

The rapid change of mental health in college students after on-campus quarantine in Shanghai 2022 Covid lockdown

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Abstract

Importance:

Social isolation during outbreaks of epidemics always challenge psychological resilience profoundly. However, it still remains unclear how students' mental health would be affected by strict *on-campus quarantine, which means students stayed at dormitories or on-campus for quarantine*. We analyzed the data from one of the earliest universities releasing strict on-campus quarantine to prevent the Omicron spread-out in Shanghai, to evaluate the time course of the psychological resilience in the influence of an unexpected change in the living space in university students.

Objectives

The campus was locked down on 9th March. From 9th to 23rd, all students on campus were asked to stay in their dormitories, and teachers sent food supplies three times a day. From 24th March to early April, students were gradually allowed to enter the campus for necessary activities. We quantify dynamic changes in depression severity during the campus locked down.

Method:

All participants were undergraduate or graduate students. The survey was released on 5th, April. All survey was dropped a public link on www.wjx.cn and administered from April 5th to 7th, 2022. Following the schedule of quarantine area, we assessed depressive symptoms in SJTU students from Period 1 (two weeks before 9th, March), Period 2 (9th to 23rd, March), and Period 3 (24th March to 5th April). 274 students completed the online survey, and two incomplete data were excluded for further analysis. All these participants aged range from 18 to 25 years old and were quarantined in dormitories since 9th March 2022.

Findings:

A remarkable increase in depression was observed in university students after stringent quarantine. The portion of students with depression started at 9.1% before quarantine and rapidly increased to 36.1% right after quarantine. No more increase in depressive symptoms was observed with time though quarantine was ongoing, which can be predicted by the food supplement satisfaction and the duration of physical fitness per day. Interestingly, the impact of a sudden change in living space on the psychological resilience was more evident in students who have a romantic relationship than singles.

Introduction

Outbreaks of severe epidemics always challenge psychological resilience profoundly. The coronavirus disease 2019 (COVID-19) was declared a public health emergency [1] in 2020, threatening physical and mental health. Negative mental health effects in pandemic vary in different crowds and phases of

epidemic. People in the worst-hit area experience compounded emotions with the fear of virus infections, inadequate supplies, suspension in social public issues, and unexpected social isolation. Among various impacts of disaster-related emotions, sudden social isolation has been proved to result in significantly increased mental health problems. A previous study on patients isolated for MERS (Middle Eastern respiratory syndrome) showed that over 40% of patients needed psychological intervention, while those who were not in isolation required none[2]. Studies of people who were isolated from social contact during COVID-19 outbreak also showed symptoms of post-traumatic stress[3], anxiety[4-7], and depression[8-12].

Compared to the general population, university students are more prone to mental health problems[13-15]. They are generally smart, curious, and highly energetic; they also have diversified backgrounds and target different goals. Investigations on college or university students in China, France, and the United States have shown that COVID-19 quarantine has a non-trivial on the mental health of college students.

We notice that there are two key impact interrelated characteristics of the on-campus quarantine. First, it tries to emulate normal campus life. In other words, students maintain normal (online) study and research activity under well-organized, unified logistical support from the university. Second, it also features highly strict isolation. Students have to comply with various regulation rules and stay in cramped dormitory conditions for most of their time. Understanding the implications and associative risk factors of such a complex regulation process is crucial for cultivating our next generation talents.

To date, it remains unclear how students' mental health would be affected by on-campus quarantine. Existing studies, unfortunately, overlook the above characteristics. For example, researchers from France[15] and the United States[16-19] mainly focus on participants who were asked to stay at home during the pandemic. Isolation or quarantine in these studies all refers to less strict physical isolation or merely keeping social distance, without compulsory separation from family or loved ones. While there have been prior works on the mental health issue of Chinese university students under stringent quarantine[7, 20], they do not assume a unified on-campus environment. These work adopts citywide or countrywide data, and therefore the targeted quarantine situation differs greatly from individual to individual.

To the best of our knowledge, it is the first comprehensive study on the mental health issue of on-campus quarantine. Our study has two salient features:

We analyze the data from Shanghai Jiao Tong University (SJTU), one of the biggest and most prominent universities in China. Shanghai witnesses a steep rise in coronavirus cases facing the Omicron challenge in March 2022. To prevent the virus from spreading further, Shanghai has to impose sporadic and localized lockdowns on March and then strict society lockdowns citywide on April 1, 2022. SJTU required all students to stay in the dormitories from 9th March [21]. The on-campus quarantine at SJTU here refers to staying in the dormitories with 2-4 roommates, and their activity area were restricted in the campus. In certain periods, students were asked not to leave their rooms for weeks. The sudden change of the living space challenged the psychological resilience of students.

Beyond the space of the quarantine, we also take the quarantine length into account. The SJTU locked down on 9th March. From 9th to 23rd, all students on campus were asked to stay in their room, and teachers sent food supplies three times a day. From 24th March to early April, students were gradually allowed to enter the campus for necessary activities. Following this schedule, we assessed depressive symptoms in SJTU students from late February to early March (two weeks before 9th, March), early-to-mid March period (Period 2; 9th to 23rd, March) and late March to early April (Period 3; 24th March to 5th April). This measure allowed us to quantify dynamic changes in depression severity during the campus locked down.

Methods

2.1 Participants

All participants were undergraduate or graduate of Shanghai Jiao Tong University. The survey was released on 5th, April. All survey was dropped a public link on www.wjx.cn and administered from April 5th to 7th, 2022. Two hundred seventy-six students completed the online survey, and two incomplete data were excluded for further analysis. Therefore, 274 participants' data were enrolled for data analysis (response rate=99.28%). All these participants aged range from 18 to 25 years old and were quarantined in dormitories since 9th March 2022.

2.2 Online survey

A structured online questionnaire was applied in which depression symptoms and its associative potential risk factors (i.e., daily physical exercise time) were assessed during three periods of time: before quarantine of Shanghai Jiao Tong University (Period 1; two weeks before Before 9th, March), the early (Period 2; 9th, March to 23rd, March) and the middle stage of quarantine at SJTU (period 3, 24th March to 5th May). The survey included two classes of self-reported questions: Socio-demographic and lifestyle questions and the Beck Depression Inventory 2nd edition (BDI-II).

Socio-demographic and lifestyle questions

Participants age and gender were asked in the socio-demographic part. In addition, we asked whether participants were covid-positive, close contact, neither covid-positive nor close contact, and vaccination management as their Covid-background. We also asked the levels of activity restriction in the three different periods. Furthermore, the survey includes self-reported ways to ease stress, such as connecting with loved ones (parents, relatives, or friends) mentors or psychiatrists for help, searching on the Internet, playing games, exercising, listening to music, et al. To assess the impact of the quarantines on social ties, we asked the duration of connecting with loved ones/game-time/physical exercise per day in three periods of time. In addition, we also ask whether they were satisfied with the food which canteen supplied. In total, 16 socio-demographic and lifestyle questions were given in the online survey.

Beck Depression Inventory 2nd edition (BDI-II)

BDI-II consisted of twenty-one questions, based on the 1996 published edition. There is a four-point scale for each item ranging from 0 to 3. Different levels of depression were determined based on established criteria in the literature: normal (≤ 13), mild depression (14-19), moderate depression (20-28), and major depression (29-63) were [22]. First, the total BDI-II scores were compared between the three different periods.

In summary, our online survey contains a total of 38 questions (16 socio-demographic and health-related questions, and 21 BDI-II questions). All participants were required to complete all these items at three stages, before, at the early or late stage of quarantine.

—insert Table 1 about here—

2.3 Statistical Analysis

First, we calculated the medians with interquartile ranges (IQRs) of all scores and quantitative covariates. Here we calculated medians instead of means because the data were mostly not normally distributed. After the normal distribution of BDI-II scores rejected, we log-transformed the BDI-2 scores before further analyses. Unless noted otherwise, all ANOVA, t-tests, and regression analyses were performed on log-transformed BDI-2 scores. To explore the potential predicting factors for the depression changes, the linear regression model was performed with changes in depressive symptoms as a dependent variable, the quarantine areas, the parent-child relationship, the duration of video games/ physical exercises per day, and the satisfaction of food supplement as predict variables. As our interest, repeated-measure ANOVA was applied with log-transformed BDI-II scores as dependent variable, quarantine period (P1/2/3) as within-subject variable, and close relationship (with partner vs. single) [1] as between-subject variables to explore the effect of romantic relationship and vaccination on depression. Post-hoc independent t-test was conducted to further examine group differences in depression in each stage. Coefficients of the accounting factors are presented as odds ratios (ORs) with 95% CIs. Statistical analysis was performed using SPSS 23 edition. The significance threshold was set at $\alpha = .05$.

[1] COVID-19 vaccination (with vs. without vaccination) was taken into account in the preliminary analysis. As the number of the population who were not administered vaccination is extremely small (N=6), we did not report relevant result in this manuscript.

Results

3.1 The rapid increasing depression after on-campus quarantine

We collected 272 valid samples after excluding two with missing values. All descriptive statistics on demographic information and other values of risk factors (i.e., daily physical exercise time) are summarized in Table 1.

We performed a one-way repeated-measure ANOVA with the log-transformed BDI-II scores as dependent variables, and quarantine period (Period 1, Period 2, and Period 3) as the within-subject variable. There

was a main effect for present of quarantine ($F(2, 528) = 140.08, p < .001, \eta^2 = .35$). Post-hoc analyses revealed that depressive symptoms were significantly increased in the early phase of quarantine (Period 2; $M = 11.46, SE = 0.64$) compared to the period before quarantine (Period 1; $M = 3.95, SE = 0.40$), paired $t(528) < 0.001$. However, comparable depressive symptom was observed in the early (Period 2) and middle phase of university quarantine (Period 3; $M = 11.40, SE = 0.67$), $p = 0.99$, suggesting that students' depressive symptom was not elevated even though quarantine was ongoing. We further plotted the raw BDI-II score distributions of the three periods (See Fig.1A) and observed a clear shift in the overall distributions from period 1 to period 2 (Wilcoxon matched-pairs signed-ranks test, $p < 0.001$), whereas no significant difference was observed between Period 2 and Period 3 (Wilcoxon matched-pairs signed-ranks test, $p < 0.001$).

—insert Figure 1 about here—

We divided all participants into two sub-groups, students with depression (BDI-II score >13) and without depression (BDI-II score <14). We observed that the portion of students with depression started at 9.1% in Period 1 and rapidly increased to 36.1% during Period 2 (Wilcoxon matched-pairs signed-ranks test, $p < 0.001$), but showed numerical decrease to 34.9% in Period 3 (Wilcoxon matched-pairs signed-ranks test, $p = 0.954$). According to the categorization criteria in BDI-II, we further divided depressed students into three sub-groups - mild (14-19), moderate (20-28), and major depression (>28). As shown in Fig.1B, the portion of students of all three sub-groups increased from Period 1 (4.0% mild, 3.7% moderate, and 1.5% severe) to Period 2 (16.8% mild, 8.4% moderate, and 10.9% severe; Wilcoxon matched-pairs signed-ranks test, all $ps < 0.001$), but fluctuated from Period 2 to Period 3 (14.1% mild, 10.2% moderate, and 9.8% severe; Wilcoxon matched-pairs signed-ranks test, all $ps \geq 0.05$).

According to the criteria of BDI-II and the time of onset of the depressive symptom, we classified all participants into four subgroups: students without depressive symptoms in all three periods (BDI-II scores ≤ 13), students who showed their depressive symptoms (BDI-II scores ≥ 13) before quarantine (Period 1), at early (Period 2) or middle phase (Period 3) of the university quarantine. One-way repeated-measure ANOVA was applied to each subgroup respectively. Main effects of quarantine on depressive symptoms were evident in all groups, except for those who were already experiencing depressive symptoms before university quarantine ($N = 25$; one-way repeated ANOVA, $F(2, 48) = 1.90, p = 0.16, \eta^2 = .07$). As the post-hoc analysis revealed, depressive symptoms were observed dramatically increased from Period 1 to Period 2 (as shown in Fig.1C) in all the other three subgroups who have not shown depressive symptoms prior to the university quarantine (all $ps \leq 0.001$). For example, even among those who did not reach mild depression level (BDI-II score >13) during university quarantine, significantly elevated depressive symptoms were observed in the early phase (Period 2; $M = 5.10, SE = 0.29$) compared with those before university quarantine (Period 1; $M = 1.73, SE = .21$), paired $t(157) = -11.76, p < .001, Cohen's d = 0.38$, Bonferroni-corrected.

As regards to the depressive symptoms changes from Period 2 to Period 3, BDI-II scores continued to increase dramatically in a relatively small proportion of students ($N = 14$; 5.1%), reaching mild depressive

levels (BECK-II scores >13; Period 2: M=8.30, SE= 1.21; Period 3: M=19.80, SE= 1.41; paired $t(13) = -4.71$, $p < .001$, *Cohen's d* = 0.72, Bonferroni-corrected), no significant difference was found in BECK-II scores between Period 2 and Period 3 (both paired $t_s \leq 1.20$, $p_s \geq .24$, *Cohen's d* ≤ 0.07 , Bonferroni-corrected) for the other 258 students (94.89%). For most students, no increase in depression was observed anymore and depressive symptoms decreased numerically in Period 3 (never depressed: M = 5.10, SE=0.29; depressed in Period 2: M= 22.68, SE= 0.97) as relative to Period 2 (never depressed: M=5.00, SE=0.29; depressed in Period 2: M= 21.24, SE=1.37).

All these results revealed that there was a dramatic increase in depressive symptoms in the early phase of the university quarantine, while in the following middle phase of quarantine there was no further increase in depressiveness in a large proportion of students (94.89%).

3.2 Factors for depression changes during quarantine

We performed a linear regression model to explore the potential predictors of the changes in depressive symptoms in early (Period 2 vs. Period 1) and middle phase of quarantine (Period 3 vs. Period 2) separately. In each regression model, the log-transformed BDI-II score changes were set as the dependent variable, with the quarantine area, food supplementary, parental bonding, and the duration of video game/physical exercise per day as predictors. The statistical summary of the regression analysis is shown in Table 2. Critically, the quarantine area which reflects the nature of quarantine showed a significant prediction of depression severity changes in Period 2 ($\beta = 0.23$, $p < 0.001$), but cannot predict the following depression changes in Period 3 ($\beta = 0.07$, $p = 0.214$). Notably, the duration of video games negatively predicts the depressive symptom change in Period 2 ($\beta = -0.23$, $p < 0.001$). In addition, the less duration of physical exercise per day and food supplement satisfaction positively predict the depressive severity changes in both Period 2 (exercise: $\beta = 0.11$, $p = 0.036$; food: $\beta = 0.29$, $p < .001$) and Period 3 (exercise: $\beta = 0.18$, $p = 0.003$; food: $\beta = 0.28$, $p < .001$), reflecting students' concerns and the vital role of food and physical exercise in coping with depression during university quarantine.

—insert Table 2 about here—

3.3 Worsen BDI-II scores in ones with romantic relationships after on-campus quarantine

We performed repeated-measure ANOVA to further examine the influence of quarantine and romantic relationships on depressive symptoms, with BECK-II scores as a within-subject variable (Period 1,2,3) and romantic relationships as the between-subject variable. We predicted the influence of quarantine would evident in both groups, whereas romantic relationship would protect against the influence of quarantine on depressive symptoms. As expectedly, the main effect of quarantine was present $F(2, 526) = 164.95$, $p < .001$, $\eta^2 = .39$, suggesting that for students with or without a romantic relationship, there was a significant depressive symptom change. Interestingly though main effect of romantic relations was not evident ($F(1, 263) = 3.66$, $p = .06$, $\eta^2 = .01$), romantic relationship was found significantly interacted with quarantine ($F(2, 536) = 17.53$, $p < .001$, $\eta^2 = .06$). There was no significant group difference observed before quarantine, ($t(263) = -1.85$, $p = 0.07$, *cohen's d* 0.02). The depressive symptoms were numerically

higher in singles ($M=4.5$, $SE=.53$, $p=.133$) as compared to those with partners ($M=3.00$, $SE=.56$). However, depressive symptoms were significantly higher in individuals with romantic relationships ($N=100$; Period 2: mean=13.49, $SE=1.20$; Period 3: mean=13.99 $SE=1.27$) than those without ($N=165$; Period 2: mean=10.22, $SE=.71$; Period 3: mean=9.82, $SE=0.74$) after university quarantine in Period 2 ($t(263)=2.50$, $p=.01$, *Cohen's d* 0.38) and Period 3 ($t(263)=3.05$, $p=.003$, *Cohen's d* 0.34) respectively.

—insert Figure 2 about here—

Discussion

There has been a growing concern about the impacts of COVID-19 quarantine on university student's mental health. The fear of virus infection of COVID-19 and the feeling of quarantine characterized this difficult period. To address this concern, several studies have examined university students' mental health during the COVID-19 quarantine and suggested measures to protect against [9, 21, 23, 24]. Although these investigations have provided timely insights, there is no report that explored the effect of such on-campus quarantine policy in which university students are required to stay in dormitories. In this study, university students who were subject to such quarantine policy were taken into account the effect of quarantine on their mental depression and its associative risk factors. To this end, the university students were encouraged to recall the three periods, before (Period 1; two weeks before 9th, March), at early (Period 2; 9th, March to 23rd, March) and middle stage of on-campus quarantine (period 3, 24th March to 5th May), and complete the BDI-II scores survey related to depression and associated factors.

A remarkable increase in depression was observed in university students after stringent quarantine. This finding is consistent with previous observations [4-7, 15, 18, 25, 26] that students become more depressed after quarantine. In this study, we further investigated and found out how students' mental health altered overtime after quarantine, taking into account the campus quarantine in which students were not allowed to leave their dormitories. The most striking finding in this study (P2: 16.8% mild, 8.4% moderate, and 10.9% severe; P3: 14.1% mild, 10.2% moderate, and 9.8 severe) was the lower levels of depression than most previous studies, for example, the study conducted by Ahmed et al in Egypt (mild 23%, moderate 24.8%, severe 11.3%, and extremely severe 15.4%), and the research conducted by Karing in Germany (mild 35.2%, moderate 22.2%, and severe 13.7% [27]). This is contrary to our original hypothesis that the proportion of depression should be quite higher than previous studies under relatively narrow activity space. There are two explanations for that: 1) The COVID-19 pandemic has lasted over two years. Most people have a new understanding of the virus, and many people have gradually become accustomed to the Chinese quarantine policy, especially highly educated university students. 2) The efficient administration of SJTU, for example, psychologists support, abundant food supplements, and several online courses run concurrently. Even though some the studies reported a relatively low depression, By analysing, we found most of these students were at home staying with their families or were confined to school but were not required to stay in the dormitory. Family companionship or relatively gentle quarantine conditions may result in relatively lower rates of depression. Besides, these studies with a low rate of depression, focus on students with medical backgrounds, while our study has no limitation to

medical backgrounds, it is possible that students taking a course on personal health are more conscious of protecting themselves and more likely to adapt to quarantine conditions.

It has been proposed that disaster-related emotional outcomes typically deteriorated over time[5, 7, 19]. However, the rates of depressive symptoms did not change significantly between Period 2 and Period 3, contradicting against the hypothesis that the negative emotion would decrease over time. It's plausible that students adapted to the quarantine situation by showing no more increase in depression in Period 3 as compared to Period 2, or students are increasingly satisfied with the food supply and the time for physical fitness as our data shows. Notably, the whole city of Shanghai started to quarantine in Period 3, but the effect of quarantine did not further accelerate students' negative emotions. This result provided more hints that students may have adapted to such situations and found ways to overcome their negative emotions (i.e., their stress or fear of the COVID-19 variances). Alternatively, this is simply because the students were allowed more quarantine areas (i.e., to walk around the campus) in period 3.

Linear regression was applied in the present study and revealed four predictors of changes in depressive symptoms during quarantine. The quarantine area, less time spent on physical exercise, and less satisfaction with food supplements during quarantine can lead to an increase in depression levels, which is consistent with existing observations [6-8]. It is worth noting that the increase of time spent on video games per day may negatively predict the increase of depressive symptoms to some extent, suggesting that video games may prevent the development of negative emotions to some extent[28]. This could be because video games can distract students' attention away from COVID-19 or its associative affairs which may raise their depression[29].

Interestingly, we found substantial differences in mental health outcomes following the initiation of quarantine in different groups. Previous studies during the COVID-19 pandemic have highlighted that social relationships played a key role during the quarantine, living with family, children, roommates, or alone led to various mental health outcomes[4, 5, 15, 30, 31]. In the present study, though there was a dramatic increase in depression in both singles and those in a close relationship, worse depressive symptoms were found in those who had a partner. One possibility is that, unlike those who were locked down at home with their loved ones, there was a sudden change in university students that they have to stay in dormitories, and they have to get used to the change of not being able to have physical contact or distance with their loved ones as usual. This change might lead to their worse depressive symptoms. Alternatively, it is possible that the communications by distance lead to more misunderstandings, therefore suffering more from negative emotions which resulted in an increase of the depression levels. All these results suggest that the university population that was in a romantic relationship should be given more consideration[32, 33].

We also considered the impact of vaccination on psychological protection against depression. The number of the population who were not administered vaccination is extremely small (N=6). Further studies may be needed when they take vaccination as a psycho-protection factor. Although our results do not indicate that administered vaccination provided psychological antibodies, studies showed that

psychological immunity, such as environmental mastery, is strongly correlated with mental and physical health[34].

In conclusion, the present study revealed a negative impact of on-campus quarantine on the severity of depression in university students. Under such a restricted policy, the symptoms of depression were associated with quarantine and intimate relationships. Poor satisfaction with food supplement, and reduced time on video games are possibly associated to an increase in the BDI-II score during the three periods. This is concerning because the quarantine occurs against a backdrop of increasing mental health problems among university students. Additional stress may lead to further adverse effects on students' learning experiences and mental health.

Limitations

First, the number of participants is relatively limited. Data in the present study represented approximately 1% of all students in SJTU. Therefore, it should be caution to apply the present results into whole population. Second, in the present study, a survey was given to participants once and they were required to rate their depressive symptoms for three different time periods. It would be more precise to ask participants for three times about their emotional status. Besides, longitudinal or cohort study can be done to know how mental status changes over time till the release of campus-wide quarantine and its associative factors.

Declarations

Compliance with ethical standards

This study has been approved by the ethics committee of Shanghai Jiao Tong University.

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Contributions

W Li conceived and supervised the project; Y Kuang, D Ma, Z Lan, B Zhao, S Zeng, Y Li, M Shang, R Zhang, L Wang, B Zhao , concepted and designed the the questions; Y Kuang, D Ma, Z Lan, and B Zhao

analyzed the data and drafted the first manuscript; all authors contributed to design the questions and prepare the manuscript.

Declaration of Competing Interest

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

Tables

Table 1

Table1. Factors that included in the Logistic Regression Model in predicting BDI-II Score.

Characteristic	Students, No. (%)			<i>p</i>	95% CI
Gender					
Men	111/274 (40.5%)			0.75	1.11 (0.59-2.11)
Women	163/274 (59.5%)			NA	NA
Education Level					
Undergraduate	181/274 (66.1%)			0.20	0.50 (0.17-1.45)
Graduate	93/274 (33.9%)			NA	NA
COVID-19 Background				0.02*	4.10 (1.25 -13.35)
COVID-positive	1/274 (0.4%)			NA	NA
Close Contact	22/274 (8.0%)			NA	NA
Others	251/274 (91.6%)			NA	NA
Vaccination coverage					
Unvaccinated	6/259 (2.3%)			0.83	0.83 (0.15-4.63)
Vaccinated	253/ 259 (97.7%)				
Close Relationship					
With partner	106/274 (38.7%)			0.007**	0.42 (0.22-0.79)
Single	168/274 (61.3%)			NA	NA
Ways to Relieve					
	Period 1	Period 2	Period 3		
With Parents	8.0	19.2	13.8	0.65	0.71 (0.17-3.06)
With relatives	3.3	1.5	1.8	0.20	NA
With Friends	20.3	22.5	27.2	0.30	NA
With Internet	20.3	18.5	14.9	0.41	NA
With games	12.0	9.0	9.4	0.04*	NA
With Music	10.9	8.3	9.0	0.73	0.75 (0.15-3.73)
With Sports	20.3	5.4	8.0	0.54	NA
With Others	4.7	0.4	0.4	0.65	0.76(0.50-1.13)

****p* < 0.001, ** *p* < 0.01, **p* < 0.05, the same below.

Table 2

Table 2 Factors Associated With BDI-II Score According to the Linear Regression.

The regression equation		Overall fitting index		Significance of the regression coefficient			
Outcome variable	predictors	R	R ²	β	LLCI	ULCI	p-value
$\Delta t1$ (Period2-Period1)	Quarantine Area	0.54	0.29	0.23	0.41	1.09	<0.001***
	Parental Bonding			-0.03	-0.57	0.31	0.554
	Video Game			-0.23	-0.95	-0.35	<.001***
	Physical Fitness			0.11	0.01	0.38	0.036*
	Food Supplement			0.29	0.40	0.86	<.001***
$\Delta t2$ (Period3-Period2)	Quarantine Area	0.37	0.14	0.07	1.18	4.40	0.214
	Parental Bonding			0.02	-3.15	1.37	0.674
	Video Game			-0.05	-0.72	1.80	0.361
	Physical Fitness			0.18	0.05	1.87	0.003**
	Food Supplement			0.28	0.78	1.55	<.001***

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Figures

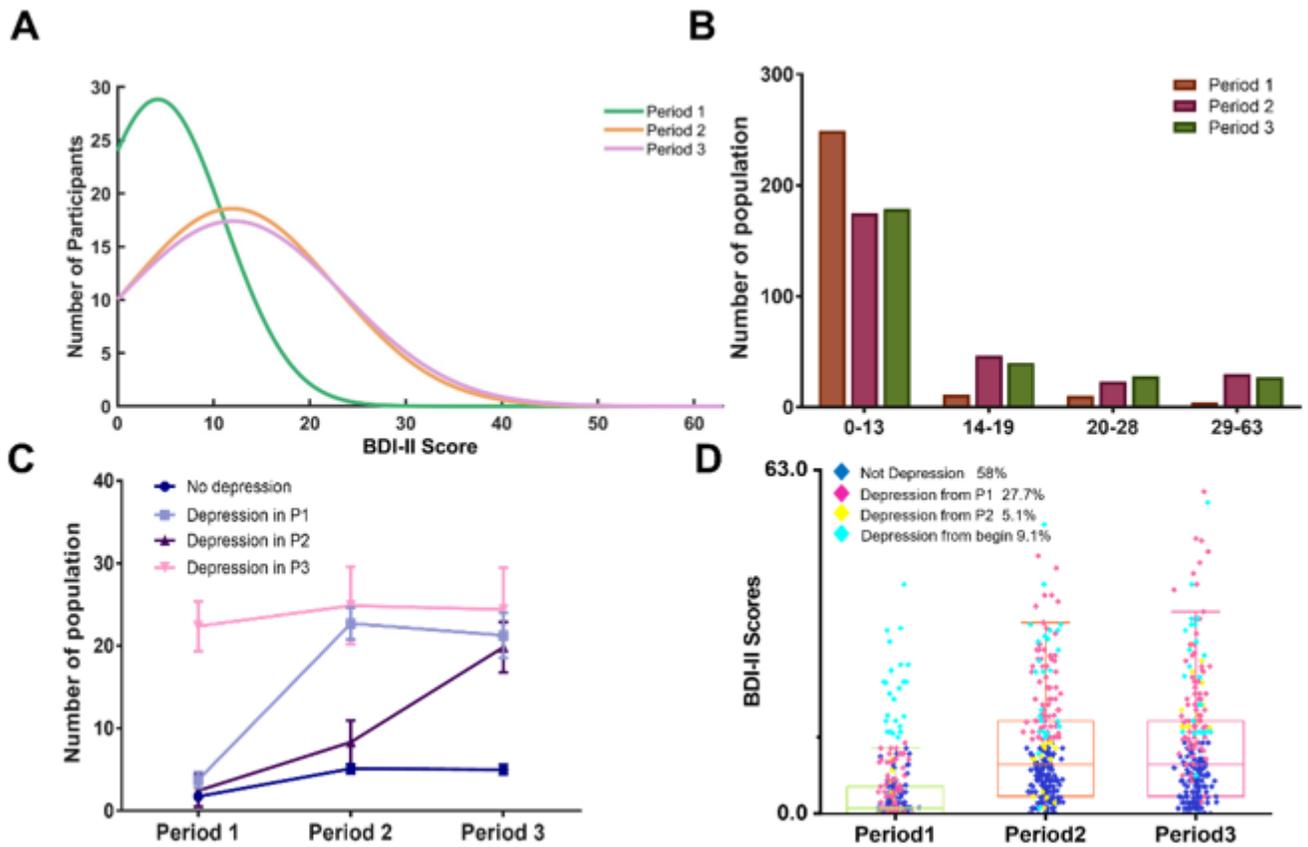


Figure 1

Quarantine-related changes in the distributions of depressive symptoms. (A) Normal distribution fit of BDI-II scores in three school quarantine phases. The green line represents the distribution of BDI-II scores before school quarantine (before 3.9). The orange line represents the distribution of BDI-II scores in the early stage of school quarantine (3.10-23). The purple line represents the distribution of BDI-II scores in the middle stage of school quarantine (after 3.24). (B) the number of students in four cauterizations according to their BDI-II scores in three periods of time. (C) the median BDI-2 scores of the four students subgroups, no depression (dark blue), depression in Period 1 (dark purple), in Period 2 (light purple), and Period 3 (pink) during the three lockdown periods. (D) BDI-II scores in three school quarantine phases. Box plot displays the interquartile range, including the lower quartile/25th percentile (bottom of the box), the upper quartile/75th percentile (top of the box), and the median (line within the box). The pink, purple, orange, and blue scatters represents students who show no depressive symptoms, depressed in the early stage of school quarantine, depressed in the middle stage of school quarantine, depressed before school quarantine. (*, **, ***, ****: $p < 0.05, 0.01, 0.001, 0.0001$ respectively, otherwise not significant). (D) Wilcoxon signed-rank test results of BDI-II scores of three school quarantine phases (P1: Period 1; P2: Period 2).

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