001) than those without.

215 　　Multiple logistic regression analysis revealed that men (Odds Ratio

216 (OR)=1.73, 95%CI=1.20-2.49, P=0.003), students in their 2nd (OR=2.20,

217 95%CI=1.46-3.33, P<0.001), 3rd (OR=3.53, 95%CI=2.31-5.41, P<0.001)

218 and 4th year (OR=3.59, 95%CI=2.39-5.40, P<0.001; compared to students

219 in their first year), moderate economic loss during the COVID-19 pandemic

220 (OR=1.48, 95%CI=1.08-3.33, P=0.015; compared to low loss), more severe

221 depressive (OR=1.48, 95%CI=1.22-1.78, P<0.001), and anxiety symptoms

222 (OR=1.12, 95%CI=1.05-1.20, P=0.001), and more severe pain (OR=1.67,

223 95%CI=1.46-1.91, P<0.001) were significantly associated with more severe

224 fatigue (Table 2).

225

226 **Discussion**

227 This study examined the prevalence of fatigue among nursing students in

228 post-COVID-19 era. We found that 67.3% of nursing students reported

229 fatigue, which is almost double the prevalence of fatigue (36%) in qualified
230 nurses on shift work assessed by the Occupational Fatigue Exhaustion
231 Recovery scale (Geiger-Brown et al., 2012). Our finding was similar to the
232 corresponding figure (73.7%) in frontline staff (including doctors, nurses,
233 police officers, volunteers, community workers, and journalists) during
234 COVID-19 outbreak in China as measured by the Fatigue Self-Assessment
235 Scale (Teng et al., 2020). In contrast, the level of fatigue among medical
236 students was relatively low (13.8%) before the COVID-19 outbreak (Abdali et
237 al., 2020). Owing to different measurement tools on fatigue, direct
238 comparisons between studies should be interpreted with caution.

239 Fatigue appeared to be common among nursing students in the post-
240 COVID-19 era and this can be attributed to several reasons. First, previous
241 studies found that fatigue among students who majored in health-related
242 subjects was usually related to poor academic performance and related
243 problems, such as absenteeism, and having a sedentary lifestyle (e.g., lack of
244 physical exercise) (Cruz et al., 2018). Sudden shifting from traditional
245 classroom learning to online learning coupled with limited outdoor physical
246 activities during the COVID-19 outbreak in China may have led to poorer
247 academic performance, and increased absenteeism, which is often linked with
248 sedentary lifestyle, and this in turn may have led to more fatigue among
249 nursing students. Second, many nursing and medical students served as
250 volunteers in clinical settings during the COVID-19 outbreak. Persistent high
251 levels of stress and anxiety (Cao et al., 2020) at work could further exacerbate
252 the risk of fatigue (Abdali et al., 2020; Doerr et al., 2015; Nijrolder et al.,
253 2008). In addition, potential risk of susceptibility to COVID-19 infection on top
254 of a heavy clinical workload may have also escalated the risk of fatigue amidst
255 the COVID-19 outbreak. Third, daily infection precautionary measures at work
256 (e.g., face mask wearing, frequent hand-washing, full gear personal

257 protection equipment adherence), reduced social etiquette practices (e.g.,
258 shaking hands) and social distancing, could lead to boredom (Miao et al.,
259 2020b), anxiety, frustration (Aristovnik et al., 2020), and mental fatigue.

260   In this study, we found that male students were more likely to report
261 fatigue than their female counterparts. In China, nursing students are
262 predominantly women. In traditional Chinese culture, men have been ascribed
263 the social status of "pillars" within the family and in the society; therefore,
264 they were often expected to be responsible for more heavy tasks and
265 challenges than women in public health crisis situations (e.g., COVID-19
266 outbreak). In addition, female students who major in health-related subjects
267 usually have a better academic performance than male students (Alzahrani et
268 al., 2018; Voyer and Voyer, 2014). Such gender differences in academic
269 performance suggests that female students may adapt better than male
270 students in the switching of learning modes. These social and educational
271 factors could result in greater fatigue in male students. Similar to previous
272 findings (Labrague and Ballad, 2020), we found that the 2nd (OR=2.20), 3rd
273 (OR=3.53) and 4th year students (OR=3.59) were more likely to report fatigue
274 than 1st year students. Senior nursing students receive more crisis response
275 and medical training compared to junior students. As such, they usually
276 undertook a greater responsibility in combating the COVID-19 outbreak, which
277 possibly explained the differences in the level of fatigue between years of
278 study.

279   There were independent associations between fatigue, depression,
280 anxiety and pain. More severe fatigue was associated with more severe
281 depression, anxiety and more severe pain among nursing students in this
282 study. Similar findings were found in university students (Shim et al., 2019)
283 before and during COVID-19 outbreak (Verma, 2020; Wang et al., 2020b).

284   The relationship between fatigue and depression / anxiety were bidirectional

285   (Thorsteinsson et al., 2019) (i.e., fatigue could increase the risk of depression

286   and anxiety, and vice versa). Consistent with previous findings (Kaasa et al.,

287   1999; Yoon et al., 2019), in this study more severe pain was associated with

288   a higher risk of fatigue in nursing students. Pain is defined as an unpleasant

289   sensory and emotional experience usually associated with actual or potential

290   tissue damage (Raja et al., 2020) caused by internal and/or external factors

291   (e.g. cold, heat, physical pressure and lesions). Adjustment mechanisms in

292   the human body attempt to relieve pain through the central brain feedback

293   system (Mauger, 2013). If the predisposing factors cannot be addressed and

294   remain chronic, the adjustment/restoration system will be out of balance and

295   the body will be fatigued (Aaronson et al., 1999; Sharpe and Wilks, 2002).

296   Similar to previous findings (Kratz et al., 2017; Nunes et al., 2017), we

297   found that nursing students with fatigue had a lower overall QOL than those

298   without. As a widely used health outcome measure, QOL is closely associated

299   with the interactions between protective factors (e.g., better social support)

300   and risk factors (e.g., physical distress) (Hatoum et al., 1998). Fatigue was

301   also associated with physical and mental distress, which could lower QOL.

302   The strengths of this study included the multi-site design, relatively large

303   sample size and use of standardized instruments. However, several

304   methodological limitations should be acknowledged. First, casual relationships

305   between fatigue and other variables could not be established due to cross-

306   sectional design. Second, only five university nursing schools were included,

307   and hence, our findings may not be generalizable to all nursing students in

308   China. Third, some factors (e.g., academic pressure and social support)

309   associated with fatigue were not assessed due to logistical reasons.

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Conclusion

Fatigue was common among nursing students in post-COVID-19 era. Considering the negative impact of fatigue on QOL and daily functioning, routine physical and mental health screening should be conducted for nursing students. Effective stress-reduction strategies should be executed to assist nursing students to combat fatigue and restore optimal health.

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Data collection, analysis and interpretation: Qianqian Zhu, Zhiwen Wang, Lin Han, Pan Chen, Wei Bai, Hong Cai, Yan-Jie Zhao, Li Chen, Zong-Mei Ge, Mengmeng Ji, Hongyan Zhang, Bing-Xiang Yang, Shuo Liu.

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Approval of the final version for publication: all co-authors.

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Ethics approval statement

340 The study protocol was approved by the Institutional Review Board (IRB) at

341 Beijing Anding Hospital of Capital Medical University and all collaborating

342 university nursing schools.

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Conflict of interest statement

345 All authors declare that there are no conflicts of interest.

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Table 1 **(on next page)**

Socio-demographical and scale' scores of nursing students

1 **Table 1. Socio-demographical and scale' scores of nursing students**

Variables	Total (N=1,070)		Non Fatigue (N=350)		Fatigue (N=720)		Univariate analyses		
	N	%	N	%	N	%	χ^2	df	P
Male gender	265	24.8	63	18.0	202	28.1	**12.78**	1	**<0.001**
Rural residence	457	42.7	145	41.4	312	43.2	0.35	1	0.555
Only Child	457	42.7	147	42.0	310	43.1	0.11	1	0.742
Year of Study							64.11	3	<0.001
First year	287	26.8	147	42.0	140	19.4			
Second year	237	22.1	72	20.6	165	22.9			
Third year	249	23.3	60	17.1	189	26.3			
Fourth year	297	27.9	71	20.3	226	31.4			
Being volunteer during COVID-19 pandemic	231	21.6	66	18.9	165	22.9	2.29	1	0.130
Having negative experiences during COVID-19 pandemic	188	17.6	51	14.6	137	19.0	3.23	1	0.073
Economic loss during COVID-19 pandemic							**18.35**	**2**	**<0.001**
Not or mild	444	41.5	177	50.6	267	37.1			
moderate	557	52.1	157	44.9	400	55.6			
Great loss	69	6.4	16	4.6	53	7.4			
Frequent use of social media during COVID-19 pandemic	778	72.7	252	72.0	526	73.1	0.13	1	0.716
Perceived economic status							**8.90**	**2**	**0.012**
Poor	218	20.4	63	18.0	155	21.5			
Fair	776	72.5	251	71.7	525	72.9			
Rich	76	7.1	36	10.3	40	5.6			
Perceived health status							**45.70**	**2**	**<0.001**
Poor	23	2.1	4	4.1	19	2.6			
Fair	449	42.0	99	28.3	350	48.6			
Good	598	55.9	247	70.6	351	48.8			
□	Mean	SD	Mean	SD	Mean	SD	t/Z	df	P
Age (years)	19.7	1.4	19.4	1.5	19.9	1.4	5.55	1068	**<0.001**
Fatigue total	4.8	2.1	2.5	0.7	6.0	1.5	51.48	1068	**<0.001**
PHQ-2 total	1.0	1.2	0.5	0.8	1.3	1.3	10.76	--[a]	**<0.001**
GAD-7 total	3.1	3.9	1.4	2.5	4.0	4.2	11.09	--[a]	**<0.001**
Pain total	2.4	1.8	1.6	1.0	2.8	1.9	9.76	--[a]	**<0.001**
QOL total	6.7	1.5	7.5	1.3	6.4	1.5	12.58	1068	**<0.001**

a: Mann-Whitney U test; Bolded values: <0.05; COVID-19: Coronavirus Disease 2019;df: degree of freedom PHQ-2: the 2-

item Patient Health Questionnaire; QOL: quality of life; GAD-7: 7-item Generalized Anxiety Disorder Scale; SD: standard deviation.

2

Table 2(on next page)

Independent correlates of fatigue by multiple logistic regression analysis

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1   **Table 2 Independent correlates of fatigue by multiple logistic regression**
2   **analysis**
3

Variables	Multiple logistic regression analysis		
	P	OR	95% CI
Male gender	**0.003**	**1.73**	**1.20-2.49**
Year of study			
Frist year	-	1.0	-
Second year	**<0.001**	**2.20**	**1.46-3.33**
Third year	**<0.001**	**3.53**	**2.31-5.41**
Fourth year	**<0.001**	**3.59**	**2.39-5.40**
Economic loss during COVID-19 pandemic			
Not or mild	-	1.0	-
Moderate	**0.015**	**1.48**	**1.08-2.02**
Great loss	0.352	1.41	0.68-2.91
Perceived economic status			
Poor	-	1.0	-
Fair	0.100	1.41	0.94-2.13
Rich	0.495	1.26	0.65-2.44
Perceived health status			
Poor	-	1.0	-
Fair	0.151	2.70	0.70-10.50
Good	0.312	2.02	0.52-7.86
PHQ-2 total	**<0.001**	**1.48**	**1.22-1.78**
GAD-7 total	**0.001**	**1.12**	**1.05-1.20**
Pain total	**<0.001**	**1.67**	**1.46-1.91**
Bolded values: <0.05; CI: confidential interval; OR: odds ratio; PHQ-2: the 2-item Patient Health Questionnaire; QOL: quality of life; GAD-7: 7-item Generalized Anxiety Disorder Scale. There was collinearity between age and grade, therefore age was not entered in the model as an independent variable.			

4