

Association between Changes in Daily Life during the COVID-19 Pandemic and Depressive Symptoms in Korean University Students

Young-Mee Kim¹ · Sung-il Cho²

¹Researcher, Institute of Health and Environment, Seoul National University

²Professor, Department of Public Health Science, Graduate School of Public Health and Institute of Health and Environment, Seoul National University

ABSTRACT

Purpose: The COVID-19 pandemic, which emerged in late 2019, had a profound impact on global public health and disrupted the daily lives of people worldwide. Particularly, university students faced a challenging situation as their university life underwent a drastic transformation due to long-term remote learning and isolation measures. This study aimed to investigate the relationship between changes in daily life during the 2020 COVID-19 pandemic and depressive symptoms among university students aged between 19 and 29 in Korea. **Methods:** We analyzed data from the nationally representative 2020 Community Health Survey (CHS). Among the 229,269 participants, 9,279 university students aged 19-29, either enrolled or on leave, were selected. After excluding 401 cases with missing values, the final sample comprised 8,878 individuals. Using multivariate logistic regression with a complex sample design, we explored the association between daily life changes during the COVID-19 pandemic and depressive symptoms. **Results:** Changes in daily life during the COVID-19 pandemic was associated with depressive symptoms in Korean university students aged 19 to 29, even after adjusting for sociodemographic characteristics, health-related factors, and COVID-19-related aspects (OR=1.28, 95% CI=1.09~1.50). **Conclusion:** Our study suggests that when examining the impact of COVID-19 on health issues, it is crucial to consider the changes in daily life caused by the pandemic. These findings can provide insights into the psychological well-being of university students during times of crisis.

Key Words: COVID-19; Pandemics; Depression; Mental health; Public health

INTRODUCTION

The COVID-19 pandemic, which emerged in late 2019, had a profound impact on global public health and altered the daily lives of people worldwide. To counter the rapid and unpredictable spread of the virus, countries like the United States, Australia, and those in Europe, took measures including border closures and social distancing [1]. In Korea, the infectious disease alert level was escalated to 'serious' in February 2020, leading to stringent social distancing and other preventive measures. These

restrictions included limits on the size of group gatherings, business hours, and prohibitions on eating in indoor public spaces. As part of implementing these measures, businesses adopted remote working and flexible work schedules, while educational institutions in Korea, ranging from elementary schools to universities, postponed in-person classes from the first semester of 2020. They shifted to online learning or modified their academic calendars in response [2].

Social distancing strategies, which have been effective in curbing COVID-19 spread, have continuously limited

Corresponding author: Sung-il Cho

Department of Public Health Science, Graduate School of Public Health, and Institute of Health and Environment, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea.

Tel: +82-2-880-2717, Fax: +82-2-762-9104, E-mail: persontime@hotmail.com

- This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No.2022R1C1C2006424)

Received: Dec 5, 2023 / Revised: Dec 21, 2023 / Accepted: Dec 22, 2023

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

people's everyday lives, leading to widespread anxiety, stress, and psychological trauma [3]. Prior research has identified a link between COVID-19 and various mental health issues, encompassing conditions like depressive symptoms, anxiety disorders, and insomnia [4,5]. Certainly, in the United States, the occurrence of depressive symptoms was over three times greater during the COVID-19 pandemic compared to the period before it [3]. Numerous studies indicate that social distancing during the COVID era, which has resulted in reduced social interactions, dietary imbalances, and a lack of physical activity, has both directly and indirectly impacted the physical, psychological, and social dimensions of individuals' lives [6,7].

In Korea, as the 2020 COVID-19 pandemic continued, there was a noticeable rise in the levels of depression observed among individuals of all age groups [8]. Particularly by the end of December, the survey showed that individuals aged 19~29 exhibited the highest levels of depression. According to the survey, the average depression score for people in their 20s was 6.36, for those in their 30s, it was 6.03, while individuals in their 40s and 50s maintained an average depression level around 5 points. The lowest level was observed in people in their 60s, with an average of 4.48[8]. These statistical results indicate that as the COVID-19 crisis prolongs, adults continue to experience a rise in anxiety and depression levels, with the 20s age group facing relatively greater mental health challenges.

During the COVID-19 period, university students were placed in a stressful situation, having to adapt to a drastically different university life than before. Schools were halted, and students found themselves in isolation, attending classes and preparing for the future, including job readiness, in a solitary environment. Research from the SARS era indicates that restrictions in daily life significantly impacted younger individuals with a broad range of daily activities, more so than other age groups [9]. The university period represents a peak time of health, activity, and curiosity, where students have ample free time to engage in various activities, participate in groups, and explore diverse social relationships [10]. However, the disruption of daily life due to COVID-19, forcing individuals to restructure their lifestyles and activity plans, can be a major event with the potential to transform one's entire life.

Despite the heightened levels of depression among university students compared to other age groups during the COVID-19 period, and their increased emotional challenges due to the restrictions on activities intersecting

with this critical time in their lives, research on depression in this demographic is markedly limited. While research has been conducted on the effects of changes in daily life as a risk factor for depression during the COVID-19 pandemic among the general population or older individuals in Korea [11,12], there is a gap in studies specifically focusing on university students. Furthermore, existing studies on university students' depression during the COVID-19 period or changes in their daily lives have been limited to specific regions, schools, or departments, which raises questions about their representativeness [10,13].

1. Study Objectives

The primary objective of this research was to examine the relationship between changes in daily life during the 2020 COVID-19 pandemic and depressive symptoms in university students in Korea. To provide a thorough and insightful analysis, we utilize a unique dataset from a comprehensive, nationally representative survey conducted in 2020. This rich dataset provides a broad spectrum of variables specifically related to the COVID-19 pandemic. It includes demographic details, lifestyle changes, health-related behaviors, and psychological impacts experienced by the respondents. This dataset encompasses a wide array of factors related to COVID-19, allowing for a detailed examination of various pandemic-related risk factors and their correlation with depressive symptoms.

METHODS

1. Study Subject

This study employed data from the 2020 Community Health Survey (CHS), administered by the Korea Centers for Disease Control and Prevention. The CHS is an annual nationwide survey initiated in 2008, designed to collect and assess regional health statistics for the purposes of health planning and evaluation [14]. The survey includes questions on health behavior, diseases, unmet medical needs, socio-physical environment, as well as individual and regional health-related factors. The CHS utilizes a multistage sampling approach to select a representative sample of adults aged 19 and older. In each of the 253 communities, 90 Primary Sampling Units (PSUs) are randomly selected, representing smaller geographical divisions. Within each PSU, a random selection of 5 to 8 households is made for participation in the survey. These households are identified from the local resident registration database. The survey is conducted annually between

August 16th and October 31st. During this period, surveyors visit the chosen households to carry out interviews. These interviews are facilitated by a computer-assisted personal interviewing (CAPI) system, which is operated on portable laptops.

For the 2020 CHS, which included 229,269 participants, the initial consideration set comprised 26,197 individuals aged 19 to 29 years. Within this group, 9,279 individuals were identified as either currently enrolled in or on a break from colleges or universities (spanning 2, 3, and 4-year programs). After removing 401 individuals due to incomplete data on various parameters like depressive symptoms ($n=12$), changes in life during COVID-19 ($n=45$), marital status ($n=2$), house income ($n=305$), and drinking ($n=1$), the final sample for the study was narrowed down to 8,878 individuals (Figure 1). Despite a significant proportion of university students being over the age of 30, our study specifically limited its focus to the age group of 19~29 years. This decision was made to minimize the possibility of confounding variables related to

age. In fact, university students over the age of 30 often have different characteristics compared to their younger counterparts, such as a higher likelihood of having a job while attending university. These distinct factors among older students can significantly influence study outcomes. This study was approved by the Institutional Review Board of Seoul National University (E2311/001-008).

2. Measures

1) Sociodemographic characteristics and health-related factors

The study included a variety of sociodemographic variables. Age was grouped into three categories: 19~20 years, 21~23 years, and 24~29 years. The categorization of age groups was based on the assumption that the risk factors associated with COVID-19 varied between different sets of university students. Freshmen, aged 19~20, faced challenges in adapting to a new university environment, while older students, aged 24~29, who were taking a break from

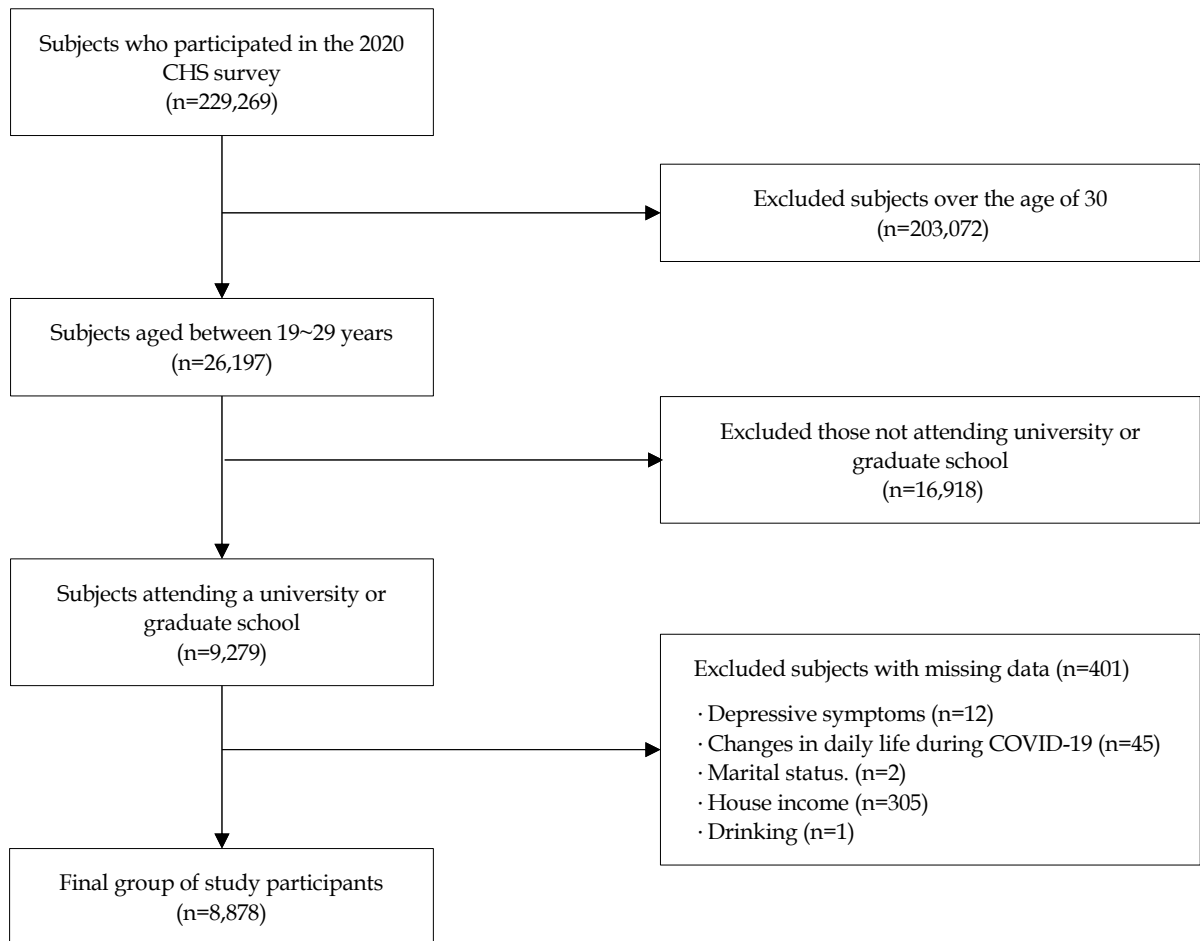


Figure 1. Flow chart of study population and sample size.

studies to prepare for employment, had different experiences and challenges [15]. This distinction in experiences led to the decision to divide the age groups as such for analysis. Marital status was divided into married/separated and unmarried. Education level was categorized into two segments: 2-year/3-year degrees and 4-year/graduate school degrees. Household income was segmented into tertiles, with the first tertile representing the poorest group. Lastly, the area of residence was classified as either metropolitan or small to medium-sized cities. Additionally, we selected health-related variables that have been reported to be associated with mental health, such as self-rated health (SRH), body mass index (BMI), physical activity, smoking, and drinking. To assess participants' SRH, we utilized the question, "How would you rate your health, in general?" with five response options. These responses were collapsed into two categories: 'poor or average SRH (very poor, poor, or average)', and 'good SRH (good or very good)'. BMI was computed by dividing body weight by the square of height (kg/m^2), and obesity status was determined using BMI. More precisely, individuals with a $\text{BMI} \geq 25 \text{ kg}/\text{m}^2$ were categorized as obese, while those with a $\text{BMI} < 25 \text{ kg}/\text{m}^2$ were categorized as normal. Regarding health behaviors, physical activity was defined as walking for at least 30 minutes a day for five or more days in the previous week. Smoking categorized individuals into non-smokers/former smokers and current smokers. Finally, drinking was classified as either non-drinkers or drinkers.

2) Change in daily life during the COVID-19 pandemic.

The assessment of changes in daily life during the COVID-19 pandemic was conducted with a following question: "If you consider your daily life before COVID-19 as being at 100 points, representing no change, and the complete cessation of daily activities as 0 points, how would you rate your current situation?" Responses were quantified on a scale ranging from 0 points, indicating a complete cessation of daily activities, to 100 points, signifying no change from pre-pandemic life. The scale featured ten intervals, each representing a 10-point increment. Participants were categorized based on the median score for changes in daily life during the COVID-19 pandemic. Those scoring below the median were classified as experiencing high changes in their daily lives, while those scoring at or above the median were considered to have experienced low changes.

3) Depressive symptoms

Depressive symptoms were evaluated using the Pati-

ent Health Questionnaire-9 (PHQ-9), a recognized tool for measuring nine depressive symptoms experienced over the past two weeks [16]. This tool uses a 4-point scale for each symptom, with scores from 'Not at all (0 point)' to 'Several days (1 point)', 'More than half the days (2 points)', and 'Nearly every day (3 points)'. The sum of these individual scores yields a total between 0 and 27. In this study, the PHQ-9 showed a Cronbach's α of .801. Participants with a total score from 0 to 4 were identified as not having depressive symptoms, while those scoring from 5 to 27 were classified as having depressive symptoms [17].

4) Variables related to COVID-19

To evaluate the experience of COVID-19 isolation and hospitalization, participants were divided into two categories based on their answers to the question, "Have you ever been isolated or hospitalized due to COVID-19?" Those who replied 'Yes' formed the directly affected group, and those who answered 'No' comprised the comparison group. The experience of COVID-19 symptoms was determined by the question, "Have you experienced respiratory symptoms like fever or cough in the past three months?" Respondents were classified into groups based on whether they had symptoms or not. Concerns about the economic effects of COVID-19 were measured with the question, "How concerned are you about the economic damage of the COVID-19 pandemic, such as job loss or financial difficulties, for yourself and your family?" Answers were scored on a 1 (strongly disagree) to 5 (strongly agree) scale, with participants indicating agreement (either strongly agree or agree) categorized as highly concerned about economic impacts.

Non-face-to-face social interactions during the pandemic was assessed by asking participants, "Do you maintain frequent communication with your family and close contacts without physical meetings?" Responses to this question were assessed using a scale ranging from 1 (completely disagree) to 5 (completely agree). Participants who selected 'agree' or 'strongly agree' were categorized as having high levels of social interactions. Conversely, those who selected 'disagree' were classified as having low levels of social interactions. Finally, the availability of COVID-19 support was examined with the question, "If you needed isolation treatment or had to self-isolate due to exposure to a confirmed case, how many people, excluding cohabiting family members, could you urgently contact for help or support?" Participants were divided into two groups based on their responses: individuals with 0~2 available helpers were categorized as the low availability

group, while those with 3 or more available helpers were categorized as the high availability group.

3. Statistical Methods

The study performed a complex sampling analysis based on the multistage sampling design from the 2020 CHS raw data. For this analysis, strata, cluster, and weight were utilized to incorporate elements of the complex sample design. A complex sample frequency analysis was used to calculate the frequency and percentage, revealing the characteristics of the study participations. Furthermore, the Rao-Scott χ^2 test was employed to compare depressive symptoms across different categories, specifically socioeconomic, health-related, and COVID-19-related factors. Finally, to determine the relationship between changes in daily life during the COVID-19 period and depressive symptoms, multivariate logistic regression with complex sample design was conducted after adjusting for socioeconomic variables, health-related variables, and COVID-19-related variables. All statistical analyses were performed using R software version 4.2 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

1. Characteristics of the Study Participations

Table 1 displays the attributes of the study participants. Out of the 8,878 participants in the study, 56.6% were male and 43.4% were female. The age group of 19~23 years constituted 80.2% of the sample. Married individuals accounted for 1.1%. Furthermore, 46.7% of the respondents lived in major metropolitan cities, while 53.3% resided in small to medium-sized cities. Regarding health-related variables, 24.3% rated their health as average or poor, and 22.2% had a BMI of 25 or above. Additionally, 13.1% were smokers, and 58.6% reported consuming alcohol. It was found that 36.9% of the respondents walked for more than 30 minutes at least 5 days in the past week. Regarding COVID-19 related indicators, 1.4% had been infected with or hospitalized due to COVID-19, and 2.5% experienced symptoms such as fever or cough. Additionally, 67.4% were categorized as having a high level of concerns about economic effects of COVID-19. Furthermore, 50.1% were found to have a low level of non-face-to-face social interaction during the social distancing period, and 47.7% were in a group that received limited support during COVID-19 quarantine.

2. Depressive Symptoms according to the Characteristics of the Study Participants

Table 1 additionally shows the prevalence of differences in depressive symptoms among participants by socioeconomic, health-related, and COVID-19 factors. Among the participants, 11.4% experienced depressive symptoms, while 88.6% did not exhibit any depressive symptoms. The prevalence of depressive symptoms was higher among females in comparison to males ($p < .001$). Individuals enrolled in 2/3-year colleges reported more depressive symptoms than those in 4-year universities or graduate schools ($p = .008$). Additionally, individuals with lower household income showed a higher prevalence of depressive symptoms ($p = .004$). Regarding health-related factors, those who assessed their SRH as average or poor displayed a higher prevalence of depressive symptoms than those who assessed it as good ($p < .001$). Additionally, smokers also exhibited a greater prevalence of depressive symptoms ($p = .002$).

Finally, in the context of COVID-19, individuals who experienced COVID-19 symptoms had a greater prevalence of depressive symptoms in comparison to those who did not ($p < .001$). Individuals who experienced significant changes in their daily lives during the COVID-19 period had a higher prevalence of depressive symptoms compared to those who experienced low changes ($p < .001$). Individuals concerned about the economic impact of COVID-19 showed a higher prevalence of depressive symptoms ($p = .002$). Furthermore, individuals actively engaging in non-face-to-face communication, such as making phone calls to acquaintances, during periods of social distancing, exhibited a lower prevalence of depressive symptoms than those who did not engage in such activities ($p < .001$). Nevertheless, individuals who had undergone quarantine or hospitalization due to COVID-19 did not show a greater incidence of depressive symptoms in contrast to those who had not ($p = .373$).

3. Associations between Changes in Daily Life during the COVID-19 Pandemic and Depressive Symptoms

The study, as detailed in Table 2, found that changes in daily life during the COVID-19 pandemic were significantly related to depressive symptoms, with an odds ratio (OR) of 1.28 (95% CI=1.09~1.50). This association persisted even after controlling for sociodemographic, health-related factors, and COVID-19-related aspects. In terms of sociodemographic characteristics, compared to males, fe-

Table 1. Prevalence of Depressive Symptoms by Sociodemographic Characteristics, Health, and COVID-19 related Factors in University Students: Unweighted Count and Weighted Percentage

Variables	Categories	Total	Depressive symptoms		<i>p</i> [§]
			No	Yes	
			n=7,866 (88.6)*	n=1,012 (n=11.4)†	
		n (%)	n (%)	n (%)	
Age (year)	19~20	3,437 (36.8)	3,063 (40.0)	374 (35.6)	.754
	21~23	3,834 (43.4)	3,387 (43.3)	447 (43.9)	
	24~29	1,607 (19.8)	1,416 (19.7)	191 (20.5)	
Gender	Male	4,641 (56.6)	4,207 (57.9)	434 (47.2)	< .001
	Female	4,237 (43.4)	3,659 (42.1)	578 (52.8)	
Marital status	Married	119 (1.1)	103 (1.1)	16 (1.7)	.129
	Not married	8,759 (98.9)	7,763 (98.9)	996 (98.3)	
Education	2-year or 3-year	1,598 (17.6)	1,369 (17.2)	229 (21.0)	.008
	4-year or graduate school	7,280 (82.4)	6,497 (82.8)	783 (79.0)	
Household income (year)	First tertile	2,921 (30.9)	2,531 (30.3)	390 (35.8)	.004
	Second tertile	3,096 (34.1)	1,454 (17.3)	170 (16.7)	
	Third tertile	2,861 (35.0)	3,881 (52.4)	320 (47.5)	
Area of residence	Metropolitan	3,400 (46.7)	2,982 (46.7)	418 (47.2)	.778
	Small to medium-sized	5,478 (53.3)	4,884 (53.3)	594 (52.8)	
SRH	Good	6,771 (75.7)	6,223 (78.4)	548 (55.9)	< .001
	Average or bad	2,107 (24.3)	1,643 (21.6)	464 (44.1)	
BMI (kg/m ²)	< 25	6,955 (77.8)	6,189 (78.1)	766 (75.2)	.077
	≥ 25	1,923 (22.2)	1,677 (21.9)	246 (24.8)	
Smoking	No	7,770 (86.9)	6,918 (87.4)	852 (83.2)	.002
	Yes	1,108 (13.1)	948 (12.6)	160 (16.8)	
Drinking	No	3,757 (41.4)	3,333 (41.5)	424 (40.6)	.647
	Yes	5,121 (58.6)	4,533 (58.1)	588 (59.5)	
Physical activity	No	5,751 (63.1)	5,085 (63.0)	666 (63.6)	.776
	Yes	3,127 (36.9)	2,781 (37.0)	346 (36.4)	
Experience of quarantine or hospitalization due to COVID-19	No	8,776 (98.6)	7,767 (98.6)	999 (98.9)	.373
	Yes	112 (1.4)	99 (1.5)	13 (1.1)	
Experience of COVID-19 symptoms	No	8,686 (97.5)	7,720 (97.9)	966 (94.9)	< .001
	Yes	192 (2.5)	146 (2.1)	2627 (5.1)	
Changes in daily life during the COVID-19 pandemic	Low	6,030 (45.0)	5,429 (45.9)	601 (38.4)	< .001
	High	2,848 (55.0)	2,437 (54.1)	411 (61.6)	
Concerns about the economic effects of COVID-19	Low	2,824 (32.6)	2,536 (33.3)	288 (27.7)	.002
	High	6,054 (67.4)	5,330 (66.7)	724 (72.3)	
Non-face-to-face social interactions	High	4,472 (49.9)	4,023 (50.7)	469 (44.0)	< .001
	Low	4,386 (50.1)	3,843 (49.3)	543 (56.0)	
Availability of COVID-19 support	High	4,581 (52.6)	4,054 (52.5)	527 (53.9)	.487
	Low	4,297 (47.4)	3,812 (47.5)	485 (46.1)	

*Unweighted count and weighted percentage of participants without depressive symptoms among the total participants; †Unweighted count and weighted percentage of participants with depressive symptoms among the total participants; §Rao-Scott χ^2 test; BMI=Body mass index; SRH=Self-rated health.

Table 2. Association of Changes in Daily Life During the COVID-19 Pandemic with Depressive Symptoms among University Students

Variables	Categories	Odds ratio* (95% Confidence intervals)
Gender	Male	1.00
	Female	1.66 (1.39~1.98) [†]
Education level	2-year or 3-year	1.00
	4-year or graduate school	0.81 (0.66~0.99) [†]
Household income (year)	First tertile	1.00
	Second tertile	0.77 (0.66~0.99) [†]
	Third tertile	0.91 (0.75~1.11)
Area of residence	Metropolitan	1.00
	Small to medium-sized	0.98 (0.84~1.15)
SRH	Good	1.00
	Average or bad	2.61 (2.22~3.07) [†]
BMI (kg/m ²)	< 25	1.00
	≥ 25	1.13 (0.93~1.38)
Smoking	No	1.00
	Yes	1.46 (1.15~1.86) [†]
Drinking	No	1.00
	Yes	1.04 (0.88~1.23)
Physical activity	No	1.00
	Yes	1.05 (0.89~1.25)
Experience of quarantine or hospitalization due to COVID-19	No	1.00
	Yes	0.69 (0.35~1.38)
Experience of COVID-19 symptoms	No	1.00
	Yes	1.83 (1.22~2.75) [†]
Changes in daily life during the COVID-19 pandemic	Low	1.00
	High	1.28 (1.09~1.50) [†]
Concern about economic damage due to COVID-19	Low	1.00
	High	1.27 (1.08~1.52) [†]
Non-face-to-face social interactions	High	1.00
	Low	1.35 (1.15~1.58) [†]
Availability of COVID-19 support	High	1.00
	Low	0.88 (0.75~1.04)

*Odds Ratios were adjusted for age and marital status; [†] $p < .05$; [‡] $p < .01$; BMI=Body mass index; SRH=Self-rated health.

males exhibited a 1.66 times higher odds ratio for depressive symptoms (95% CI=1.39~1.98). Individuals with a 4-year college or graduate school education had a 19% lower prevalence of depressive symptoms compared to those with 2-year or 3-year college education (95% CI=0.66~0.99). Additionally, individuals in the second tertile income bracket experienced a 23% decrease in depressive symptoms compared to those in the first tertile (95% CI=0.66~0.99). Regarding health-related factors, individuals with bad or average SRH experienced a 2.61 times increase in the prevalence of depressive symptoms compared to those with good SRH (95% CI=2.22~3.07). Smo-

kers had a 1.46 times higher prevalence of depressive symptoms compared to non-smokers (95% CI=1.15~1.86). Additionally, specific COVID-19-related factors played a role. Individuals who experienced COVID-19 symptoms had a 1.83 times higher prevalence of depressive symptoms compared to those who did not (95% CI=1.22~2.75). Groups with high concerns about economic damage due to the pandemic showed a 1.27 times increase (95% CI=1.08~1.52), and those who did not engage in non-face-to-face social interactions had a 1.35 times higher prevalence (95% CI=1.15~1.59), all of which were related to an increased prevalence of depressive symptoms.

DISCUSSION

This study investigated whether changes in daily life during the COVID-19 pandemic was associated with increased depressive symptoms, utilizing survey data from a nationally representative group of university students in Korea aged 19 to 29 years. Our results indicated a significant connection between changes in daily life during the COVID-19 pandemic and depressive symptoms, even when accounting for various sociodemographic and health-related factors that influence depressive symptoms.

In this study, we identified distinctions in sociodemographic and health-related factors between the group without depressive symptoms and the group with depressive symptoms during the COVID-19 pandemic. Specifically, among Korean university students, differences were observed in sociodemographic factors like gender, education, and household income. Additionally, health-related factors, such as SRH and smoking, exhibited variations between these two groups. These findings underscore the multifaceted nature of depressive symptoms, influenced by a range of factors encompassing sociodemographic and health-related aspects [18,19].

The prevalence of depressive disorders on a global scale experienced a substantial increase as a consequence of the COVID-19 pandemic (20). Our findings indicate that Korean university students who experienced changes in their daily life during the COVID-19 pandemic exhibited more depressive symptoms compared to those who did not. This aligns with prior research findings indicating that the crisis brought about by the COVID-19 pandemic, which mandated social distancing and changes in daily routines, can result in mental health issues like depression [21]. Particularly, university students have been placed in a stressful situation of adapting to the drastic changes in college life, which are distinctly different from before. Starting from March 2020, most classes abruptly shifted to online, remote formats, and as this change became prolonged, students faced numerous challenges including excessive assignments, accumulated fatigue due to computer-based learning, and dissatisfaction with the quality of education [22,23]. Moreover, it is thought that the restriction of activities due to online classes and social distancing measures could further intensify emotional problems for university students, who are typically in a life stage of wide-ranging activities and vigorous engagement [9]. This situation presents a significant challenge to their mental health, underscoring the need for concrete and effective strategies to support the mental well-being of university students.

The CHS, encompassing various variables related to COVID-19, was conducted from the third week of August 2020 to the last week of October 2020 (August 16th to October 31st). This timeframe effectively captures the early aspects of the COVID-19 situation. This encompassed a detailed analysis of the rates of quarantine or hospitalization as a result of COVID-19, as well as the incidence of common COVID-19 symptoms such as fever and cough. The findings revealed that among the participants, 1.4% underwent quarantine or were hospitalized as a consequence of COVID-19 infection, while 2.5% exhibited COVID-19 symptoms including fever and cough. Conversely, the concern regarding economic damage resulting from the COVID-19 pandemic was remarkably high, with 67.4% of respondents expressing fear over financial setbacks.

Multivariate logistic regression analysis, accounting for the complex sample design, indicated an increased likelihood of depressive symptoms among individuals who have encountered COVID-19 symptoms, those who harbor a concern of economic repercussions due to the pandemic, and those with diminished social networking capabilities. This finding is in line with prior studies suggesting that anxiety and fear related to COVID-19 are potential contributors to depressive symptoms [24]. The study further highlights the critical importance of sustaining non-face-to-face interactions, such as through phone calls or online messaging, and maintaining robust social networks, even amidst the challenges posed by social distancing measures. This approach aligns with the context of prior research, particularly in the context of the ongoing pandemic and its extensive effects on daily life and social interactions, underscoring its crucial importance for mental health support [25,26].

Among the sociodemographic factors, household income, and education were found to have a statistical association with depressive symptoms. In this study, household income refers to household income, not the individual income of students. This implies that the economic situation of a student's parents was related to the likelihood of depressive symptoms among university students. Additionally, students attending four-year universities or graduate schools had a lower probability of depression compared to those in two- or three-year colleges, aligning with previous studies indicating an inverse correlation between higher socioeconomic status and depression [27]. Regarding health status, a statistical association was revealed between SRH and current smoking status with depressive symptoms. Generally, SRH and smoking status are well-known risk factors for depression. Espe-

cially in the case of smoking, it has been identified in previous studies as a factor affecting the mental health of university students [28]. Our research also highlighted that during the COVID-19 period, university students who smoked had a higher probability of exhibiting depressive symptoms. Our findings support previous research results that suggest the negative social conditions created by the COVID-19 pandemic may present a more severe threat to an individual's psychological and mental health, and that this can vary depending on the unique characteristics of the individual [29].

Considering research findings that suggest a significant impact of the COVID-19 pandemic on the daily lives of university students in their 20s, particularly due to the shift to online classes and limited social interactions as a result of social distancing measures, it is evident that these changes are associated with depressive symptoms. It is therefore essential to implement universal interventions targeting these university students. Examples of such interventions include offering online courses through various media and promoting non-face-to-face group activities to mitigate mental health issues caused by the pandemic. Further, it is crucial to identify vulnerable groups and provide mental health services for the promotion and prevention of mental health disorders. These services could include mental health counseling and economic support for those facing financial difficulties. This comprehensive approach is essential to address the broad spectrum of challenges posed by the pandemic, focusing on university students.

There are several limitations to consider in this study. Firstly, being a cross-sectional study, we couldn't establish causal relationships between changes in daily life during the pandemic and depressive symptoms. Thus, further research is needed to establish a definitive causal link between the increase in depressive symptoms and pandemic-induced changes in daily life. Secondly, the evaluation of depressive symptoms was based on the Korean version of the PHQ-9, which may differ from the DSM-V criteria for depression [30]. Lastly, both the exposure and the outcome relied on self-reported questionnaires, which can be influenced by respondents' mood or memory at the time of survey completion.

CONCLUSION

Our findings suggest that changes in daily life during the COVID-19 pandemic was associated with depressive symptoms in Korean university students aged between 19 and 29 years, even after accounting for sociodemographic

characteristics, health-related factors, and COVID-19-related aspects. Our study suggests that when examining the impact of COVID-19 on health issues in university students, it is crucial to consider the changes in daily life levels caused by the pandemic.

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

REFERENCES

1. Thu TPB, Ngoc PNH, Hai NM. Effect of the social distancing measures on the spread of COVID-19 in 10 highly infected countries. *Science of the Total Environment*. 2020;742:140430. <https://doi.org/10.1016/j.scitotenv.2020.140430>
2. Disaster C, of the Republic SCH. Rules and guidelines for distancing in daily life to control coronavirus disease 2019 in Korea: 3rd version, announced on July 3, 2020. *Journal of Educational Evaluation for Health Professions*. 2020;17:20. <https://doi.org/10.3352/jeehp.2020.17.20>
3. Ettman CK, Abdalla SM, Cohen GH, Sampson L, Vivier PM, Galea S. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Network Open*. 2020;3(9):e2019686-e. <https://doi.org/10.1001/jamanetworkopen.2020.19686>
4. Hosen I, Al-Mamun F, Mamun MA. Prevalence and risk factors of the symptoms of depression, anxiety, and stress during the COVID-19 pandemic in Bangladesh: a systematic review and meta-analysis. *Global Mental Health*. 2021;8:e47. <https://doi.org/10.1017/gmh.2021.49>
5. Al Mamun F, Gozal D, Hosen I, Misti JM, Mamun MA. Predictive factors of insomnia during the COVID-19 pandemic in Bangladesh: a GIS-based nationwide distribution. *Sleep Medicine*. 2022;91:219-225. <https://doi.org/10.1016/j.sleep.2021.04.025>
6. Hoffart A, Johnson SU, Ebrahimi OV. Loneliness and social distancing during the COVID-19 pandemic: risk factors and associations with psychopathology. *Frontiers in Psychiatry*. 2020;11:589127. <https://doi.org/10.3389/fpsy.2020.589127>
7. Feeney MP, Xu Y, Surface M, Shah H, Vanegas-Arroyave N, Chan AK, et al. The impact of COVID-19 and social distancing on people with Parkinson's disease: a survey study. *NPJ Parkinson's Disease*. 2021;7(1):10. <https://doi.org/10.1038/s41531-020-00153-8>
8. Hyun JH. COVID-19, Korean National Mental Health Survey (2020). Survey Report. Daegu: Daegu University, Ministry of Health and Welfare; 2020 December. Report No.: 11-1352000-002917-01.
9. Mihashi M, Otsubo Y, Yinjuan X, Nagatomi K, Hoshiko M,

- Ishitake T. Predictive factors of psychological disorder development during recovery following SARS outbreak. *Health Psychology*. 2009;28(1):91.
<https://doi.org/10.1037/a0013674>
10. Hong SH. An exploratory study of daily life and coping behaviors since the onset of COVID-19: data from university students. *Journal of Families and Better Life*. 2021;39(2):47-61.
<https://doi.org/10.7466/jfbl.2021.39.2.47>
 11. Cho S, Ju HR, Oh H, Choi E-S, Lee JA. The association between the restriction of daily life and depression during the COVID-19 pandemic in Korea: a nationwide based survey. *Scientific Reports*. 2022;12(1):17722.
<https://doi.org/10.1038/s41598-022-21301-5>
 12. Lee H, Chu HS. The effects of changes in daily life due to the COVID-19 pandemic on the depressive symptoms among community-dwelling older adults in Korea. *International Journal of Mental Health Nursing*. 2022;31(4):974-984.
<https://doi.org/10.1111/inm.13008>
 13. Park JH. Depression and anxiety patterns perceived by undergraduate students and effect of positive psychological capital in COVID-19 situation. *The Journal of Welfare and Counseling Education*. 2021;10(2):51-71.
 14. Kim YT, Choi BY, Lee KO, Kim H, Chun JH, Kim SY, et al. Overview of Korean Community Health Survey. *Journal of the Korean Medical Association*. 2012;55(1):74-83.
<https://doi.org/10.5124/jkma.2012.55.1.74>
 15. Choi SH, Lee HY. Influence on college students' depression of anxiety, unemployment stress, and self-esteem - moderating effect of resilience. *The Journal of the Korea Contents Association*. 2014;14(10):619-627.
<https://doi.org/10.5392/jkca.2014.14.10.619>
 16. Park S-J, Choi H-R, Choi J-H, Kim K-W, Hong J-P. Reliability and validity of the Korean version of the Patient Health Questionnaire-9 (PHQ-9). *Anxiety and Mood*. 2010;6(2):119-124.
 17. Lee S, Huh Y, Kim J, Han C. Finding optimal cut off points of the Korean version of the Patient Health Questionnaire-9 (PHQ-9) for screening depressive disorders. *Mood and Emotion*. 2014;12(1):32-36.
 18. Schofield MJ, O'halloran P, McLean SA, Forrester-Knauss C, Paxton SJ. Depressive symptoms among Australian university students: Who is at risk? *Australian Psychologist*. 2016;51(2):135-144. <https://doi.org/10.1111/ap.12129>
 19. Asante KO, Andoh-Arthur J. Prevalence and determinants of depressive symptoms among university students in Ghana. *Journal of Affective Disorders*. 2015;171:161-166.
<https://doi.org/10.1016/j.jad.2014.09.025>
 20. Santomauro DF, Herrera AMM, Shadid J, Zheng P, Ashbaugh C, Pigott DM, et al. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *The Lancet*. 2021;398(10312):1700-1712.
[https://doi.org/10.1016/S0140-6736\(21\)02143-7](https://doi.org/10.1016/S0140-6736(21)02143-7)
 21. Venkatesh A, Edirappuli S. Social distancing in covid-19: what are the mental health implications? *BMJ*. 2020;369:m1379.
<https://doi.org/10.1136/bmj.m1379>
 22. Lee YJ. An analysis of positive psychological capital influencing emotional reactions of college students under COVID-19. *The Journal of Humanities and Social Science*. 2020;11(6):2885-2899. <https://doi.org/10.22143/hss21.11.6.203>
 23. Im S, Choi EH, Lee M, Hong NY, Hwang DY, Choi YB. Adjustment experiences of nursing students in the face of COVID-19. *Journal of the Korean Society of School Health*. 2020;33(3):213-221. <https://doi.org/10.15434/kssh.2020.33.3.213>
 24. Khudaykulov A, Changjun Z, Obrenovic B, Godinic D, Alsharif HZH, Jakhongirov I. The fear of COVID-19 and job insecurity impact on depression and anxiety: an empirical study in China in the COVID-19 pandemic aftermath. *Current Psychology*. 2022;1-14. <https://doi.org/10.1007/s12144-022-02883-9>
 25. Katayama O, Lee S, Bae S, Makino K, Chiba I, Harada K, et al. Are non-face-to-face interactions an effective strategy for maintaining mental and physical health? *Archives of Gerontology and Geriatrics*. 2022;98:104560.
<https://doi.org/10.1016/j.archger.2021.104560>
 26. Kim NY, Kim JE. Influence of social contact on suicidal ideation among nursing students during the COVID-19 pandemic: the mediating effects of depression and loneliness. *Journal of the Korean Society of School Health*. 2023;36(2):31-39.
<https://doi.org/10.15434/kssh.2023.36.2.31>
 27. Everson SA, Maty SC, Lynch JW, Kaplan GA. Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *Journal of Psychosomatic Research*. 2002;53(4):891-895.
[https://doi.org/10.1016/s0022-3999\(02\)00303-3](https://doi.org/10.1016/s0022-3999(02)00303-3)
 28. Milic M, Gazibara T, Pekmezovic T, Kiscic Tepavcevic D, Maric G, Popovic A, et al. Tobacco smoking and health-related quality of life among university students: mediating effect of depression. *Plos One*. 2020;15(1):e0227042.
<https://doi.org/10.1371/journal.pone.0227042>
 29. Salari N, Hosseini-Far A, Jalali R, Vaisi-Raygani A, Rasoulpoor S, Mohammadi M, et al. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Globalization and Health*. 2020;16(1):1-11.
<https://doi.org/10.1186/s12992-020-00589-w>
 30. Regier DA, Narrow WE, Kuhl EA, Kupfer DJ. The conceptual development of DSM-V. *American Journal of Psychiatry*. 2009;166(6):645-650.
<https://doi.org/10.1176/appi.ajp.2009.09020279>