Factors affecting the mental health of medical students during the COVID-19 pandemic
A cross-sectional study

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Abstract

The coronavirus disease 2019 outbreak has impacted many educational institutions by imposing restrictions on offline or in-person lessons. Many students were stressed by "the loss of everyday life" due to the pandemic, and it is important to examine the impact of this loss on adolescents' mental health. This study aimed to investigate the factors that affect students' mental health during the pandemic from various perspectives. A total of 166 medical students participated in this study. Participants completed questionnaires about their demographics, life stress, mental health, and stress factors during in-person and online lecture days. Participants were divided into 2 groups, those with low and high mental health. The researchers compared independent variables between the groups using the χ^2 test or Fisher's exact test. Multiple logistic regression analysis was performed, with mental health as the dependent variable. The multiple logistic regression analysis indicated that increased time spent online was significantly associated with mental health ($P < .05$). Human relations and the inability to meet/talk with friends trended toward a significant association with mental health ($P < .1$). The students who were not stressed about the increased time spent online were at a risk of low mental health. The students who appreciated interacting with others experienced more stress during the lockdown. To reduce students' stress on online days, teachers should devise a lecture style with frequent breaks and introduce active learning. The findings of this study will contribute to addressing students' low mental health and reducing their stress during the coronavirus disease 2019 pandemic.

Abbreviations: COVID-19 = coronavirus disease 2019, K6 = Kessler screening scale for psychological distress, OR = odds ratio, WHO = world health organization.

Keywords: COVID-19, interpersonal exchange, mental health, online learning

1. Introduction

The coronavirus disease 2019 (COVID-19) outbreak has impacted the lives of millions of people worldwide since 2019, causing extraordinary disruptions to healthcare delivery, economic activities, and social interactions.[1] A COVID-19 outbreak occurred in Wuhan, Hubei Province, China.[2–4] The world health organization (WHO) declared the coronavirus outbreak a public health emergency of international concern,[5,6] and declared the new COVID-19 as a pandemic.[7–10] In Japan, schools were temporarily closed nationwide,[11] and a state of emergency was declared for the metropolitan areas.[11,12]

Consequently, many educational institutions, including universities, imposed restrictions on in-person lessons, forcing them to shift to remote learning. In remote lectures, students attended lectures online, reducing the chances of in-person contact with faculty and other students. Specifically, medical students could no longer directly receive practical instruction that was supposed to be provided in person, and issues regarding the ideal form of medical education have been highlighted.[13,14] As such, students' lives drastically changed. Their time on the Internet increased as they adapted to online learning and experienced a student life without sports, interaction with friends, and campus life.[15] A systematic review reported that these measures reduced the spread of the virus, while increasing depression and reducing well-being in people. This review found lower psychological well-being and higher anxiety and depression than before COVID-19.[16] Many students were stressed by "the loss of everyday life" due to the pandemic. Therefore, it is important to examine the pandemic's impact on adolescents' mental health,[17] as developmental theorists labeled this stage as a period of storm and stress.[18] Factors including social restrictions, low-self rated

health, poor sleep quality, higher perceived stress load, less family support, and unsteady family income are associated with decreasing mental health.[16,19,20] Additionally, some studies suggested that remote learning also affects students' mental health. However, the participants of these studies were not medical students; they were students in fields such as business and music.[21–23]

The authors hypothesized that the decrease in opportunities for students to meet in person due to changes in the lecture format may be 1 of the contributing factors to the decline in students' mental health during the pandemic. Specifically, mental health of medical students may be affected to a similar or even greater degree than that reported in previous studies due to the remote learning system. This may be because even though medical students are required to attend practical lectures, they do not get the opportunity for in-person learning due to COVID-19, which may increase their anxiety. Therefore, it is necessary to clarify what affects the mental health of medical students. This study investigates the factors that affect students' mental health during the COVID-19 pandemic from various perspectives.

2. Methods

2.1. Participants

A total of 177 medical students in their first to third years in the Faculty of Rehabilitation, Nishi Kyushu University, were recruited for this study. Informed consent was obtained from all the participants before the study. From the potential participants, 166 completed responses (collection rate: 93.8%) were received. None of the responding participants were excluded, and the final sample consisted of 166 participants: 70 female and 96 male students; 65, 63, and 38 were in their first, second, and third years, respectively (Fig. 1). The study was conducted in January 2022 with the approval of the Ethics Committee of Nishi Kyushu University (approval number: 21TKQ21) and in compliance with the Declaration of Helsinki.[24]

The 166 participants who met the research criteria (the students who completed responses) were divided into 2 groups. The first group included students with low mental health,

and the second group included those with high mental health (Fig. 1).

2.2. Procedures

The study's participants completed and returned the questionnaires, and the collected data were aggregated and analyzed. The study questionnaires were self-reported and took approximately 5 minutes to complete. Participants completed questionnaires about their demographics, life stress, and mental health and questions about stress factors during in-person lecture days and online lecture days. All the questionnaire responses were received anonymously.

2.3. Measures

2.3.1. Demographics. The questionnaire comprised 5 questions: gender, grades, major, part-time job, and family environment. Table 1 reports the comparative data from this questionnaire between participants with low mental health and high mental health.

2.3.2. Questions about life stress. The authors devised 12 items regarding subjective life stress. Items included human relations, academics, behavioral restrictions, health, income, inability to meet/talk with friends, home environment, job/career options, cultural activities such as club activities, increased time spent online, in-person lectures, and online lectures (Table 1). We asked about the category relating to life stress based on whether the participants thought the item related to their stress; this was not a rated scale.

2.3.3. Mental health. The Kessler screening scale for psychological distress (K6) was used to measure students' mental health. The scale has been employed in annual government health surveys in the United States, Canada, and the WHO World Mental Health Surveys.[25] The scale assesses the frequency of experiencing psychological distress over 30 days through 6 items. Participants responded to the items on a 5-point Likert scale (0 = *not at all*, 1 = *little*, 2 = *sometimes*,
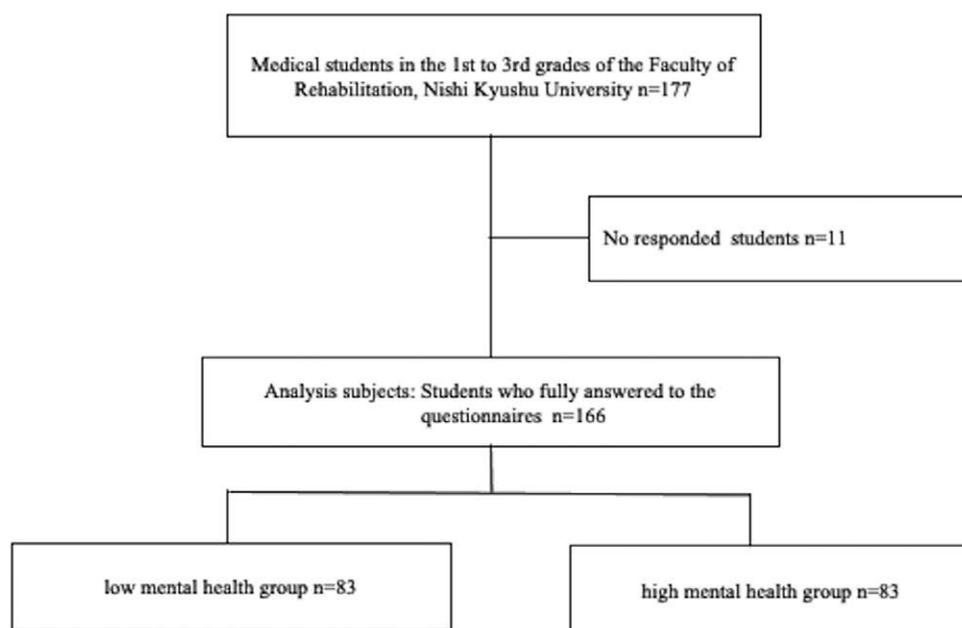
Figure 1. Flow chart of the study.

Table 1

Variable comparison between the 2 groups.

Variables	Low mental health group n = 83	High mental health group n = 83	P-value
Gender, n (%)			
Male	44 (53)	52 (62)	.21
Female	39 (47)	31 (37)	
Grades, n (%)			
1st	28 (34)	37 (45)	.31
2nd	33 (40)	30 (36)	
3rd	22(27)	16 (19)	
Major, n (%)			
Physical therapy	45(54)	61 (73)	<.01*
Occupational therapy	38(46)	22 (27)	
Part-time job, n (%)			
Have	63 (76)	65 (78)	.71
None	20 (24)	18 (22)	
Family environment, n (%)			
Living alone/living in the dormitory	29(35)	34 (41)	.42
Living with parent	50 (60)	46 (55)	.53
Living with brother/sister	36(43)	29 (35)	.27
Living with others	8(10)	9 (11)	.58
Subjective life stress during the COVID-19 pandemic, n (%)			
Human relations	16 (19)	6 (7)	<.05*
Academics	28 (34)	19 (23)	.12
Behavioral restrictions	48 (58)	49 (59)	.59
Health	11(27)	10 (12)	.82
Income	23 (28)	20 (24)	.60
Inability to meet/ talk with friends	19 (23)	21 (25)	.72
Home	1 (1)	0 (0)	.32
Finding a job/ career options	7(8)	4 (5)	.35
Cultural activities such as club activities	11 (13)	5 (6)	.12
Increased time spent online	13(16)	3 (4)	<.01*
In-person lectures	58 (70)	38 (48)	<.01*
Online lectures	44 (53)	46 (55)	.59

* $P < .05$, χ^2 test or Fisher's exact test.
COVID-19 = the coronavirus disease 2019.
Data are expressed as number (%).

3 = *often*, 4 = *always*). High K6 scores indicate a high level of psychological distress. The participants were categorized into 2 groups based on their scores: K6 < 13 or K6 ≥ 13. Scores in the K6 ≥ 13 categories indicated that the participants had low mental health.

Furthermore, the Japanese version of the burnout scale was used as another measure of mental health. Burnout has been defined as "a state of exhaustion in which 1 is cynical about the value of 1's occupation and doubtful of 1's capacity to perform."[26] WHO includes burnout in the recent 11th revision of the International Classification of Diseases as a global occupational phenomenon that influences health.[27] The Japanese version of the burnout scale consists of 17 items across 3 subscales of emotional exhaustion, depersonalization, and decreased personal achievement. The reliability and validity of the scale have also been reported.[28] This study used a burnout scale created for medical students with certain modifications. As for the scale, all the 17 items were rated on a 5-point Likert scale (1 = *not applicable* to 5 = *most applicable*). The higher the score on the modified version burnout scale, the higher the burnout risk. However, as this scale did not have a cutoff value, the median was set based on the data obtained from this survey. Those with a higher score than the median were considered to have low mental health, whereas those with a lower score had high mental health.

In this study, these 2 scales were used to identify stress factors that affect participants' mental health from various angles, as previous research has suggested that both psychological distress and burnout affect mental health,[25,27] and if either scale indicated low mental health, the participants were assigned to the low mental health group.

2.3.4. Questions about stress factors during in-person lecture days. The authors developed 13 items that could be considered as stress factors during in-person lecture days. Items included waking up early, taking a long time to leave for school, lack of sleep, returning home late, carrying heavy teaching materials, grooming, school expenses, interacting with people, inability to learn at own pace, obligation to wear a mask, preparation of lunch, high risk of spreading COVID-19, and Others.

2.3.5. Questions about stress factors during online lecture days. The authors devised 16 items that could be considered stress factors on online lecture days. Items included studying atmosphere, ability to concentrate, difficulty in making presentations, face appearances, a considerable amount of assignments, ability to correctly grasp the way to attend classes and submit assignments, online communication (group work), no interaction with people, inadequate online environment, checking emails, fewer opportunities for communication, feeling physical fatigue, less time for mutual exchange of questions, lack of exercise, cost of environment maintenance, and electricity bill increase.

2.4. Statistical analysis

Independent variables were compared between the 2 groups using the χ^2 test or Fisher's exact test as appropriate. In addition, multiple logistic regression analysis with backward stepwise selection was performed with mental health as the

dependent variable. Odds ratios (ORs), which is a measure of the association between an exposure and outcome, and 95% confidence intervals, which is a range of values that 1 can be 95% confident contains the true mean of the population, were calculated. While calculating the multivariate OR, human relations, inability to meet/talk with friends, increased time spent online, and in-person lectures were set as covariates. In the above analyses, a bilateral P-value < .05 was considered statistically significant. All statistical analyses were performed using the statistical analysis software SPSS (Version 26.0, IBM, Tokyo, Japan).

3. Results

The results indicated that the dependent variable (mental health) was significantly affected by the independent variables: major ($P < .01$), human relations ($P < .05$), increased time spent online ($P < .01$), and in-person lectures ($P < .01$), using the χ^2 test or Fisher's exact test (Table 1). The multiple logistic regression analysis results using the step-down procedure indicated that the increased time spent online was significantly associated with mental health ($P < .05$). Furthermore, human relations and the inability to meet/talk with friends were significantly associated with mental health ($P < .1$). The OR of stress caused by increased time spent online was 0.231 times higher than that of those who were not stressed by the same, indicating that students who were not stressed by increased time spent online had low mental health. The OR of stress with human relations was 0.345 times higher than that of those who were not stressed by human relations. This indicated that students who were not stressed by human relations had low mental health. The OR of stress caused by the inability to meet/talk with friends was 2.033 times higher than that of those who were not stressed by the same. This indicated that the students who were stressed by the inability to meet/talk with friends had low mental health (Table 2).

The results of the questions about stress factors during in-person lecture days are shown in Table 3. The main factors reported were rising early, taking a long time to leave for school, and lack of sleep. The results from questions about stress factors during online lecture days are shown in Table 4. The main factors that were reported are inadequate study atmosphere, required concentration, and difficulty in making presentations.

4. Discussion

This study investigated the factors affecting students' mental health during the COVID-19 pandemic from various perspectives. "Not stressed by increased time spent online" was significantly associated with low mental health, and factors such as "not stressed with human relations" and "stressed by the inability to meet/talk with friends" trended toward being significantly associated with low mental health.

First, it was hypothesized that students stressed by the increased time spent online had low mental health during the COVID-19 pandemic. This is because society and the current educational situation forced them to switch to an online format. As teachers continue to perform online lectures at the university, it may increase students' stress levels and cause low mental health. However, the results of the current study were contrary and showed that students who answered "not stressed with increased time spent online" had low mental health, indicating that the students who were not stressed about studying online may themselves increase their daily online time. As a result, they may be affected by Internet use, as previous research has suggested that online time is negatively associated with mental health.[29] A Chinese cross-sectional self-report survey suggested that psychological disturbances were associated with daily online time.[30] Review studies have suggested that Internet

use impacts students' health-promoting and health-threatening behavior. Potential harmful effects of extensive screen time and technology use include lower mental and physical health as well as lower well-being, including attention-deficit symptoms, impaired emotional and social intelligence, technology addiction, impaired brain development, disrupted sleep, digital eye strain, and social isolation.[31–33] Therefore, it can be inferred that students who report "not stressed with increased time spent online" are at risk of low mental health during the COVID-19 pandemic.

Second, students who are not stressed with human relations and students who are stressed by the inability to meet/talk with friends may appreciate interacting with others or want to interact with others. As it has been reported that less communication with friends was the main risk factor for mental health problems during the COVID-19 pandemic,[34] those who appreciate interacting with others can easily feel more stressed because they are restricted from doing so. The communication between students is mostly text-based exchanges through smartphones. Therefore, non-verbal communication such as facial expressions and speaking styles are unavailable, making it challenging to completely understand each other's intentions, which may also be stressful.

Third, regarding stress factors during in-person and online lecture days, the main stress factors were waking up early, taking a long time to leave for school, and lack of sleep during in-person lecture days. Alternatively, the main stress factors for online lecture days were a lack of appropriate atmosphere for studying, ability to concentrate, and difficulty in making presentations. These results indicate that teachers should develop a lecture style that includes frequent breaks. They should also introduce active learning, which maximizes information processing and requires critical thinking, and other strategies to best support student learning[33] to make students feel as if they

Table 2		
Multiple logistic regression analysis between the 2 groups.		
	Multivariate OR	
Variables	**OR (95% CI)**	**P-value**
Human relations	0.345(0.117–1.012)	.053
Inability to meet/ talk with friends	2.033(0.882–4.687)	.096
Increased time spent online	0.231(0.059–0.900)	.035*
In-person lectures	1.190 (0.099–4.300)	.891

* $P < .05$, by multiple logistic regression analysis.
OR = odds ratio, CI = confidence interval.
Data are expressed as median (interquartile range) or number (%).
Increasing time spent online was significantly associated with mental health.

Table 3	
Stress factors on in-person lecture days.	
Stress factors on in-person lecture days n = 96	**n (%)**
Getting up early	73 (76)
Taking a long time to leave for school	46 (48)
Lack of sleep	36 (38)
Returning home late	30 (31)
Carrying heavy teaching materials	26 (27)
Grooming	26 (27)
School expenses	24 (25)
Interacting with people	18 (19)
Inability to learn at own pace	17 (18)
Obligation to wear a mask	17 (18)
Preparation of lunch	14(15)
High risk of spreading COVID-19	8 (8)
Others	3 (3)

COVID-19 = the coronavirus disease 2019.

Table 4

Stress factors during online lecture days.

Stress factors on online lecture days n = 90	n (%)
No atmosphere for studying	59 (66)
Concentration is required	52 (58)
Difficult to make presentations	32 (36)
Face appearances	32 (36)
Many assignments	30 (33)
Impossible to correctly grasp how to submit assignments	28 (31)
Online communication (group work)	27 (30)
No interactions with people	20 (22)
Inadequate online environment	18 (20)
Checking emails	17 (19)
Less opportunities for communication	17 (19)
Feeling physical fatigue	16 (18)
Less time for mutual exchange of questions	14 (16)
Lack of exercise	13 (14)
Cost of environment maintenance and electricity bill increase	8 (9)
Others	2 (2)

are attending in-person lectures. For online learning to be effective, educators must strive to design courses that incorporate the principles of active learning and implement relevant teaching strategies that focus on practicing scientific skills, critical thinking, and problem-solving.[35]

This study also has several limitations. First, the sample size of the participants was small. Second, the participants' selection may have led to bias, as all the participants were recruited from a single university in Japan. Third, data collection for this research did not include the lockdown period due to COVID-19; thus, it is still unclear if the students' mental health was the same during and after the lockdown period. In future research, the generalizability of this study's findings should be assessed for other types of students with a larger sample and other countries in various situations.

5. Conclusions

The students who are not stressed with increased time spent online are at a risk of low mental health. Furthermore, students who appreciate interacting with others may feel more stressed. Teachers should incorporate frequent breaks and introduce active learning during lectures to reduce students' stress during online lecture days. The findings of this study will contribute to addressing students' low mental health and reducing their stress during the COVID-19 pandemic.

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