International Comparison of Depression During the COVID-19 Pandemic Among University Students in 13 Countries: A Web-Based Cross-Sectional Survey

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Introduction

Due to the unprecedented COVID-19 pandemic, anxiety about the possibility of infection, stress, and depression has grown worldwide,[1-3] and limited outdoor activities due to COVID-19 restrictions have led specifically to elevated feelings of depression in young people who had previously been physically active. However, studies on the association between COVID-19 and depression in physically active undergraduate and graduate students are lacking.[4]

Rigorous personal hygiene practices are more effective than national policies for COVID-19 prevention.[5] We assumed that many undergraduate and graduate students who engaged in frequent outdoor and social activities before the pandemic would experience increased pandemic-related depressive symptoms, and the degree of their symptoms would be affected by their personal hygiene practices. Thus, we aimed to identify the predictors of depressive symptoms due to the COVID-19 pandemic among undergraduate and graduate students worldwide to provide data for use in the creation of pandemic-related mental health policies for younger generations.

Methods

We administered an online survey to undergraduate and graduate students in 13 countries (the Republic of Korea [KR], China, Japan, the Philippines, Nepal, Indonesia, Peru, Paraguay, Cuba, Ethiopia, the Democratic Republic of the Congo [DRC], Senegal, and the United States) from May 25, 2020, to June 14, 2020. The minimum sample size of 1391 participants was determined using G*Power 3.1, with a 95% confidence interval and 5% error range. The survey considered geographical and time efficiency, and the participants were selected by nonprobability sampling using snowball sampling.

The dependent variable was the severity of depressive symptoms, as measured using the Patient Health Questionnaire-9 (PHQ-9),[6] and the independent variables were categorized into individual variables (private insurance, chronic diseases [CDs], concerns, preventive practices [PPs], and social distancing [SD]). The individual variables also included sex, age, and education level (bachelor's and master's degrees).

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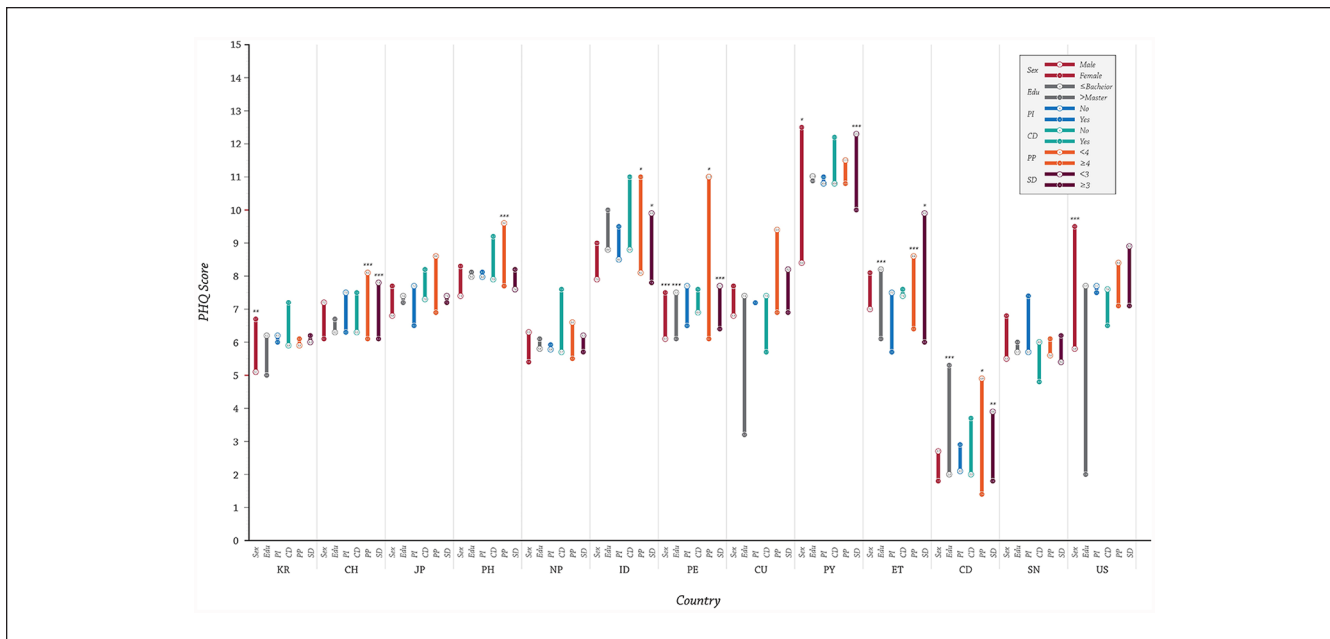Email: ewnam@yonsei.ac.kr

Figure 1. Demographic characteristics of the study cohort (n = 3604).
KR[a], Republic of Korea; CH, China; JP, Japan; PH, Philippines; NP, Nepal; ID, Indonesia; PE, Peru; CU, Cuba; PY, Paraguay; ET, Ethiopia; CD, Democratic Republic of Congo; SN, Senegal; US, the United States; PI[b], private insurance; CD[c], chronic disease; PP[d], prevention practice, number of prevention practices followed from the answers to 5 questions regarding COVID-19 prevention; SD[e], social distancing, number of social distancing practices followed from the answers to 4 questions regarding COVID-19 social distancing; PHQ[f], Patient Health Questionnaire, using the 3 types of standard cutoff scores (5, 10, and 15).
*P < .05, **P < .01, ***P < .001.

We analyzed the differences in depressive symptoms among the countries according to the independent variables. *T* tests (independent samples *t* tests) were used for the analysis, and ggplot2 from the *R* package was used for visual expression. Linear regression analyses were performed on the following seven models to identify the predictors of depressive symptoms: full ordinary least squares regression (OLS; Model 1), multilevel regression (Model 2), and hierarchical multiple regression (HMR; Models 3-7). All three parts of the survey were approved annually by the institutional review board (IRB) of Yonsei University in Korea (IRB Number: 1041849-202004-SB-043-1).

Results

The percentage of participants engaging in at least four of five COVID-19 PPs was 76.4% (Figure 1), with the highest percentages in China (87.4%), Cuba (87.2%), Korea (81.2%), and Peru (80.1%). The lowest percentages were in Senegal (50.0%) and Ethiopia (54.9%). The percentage of participants practicing at least 3 of 4 SD measures was 47.0%, with the percentage exceeding 50.0% in the DRC (71.4%), Cuba (69.8%), China (64.9%), and Ethiopia (52.6%); the lowest percentage was in Korea (20.9%). The mean PHQ score was 7.5, with the highest score in Paraguay (11.0) and the lowest in the DRC (2.2).

Three regression analyses were performed on seven models (Table 1). In the full OLS model (Model 1), the total PHQ score for KR was higher by 4.83, 2.19 (*P* < .01), 2.12 (*P* < .001), 1.35 (*P* < .05), 1.20 (*P* < .01), 1.14 (*P* < .01), and 1.13 (*P* < .05) for Paraguay, the Philippines, Indonesia, Ethiopia, China, Peru, and Cuba, respectively. The PHQ score was higher by 1.00 for countries with CDs than for those without, and the difference was significant (*P* < .001). The PHQ score was lower by 1.86 among people who employed a greater number of PPs than for those who employed fewer PPs (*P* < .001), and it was lower by 0.91 among people who strictly complied with SD than for those who did not, and the difference was significant (*P* < .001).

For Model 2, the predictors were fixed by country. The PHQ score was significantly lower (by 0.88) among women (*P* < .001), and the score decreased by 0.05 with a 1-year increase in age (*P* < .001).

Using Models 3 to 7, the PHQ scores were significantly higher for the Philippines, Indonesia, Peru, and Ethiopia than for Korea. Furthermore, sex, age, CD, concerns about COVID-19 infection in the family, PP, and SD were significant predictors of PHQ scores.

Discussion

We aimed to investigate COVID-19 pandemic–related depressive symptoms and identify their predictors in undergraduate and graduate students from 13 countries. The

Table 1. Results of the Regression Analyses of Models 1 to 7.

Variables	Model 1 (full OLS)	Model 2 (MLR)	Model 3 (HMR)	Model 4 (HMR)	Model 5 (HMR)	Model 6 (HMR)	Model 7 (HMR)
Countries							
KR	—		—	—	—	—	—
CI	1.20 [-42 to 1.98]**		0.57 [-0.19 to 1.34]	0.60 [-0.15 to 1.37]	0.61 [-0.15 to 1.37]	0.67 [-0.08 to 1.42]	1.23 [0.45 to 2.02]**
JP	0.94 [-0.11 to 2.01]		1.16 [0.10 to 2.24]*	1.19 [0.13 to 2.25]*	0.96 [-0.10 to 2.02]	1.04 [-0.01 to 20.09]	1.38 [0.33 to 2.43]**
PH	2.19 [1.31 to 3.07]***		1.98 [1.13 to 2.84]***	1.98 [1.14 to 2.83]***	1.81 [0.96 to 2.67]***	1.93 [1.09 to 2.76]***	2.69 [1.82 to 3.56]***
NP	-0.06 [-0.91 to 077]		-0.40 [-1.21 to 0.42]	-0.35 [-1.14 to 0.44]	-0.50 [-1.30 to 0.29]	-0.49, -1.27 to 0.29	0.36 [-0.46 to 1.18]
ID	2.12 [1.37 to 2.88]***		2.36 [1.61 to 3.10]***	2.42 [1.69 to 3.14]***	2.18 [1.44 to 2.92]***	2.06 [-1.34 to 2.79]***	2.68 [1.95 to 3.41]***
PE	1.14 [0.31 to 1.97]**		1.33 [0.52 to 2.13]**	1.30 [0.49 to 2.1]*	1.01 [0.18 to 1.84]*	1.26 [0.47 to 2.06]**	1.73 [0.92 to 2.54]***
CU	1.13 [0.20 to 2.33]*		1.13 [0.13 to 2.14]*	1.14 [0.15 to 2.13]*	0.74 [-0.28 to 0.76]	1.27 [0.29 to 2.25]*	1.79 [0.78 to 2.80]***
PY	4.83 [3.85 to 5.82]***		5.13 [4.17 to 6.09]***	5.10 [4.15 to 6.07]***	4.79 [3.80 to 5.78]***	4.96 [4.00 to 5.90]***	5.55 [4.59 to 6.51]***
ET	1.35 [0.29 to 2.41]*		1.68 [0.64 to 2.73]**	1.70 [0.69 to 2.71]**	1.50 [0.48 to 2.52]**	1.17 [0.16 to 2.18]*	2.22 [1.20 to 3.24]***
DRC	-3.42 [-4.33 to -2.51]***		-3.72 [-4.60 to -2.84]	-3.70 [-4.55 to -2.85]***	-3.84 [-4.69 to -2.99]***	-3.80 [-4.64 to 2.97]***	-2.96 [-3.83 to -2.08]***
SN	-0.05 [-1.65 to 1.56]		0.11 [-1.50 to 1.72]	0.13 [-1.45 to 1.71]	0.20 [-1.38 to 1.79]	-0.53 [-2.10 to 1.05]	0.57 [-1.01 to 2.16]
US	1.53 [-0.06 to 3.12]		1.39 [-0.21 to 2.99]	1.43 [-0.16 to 3.03]	1.26 [-0.33 to 2.86]	1.13 [-0.45 to 2.71]	2.06 [0.46 to 3.66]*
Sex	—		—	—	—	—	—
Male (1)							
Female (2)	0.88 [0.48 to 1.28]***	0.88 [0.49 to 1.28]***	0.76 [0.35 to 1.16]***	0.75 [0.34 to 1.15]***	0.73 [0.33 to 1.14]***	0.90 [0.50 to 1.30]***	0.80 [0.40 to 1.21]***
Age	-0.05 [-0.07 to -0.03]***	-0.05 [-0.07 to -0.03]***	-0.05 [-0.07 to -0.03]***	-0.05 [-0.08 to -0.32]***	-0.05 [-0.08 to -0.03]***	-0.05 [-0.07 to -0.03]***	-0.05 [-0.07 to -0.03]***
Education							
Less than or equal of bachelor's degree	—	—	—	—	—	—	—
Master degrees of higher	0.06 [-0.47 to 0.60]	0.06 [-0.47 to 0.59]	0.01 [-0.53 to 0.56]	-0.01 [-0.55 to 0.53]	0.02 [-0.52 to 0.56]	0.05 [-0.49 to 0.59]	0.04 [-0.50 to 0.58]
Insurance							
No	—	—	—				
Yes	-0.01 [-0.45 to 0.44]	0.04 [-0.40 to 0.48]	-0.02 [-0.47 to 0.43]				
CD							
No	—	—		—			
Yes	1.00 [0.35 to 1.67]**	1.01 [0.35 to 1.67]**		1.11 [0.44 to 1.78]**			
Anxiety							
No	—	—			—		
Yes	0.76 [0.35 to 1.17]***	0.79 [0.39 to 1.20]***			0.62 [0.12 to 1.04]**		
PP							
<4	—	—				—	
≥4	-1.86 [-2.31 to -1.40]***	-1.86 [-2.31 to -1.40]***				-2.04 [-2.49 to -1.60]***	
SD							
<3	—	—					—
≥3	-0.91 [-1.33 to -0.50]***	-0.92 [-1.34 to -0.51]***					-1.30 [-1.71 to -0.90]***
Cons	8.11 [7.23 to 9.00]	9.10 [7.89 to 10.30]	6.64 [5.84 to 7.44]	6.80 [6.01 to 7.60]	6.64 [0.22 1.04]	8.33 [7.49 to 9.18]***	7.10 [6.31 to 7.89]
R^2	0.14	0.11	0.11	0.11	0.11	0.13	0.11
F/χ^2	35.25***	113.24***	28.09***	28.84***	28.72***	33.86***	30.88***

Abbreviations: CD, chronic disease; CU, Cuba; DRC, Democratic Republic of the Congo; ET, Ethiopia; full OLS, full ordinary least squares regression; HMR, hierarchical multiple regression; ID, Indonesia; JP, Japan; KR, Republic of Korea; MLR, multilevel regression; NP, Nepal; PE, Peru; PH, the Philippines; PP, prevention practice, number of prevention practices followed from the answers to 5 questions regarding COVID-19 prevention; PY, Paraguay; SD, social distancing, number of social distancing practices followed from the answers to 4 questions regarding COVID-19 social distancing; SN, Senegal; US, the United States.

*$P < .05$, **$p < .01$, ***$p < .001$.

accuracy of the PHQ scores obtained was similar to that reported previously.[7-10]

We confirmed that SD, PP, education, and sex are major predictors of depressive symptoms due to the COVID-19 pandemic. Compliance with PP was a predictor of depressive symptoms in 6 of the 13 countries surveyed (China, the Philippines, Peru, Paraguay, Ethiopia, and the DRC). People in these countries showing poor compliance with PP had greater depressive symptoms than those showing good compliance. This could be because people who employ prevention behaviors believe that they are responding effectively to the risk of COVID-19; thus, they have relatively fewer concerns and less stress about potential infection.

The most effective PP against COVID-19 is face mask usage.[11] In our study, face mask usage was the highest in Korea (94.9%), followed by China (94.4%), Cuba (90.5%), and Japan (84.7%). The use of face masks was lowest in Senegal (32.7%), followed by Ethiopia (41.1%), the United States (43.6%), and Paraguay (43.6%).

Conclusion

In this study, SD compliance was a major predictor of COVID-19-related depression. People with poor SD compliance had more depressive symptoms than those with good SD compliance, which corresponds with recent findings that indicate outdoor activities are strongly correlated with concerns and stress about COVID-19 infection.[12] Directly or indirectly meeting people while commuting to work or engaging in social activities is also a major COVID-19-related stressor.[13] Thus, practicing SD appears to reduce depressive symptoms by promoting psychological stability. However, as SD practices are becoming more prevalent, a growing number of people feel isolated and lonely.[14] Further studies should be performed to analyze depressive symptoms during the COVID-19 pandemic to distinguish between social isolation–related depression and that caused by concerns about infection because of SD noncompliance.

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