

Anxiety, Depression, Knowledge, and Adherence to COVID-19 Infection Prevention Behavior in International Students

Young Ju Lee

Department of Nursing Science, Gimcheon University, Co-Professor

ABSTRACT : This study aimed to determine the levels and relationships of anxiety, depression, knowledge, and adherence to COVID-19 infection prevention behavior in international students. The sample consisted of 236 international students from universities in G region, South Korea. The results found that Coronavirus Anxiety Scale (CAS) ($p = .018$) and knowledge ($p < .000$) scores were significant factors affecting adherence to infection prevention behavior in international students. In addition, there were positive correlations between anxiety and depression ($r = .644$, $p = .000$), anxiety and CAS score ($r = .663$, $p = .001$), depression and CAS score ($r = .417$, $p < .001$), and knowledge and adherence to personal precautions for infection prevention ($r = .517$, $p < .001$), whereas there was a negative correlation between depression and knowledge ($r = -.182$, $p = .005$). The findings suggest that it is necessary to develop a variety of programs for international students that can reduce their health concerns about COVID-19 during the global pandemic, provide them with correct knowledge about infection prevention, and improve their adherence to infection prevention behavior.

KEYWORDS: COVID 19(Coronavirus Disease), International Students, Anxiety, Depression, Knowledge, Preventive behavior

I. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is caused by coronavirus (CoV), which can infect humans and various animals, and is transmitted through respiratory droplets from an infected person. COVID-19 infection typically occurs when an infected person coughs, sneezes, or speaks[1]. The total cumulative number of COVID-19 confirmed cases is 122,007 as of April 30, 2021, and the number of confirmed imported cases is 8,322[2]. COVID-19 is a life-threatening disease, and there are high uncertainties regarding the source of COVID-19 infection, infection route, symptoms, and fatality rate, thus becoming a social risk that causes anxiety and fear to the public around the world[3]. Therefore, experts recommend that social distancing, which restricts face-to-face contacts with other persons, is the best way to reduce the spread of COVID-19 infection, and that individuals maintain a distance from others outside[4]. As of September 2021, there are about 152,281 international students staying in South Korea. They have diverse background with Chinese students accounting for the largest proportion ($n=67,030$, 44.2%) of all international students in South Korea, followed by Vietnamese students ($n=35,843$, 23.5%), Mongolian students ($n=6,028$, 4.0%), Japanese students ($n=3,818$, 2.5%), and American students ($n=2,218$, 1.5%)[5]. Accordingly, the number of new confirmed COVID-19 cases among overseas entrants in South Korea is steadily increasing, the Ministry of Education is controlling international students' entry into this country, encouraging them to participate in remote learning in their home countries, and continuously implementing measures to protect and manage international students for the protection of COVID-19 infection due to foreign inflow[6]. With focus on the prevention of COVID-19, domestic universities switched to remote learning, and conducted non-face-to-face online classes, concerned departments of all universities canceled clinical practicums, and the government authorities are implementing social distancing for all citizens, such as using hand sanitizers and wearing a mask[7].

In particular, it is sufficiently predictable that international students have a different language and culture from domestic students, and may thus be in a vulnerable situation. Therefore, interest and support for international students' health is essential, and they should also be considered in national policy-making or supporting processes[8]. A study analyzing COVID-19-related stigma experience, and physical and psychological health in international students reported that those from China, known as the origin country of COVID-19 were making efforts such as stricter compliance with the quarantine guidelines to avoid social stigma against them such as indiscriminate accusations and discrimination that they were treated as potential coronavirus carriers [9]. Depression is one of the most common psychiatric disorders[10], and many studies regarding depression in the general population after COVID-19 outbreak have reported an increase in the prevalence of depression and anxiety. In fact, the prevalence rates of overall anxiety, COVID-19-related phobia and anxiety after COVID-19 outbreak have been reported to markedly increase[11-17]. Since it is difficult for foreigners in a foreign country to obtain important health information on COVID-19 prevention and response in their own language, it was

reported that they rely on online communities of their natives to obtain information[18]. Recent studies involving university students in the COVID-19 situation have been mostly related to evaluation, perception, and experience of offered educational programs, such as development and application of educational content, educational performance, class satisfaction, learning experience, and development of new teaching methods in the COVID-19 situation[19-23]. Although international students residing in South Korea are experiencing fear, anxiety, and depression over concerns about contracting COVID-19, studies regarding psychological analysis of anxiety and depression in international students, infection-related knowledge, and the level of adherence to personal precautions for infection prevention are scarce. Therefore, it is necessary to investigate the levels of anxiety, depression, and knowledge related to COVID-19, and the degree of compliance with personal precautions for infection prevention in international students. In this regard, this study attempted to investigate international students' levels of anxiety, depression, knowledge, and adherence to personal precautions for infection prevention due to the prolonged COVID-19 situation and the spread of COVID-19 variants, and to provide basic data for the development of COVID-19-related psychological prevention programs and personal precaution programs for international students residing in South Korea.

II. METHOD

Study design : This descriptive research study aimed to investigate the levels of anxiety, depression, knowledge about COVID-19, and adherence to personal precautions for infection prevention in 236 international students from universities located in G region, South Korea.

Participants and data collection : Participants in this study were 236 international students from G University located in G region who agreed to sign the consent form to participate in this study after reading the study description. The participants were explained about the purpose of this study, and the autonomy of participation in this study, and confidentiality, and were asked to anonymously participate and complete the survey questionnaire. They were informed that the data collected from the survey would be used only for the purpose of this study, and all personal information will be processed anonymously to ensure anonymity. In addition, they were explained that they could refuse to participate in this study at any time, or withdraw participation at any time during participation if they do not want to participate in this study. A questionnaire (in Korean, Chinese, Mongolian, Vietnamese) was developed to investigate the levels of anxiety, depression, knowledge, and adherence to personal precautions that international students felt due to COVID-19 in a foreign country, and was reviewed by one professional translator, and one nursing professor, and one manager from the infectious disease emergency response headquarters for the prevention of infectious diseases at the university. Using the questionnaire, a preliminary survey was conducted with three staff in charge of interpreting Chinese, Mongolian, and Vietnamese languages at the University International Interchange Center. Then, terms were revised and the difficulty level was adjusted to finalize the questionnaire. An online survey was conducted using KSDC DB (Korean Social Science Data Center), a program linked to the university library.

Tools

COVID-19-related anxiety scale : Anxiety was measured using the Beck Anxiety Inventory (BAI) originally developed by Beck et al., and translated into Korean and tested for validity by Yook & Kim[24, 25]. The BAI consists of a total of 21 items, and each item is rated on a 4-point Likert scale ranging from 0 (not at all) to 3 (severely – it bothered me a lot). The total score ranges from 0 to 63, and a higher score indicates higher anxiety. a total score of 8 or higher was considered significant anxiety. Its reliability was Cronbach $\alpha = .92$ in a study by Beck et al., and was Cronbach $\alpha = .90$ in this study.

COVID-19-related depression scale : The Patient Health Questionnaire-9 (PHQ-9), a depression screening scale, is a self-report test designed to simply screen for depression and evaluate the severity of depression[26]. It consists of 9 items that correspond to the DSM-IV diagnostic criteria for major depressive disorder, and is to see how often you have had those problems over the last two weeks. Each item is rated on a 4-point scale: 'not at all', 'several days', 'more than a week', and 'nearly every day'. The total score ranges from 0 to 27, with a score of 5 to 9 as minimal depression, a score of 10 to 14 as mild depression, a score of 15 to 19 as moderate depression, and a score of 20 or higher as severe depression[27]. The reliability of the PHQ-9 was Cronbach $\alpha = .92$ in a study by Park analyzing its reliability and validity[28], and its reliability was Cronbach $\alpha = .92$ in this study.

CAS (Coronavirus Anxiety Scale) : The COVID-19-related anxiety and concern in this study was measured using the Coronavirus Anxiety Scale (CAS) developed by Lee[29]. The score ranges from 0 for 'not at all' to 4 points for 'nearly every day', and a higher score indicates higher COVID-19-related anxiety. The reliability of the CAS was Cronbach $\alpha = .93$ in a study by Lee[29], and was Cronbach $\alpha = .72$ in this study.

Knowledge about COVID-19 : Knowledge about COVID-19 in this study was measured using a 10-item questionnaire developed by the researcher of this study based on the COVID-19 guidelines provided by the Korea Disease Control and Prevention Agency (KCDA)^[1]. The total score ranges from 0 to 10, with 0 points for ‘wrong answer’ and ‘I do not know’, and 1 point for ‘correct answer’. A higher score indicates more knowledge.

Adherence to personal precautions related to COVID-19 : The level of adherence to personal precautions for COVID-19 was measured using a 10-item questionnaire, which was produced based on the COVID-19 Prevention Guidelines 10 (9th edition, Appendix #5) provided by the KDCA[1]. Each item is scored 1 point for ‘not at all’, 2 points for ‘practice it occasionally’, and 3 points for ‘practice it always’. A higher score indicates higher adherence to personal precautions.

Data analysis : The collected data were analyzed with frequency analysis, percentage, mean and standard deviation, t-test, ANOVA, Pearson’s correlation coefficients, and multiple linear regression analysis using SPSS 25.0 program.

III. RESULTS

General Characteristics of Subjects : Regarding the general characteristics of the participants, the participants consisted of 102 female students (43.2%), and 134 male students (56.8%). In terms of academic year, there were 9 first-year students (3.8%), 19 second-year students (8.1%), 46 third-year students (19.5%), 128 fourth-year students (54.2%), 19 graduate school students (8.1%), and 15 language institute students (6.4%). In terms of nationality, 84 (35.6%) were from China, 124 (52.5%) from Mongolia, and 28 (11.9%) from Vietnam. In terms of satisfaction with studying in South Korea, 2 (0.8%) were dissatisfied at all, 65 (27.5%) were not satisfied, 141 (59.7%) were satisfied, and 28 (11.9%) were very satisfied [Table 1].

Table 1: General characteristics of subjects

(N=236)

Characteristics	Categories	n(%)
Gender	Male	134(56.8)
	Female	102(43.2)
School grade	First	9(3.8)
	Second	19(8.1)
	Third	46(19.5)
	Fourth	128(54.2)
	Master's degree	19(8.1)
	Korean Language Institute	15(6.4)
Nationality	China	84(35.6)
	Mongolia	124(52.5)
	Vietnam	28(11.9)
Satisfaction of studying abroad	Not satisfied at all	2(0.8)
	Not satisfied	65(27.5)
	Satisfies	141(59.7)
	Very satisfied	28(11.9)

Difference according to the general characteristics of the participants : The level of COVID-19-related anxiety was higher in females than in males ($p=.031$), was higher in fourth-year students ($p=.001$), and was higher in those who were very dissatisfied with their studying abroad ($p=.011$). The level of COVID-19-related depression was higher in second-year and fourth-year students, and was higher in those who were dissatisfied with their studying abroad ($p=.000$). The COVID-19 CAS score was higher in females than in males ($p=.008$), and as for satisfaction with studying abroad, those who responded as dissatisfied had the highest depression ($p=.001$). The level of knowledge about COVID-19 was higher in Chinese students ($p=.002$). The level of adherence to personal cautions for infection prevention related to COVID-19 was higher in females than in males ($p=.034$), higher in Chinese students than in Mongolian students and Vietnamese students ($p=.000$), and was higher in those who were very satisfied with their studying abroad ($p=.032$) [Table 2].

Table 2: Anxiety, depression, COVID-19 CAS score, knowledge, and adherence to preventive behavior according to general characteristics

(N=236)

Variables	Category	Anxiety (BAI score)		Depression (PHQ-9 score)		COVID-19 CAS score		Knowledge		Adherence to preventive behavior	
		M±SD	F or t(p)	M±SD	F or t(p)	M±SD	F or t(p)	M±SD	F or t(p)	M±SD	F or t(p)
Gender	Female	10.16±9.69	2.17 (.031)	14.75±6.15	1.62 (.106)	6.09±1.52	2.69 (.008)	8.41±1.56	1.20 (.232)	27.59±1.97	2.13 (.034)
	Male	7.68±7.87		13.49±5.73		5.63±1.07		8.16±1.58		26.93±2.64	
Grade	1	3.67±6.48	3.23 (.001)	11.67±6.95	2.52 (.000)	5.11±0.33	5.19 (.000)	8.22±1.20	1.16 (.059)	27.00±2.40	2.34 (.192)
	2	9.53±10.90		15.32±6.39		5.68±1.25		8.21±1.72		26.16±2.52	
	3	7.17±7.93		13.07±3.82		6.59±1.94		8.46±1.79		26.54±2.94	
	4	10.32±9.24		14.91±6.62		5.76±1.07		8.09±1.57		27.45±2.10	
	Master's degree	8.21±4.02		13.16±4.89		5.47±0.51		8.79±1.03		28.00±1.63	
	Korean Language Institute	2.93±5.62		10.47±2.48		5.20±0.86		8.73±1.39		27.73±2.94	
Nationality	China	8.25±8.75	.21 (.543)	13.37±5.65	1.18 (.519)	5.87±1.43	.15 (.749)	8.98±1.26	17.37 (.002)	28.30±1.75	18.22 (.000)
	Mongolia	9.01±8.99		14.22±6.17		5.83±1.22		8.01±1.49		26.81±2.31	
	Vietnam	9.11±8.07		15.25±5.69		5.71±1.30		7.32±1.95		25.71±3.04	
Satisfaction of studying abroad	Not satisfied at all	17.50±21.92	2.68 (.011)	13.50±6.36	9.02 (.000)	6.50±2.12	3.13 (.001)	9.50±0.71	1.34 (.204)	27.50±2.12	2.16 (.032)
	Not satisfied	9.41±7.03		16.92±7.61		5.70±0.93		8.00±1.67		26.76±2.29	
	Satisfied	9.08±9.34		13.26±4.63		6.00±1.48		8.34±1.55		27.24±2.55	
	Very satisfied	4.93±7.86		11.18±4.82		5.25±0.84		8.50±1.45		28.11±1.42	
Total	M±SD	8.75±8.77		14.04±5.94		5.83±1.03		8.27±1.56		27.21±2.39	
	Range	20-63		1-36		0-20		0-10		1-30	

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

Correlation between COVID-19-related anxiety, depression, COVID-19 CAS score, knowledge, and adherence to personal precautions

There were positive correlations between COVID-19-related anxiety and depression ($r=.644$, $p=.000$), between anxiety and COVID-19 CAS score ($r=.663$, $p=.000$), between depression and COVID-19 CAS score ($r=.417$,

$p=.000$), and between knowledge and adherence to personal precautions for infection prevention ($r=.517$, $p=.000$), whereas there was a negative correlation between depression and knowledge ($r=-.182$, $p=.005$) [Table 3].

Table 3. Correlation between anxiety, depression, COVID-19 CAS score, knowledge and adherence to preventive behavior

(N=236)

Variables	Anxiety (BAI score)	Depression (PHQ-9 score)	COVID-19 CAS score	Knowledge	Preventive behavior performance
	r(p)	r(p)	r(p)	r(p)	r(p)
Anxiety (BAI score)	1				
Depression (PHQ-9 score)	.644(.000)**	1			
COVID-19 CAS score	.663(.000)**	.417(.000)**	1		
Knowledge	-.047(.954)	-.182(.005)	-.060(.360)	1	
Preventive behavior performance	-.039(.549)	-.099(.128)	-.077(.237)	.517(.000)**	1

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

Factors affecting adherence to personal precautions related to COVID-19

The factors significantly affecting adherence to personal precautions related to COVID-19 included COVID-19-related depression ($p=.018$), and knowledge ($p=.000$), and the explanatory power was 29% [Table 4].

Table 4. Factors affecting adherence to infection preventive behavior related to COVID-19

(N=236)

Variables	Adherence to preventive behavior			
	B	β	t	P
Anxiety (BAI score)	0.03	0.10	1.11	.270
Depression (PHQ-9 score)	0.00	0.01	0.13	.894
COVID-19 CAS score	-0.33	-0.18	-2.38	.018
Knowledge	0.81	0.53	9.34	.000

$R^2=.29$, $F=23.08$, $p=.000$

IV. DISCUSSION

This study attempted to investigate the levels of COVID-19 related anxiety, depression, knowledge, and adherence to personal precautions for infection prevention that international students felt due to the recent re-spread of COVID-19, and the results are as follows. This study showed that the COVID-19-related anxiety (BAI) score in Chinese, Mongolian, and Vietnamese students was 8 points or higher, indicating anxiety, and the BAI score was higher in Vietnamese students than Chinese and Mongolian students, but it was not significantly different. The COVID-19-related depression score (PHQ-9 score) was 13.37 ($SD\pm 5.65$) in Chinese students, 14.22 ($SD\pm 6.17$) in Mongolian students, indicating mild depression, while it was 15.25 ($SD\pm 5.69$) in Vietnamese students, indicating moderate depression. However, there was no significant difference between countries. Song et al.[30] reported that after the global spread of COVID-19, Chinese students experienced indiscreet criticism due to social stigma against China, known as the origin country of COVID-19, and Chinese people, and experienced discrimination and alienation because of being a Chinese. In addition, the results of this study were consistent with the results of a study by Ma et al.[31], reporting on mental health problems such as acute stress, anxiety and depressive symptoms in Chinese college students during the COVID-19. In particular, that study reported that infected family members, large-scale media exposure, low social support, previous mental health

problems, and psychosocial factors were associated with an increased risk of mental health problems in college students. Misirlis et al.[32] reported that due to COVID-19, international students easily experience anxiety and depression in a closed and unfamiliar foreign environment far from their home country. The results of this study found that there was no significant difference in anxiety and depression scores in international students between countries. This result is thought to be because this study period was during the COVID-19 pandemic, and at the time when COVID-19 was re-spread worldwide, and the anxiety and depression scores in Vietnamese students were thus somewhat higher compared to Chinese students, but it was not significantly different.

This study found that the level of adherence to COVID-19-related personal precautions was higher in females compared to males ($p=.034$), was higher in Chinese students compared to Mongolian and Vietnamese students ($p=.000$), and was higher in those who were very satisfied with studying abroad ($p=.032$). This result is consistent with the results of a study by Kim et al.[33], regarding factors affecting the compliance of COVID-19 precautions in international students residing in Busan, South Korea that reported that compliance with COVID-19 precautions was higher in women compared to men, and was higher in Chinese students. In preparation for the prolonged COVID-19, it is necessary to keep monitoring anxiety, depression, and personal hygiene in international students, and various efforts from the government authorities and the Ministry of Education are also required to strengthen psychological preparedness and mental health management in international students.

V. CONCLUSION

This study is significant in that it investigated the levels of COVID-19 related anxiety, depression, COVID-19 CAS, knowledge, and adherence to personal precautions for infection prevention among international students during the ongoing global COVID-19 pandemic, and provided basic data for the development of programs for international students to acquire accurate knowledge about COVID-19 and practice personal precautions for infection prevention. It is necessary to periodically analyze depression and anxiety in international students in the COVID-19 pandemic situation, and to provide psychological preparedness, and emotional and psychological counseling services to international students at a high risk of anxiety and depression. In addition, it is necessary to develop and distribute various cultural content and personal hygiene programs that can alleviate language barrier, isolation, and discrimination felt by international students in the COVID-19 situation, and expand opportunities for international students to communicate and interact with each other online. In addition, to prevent the spread of the COVID-19, the development of programs for adherence to personal precautions for international students and repetitive studies are needed for validation in the future.

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