

Original Research

Mental Health of Teachers during the First Wave of COVID-19 in Daegu, Korea: Challenges in Reopening Schools

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Academic Editors: Ines Testoni, Adriano Zamperini and Lorenza Palazzo

Special Issue: [How COVID-19 Changed Individual and Social Life: Psychological and Mental illness Studies on the Pandemic Outcomes](#)

OBM Neurobiology

2024, volume 8, issue 2

doi:10.21926/obm.neurobiol.2402221

Received: February 25, 2024**Accepted:** April 26, 2024**Published:** May 06, 2024

Abstract

This study conducted an in-depth analysis of the psychological states of teachers during the first outbreak of coronavirus disease 2019 (COVID-19) using data on school mental health projects related to COVID-19 in Daegu from May to June 2020. The participants comprised 811 (34.9%) male and 1,511 (65.1%) female teachers in 1,041 (44.8%) middle and 1,281 (55.2%) high schools. After schools reopened, the most common causes of unbearable stress were unusual experiences, fear of infection, and negative emotions. Moreover, 41.5%/40.4%



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reported experiencing anxiety/depression, out of which 25.1%/23.6%, 10.0%/14.0%, and 6.4%/2.8% exhibited mild, moderate, and severe levels, respectively. The study identified the following influencing factors of anxiety: being female (OR: 1.52), years of employment (≤ 5 and < 15 ; OR: 1.36; reference: < 5), average monthly household income ($\leq 3,000,000$ and $< 5,000,000$ [OR: 0.69], $5,000,000 \leq$ [OR: 0.67]; reference $\leq 1,000,000$ and $< 3,000,000$ won), depression (OR: 19.14), posttraumatic stress symptoms (OR: 11.65), job stress (OR: 9.13), resilience (OR: 0.37), and subjective well-being (OR: 0.45). We identified the following factors for depression: being female (OR: 1.51), aged 40s (OR: 1.70; reference: 20s), average monthly household income ($\leq 3,000,000$ and $< 5,000,000$ [OR: 0.75], $\leq 5,000,000$ [OR: 0.66]; reference: $\leq 1,000,000$ and $< 3,000,000$ won), anxiety (OR: 19.14), posttraumatic stress symptoms (OR: 4.03), job stress (OR: 14.04), resilience (OR: 0.29), and subjective well-being (OR: 0.33). The findings suggest a necessity for specific, systematic measures and psychological support to teachers vulnerable to the impact of disasters, such as the COVID-19 pandemic, to cope with disasters and improve school adaptation.

Keywords

COVID-19; school; teacher; mental health; anxiety; depression

1. Introduction

In November 2021, the World Health Organization (WHO) estimated more than five million deaths worldwide due to coronavirus disease 2019 (COVID-19) [1]. The first reported case in South Korea was on January 20, 2020. In particular, after identifying the first infected person in Daegu Metropolitan City in February 2020, COVID-19 spread rapidly throughout the city, with cumulative confirmed cases exceeding 6,000 (more than 68% of the confirmed cases nationwide) by the end of March 2020. At this point, the government declared Daegu a particular disaster area [2]. The direct physical effects of COVID-19 created an environment that also affected many determinants of mental health. Fears of being infected, social restrictions, lockdowns, closures of schools and businesses, losses in livelihood, decrease in economic activity, and the shifting priorities of governments to mitigate COVID-19 outbreaks can potentially and substantially affect the mental health of the population [3]. A meta-analysis of data from 204 countries or territories in 2020 demonstrated that the total prevalence rates of major depressive and anxiety disorders increased by 27.6% and 25.6%, respectively, especially among females and younger age groups [3]. Another study from 2020 reported that suicide, domestic violence, anxiety, depression, and other mental illnesses are increasing due to the COVID-19 crisis [4].

Apart from the severe impact on public health and welfare, the secondary effects of the COVID-19 crisis led to profound disruptions in various sectors, notably education. The Ministry of Education postponed school reopening thrice, revised its policy to allow online classes, and ultimately resumed school for each grade in May 2020 [5]. While schools held face-to-face classes, academic performance saw considerable challenges throughout 2020 [5]. High levels of stressful situations exposed students, teachers, and staff to severe emotional distress. COVID-19 created new challenges for teachers, such as the fear of infection and quarantine and prevention activities at

school and home, requiring them to quickly adapt to various teaching strategies and online environments [5, 6].

The pandemic exacerbated or triggered negative emotions and mental illness in students [7] and teachers [8]. Several online surveys of teachers conducted while schools were closed due to the pandemic showed that many teachers were experiencing overwork, stress, psychosomatic symptoms, and burnout, urgently requiring psychological support [9, 10]. A recent systematic review found that the most common psychiatric pathologies in teachers are general anxiety disorder and depression, with a relatively high prevalence of burnout syndrome [8].

Studies on the impact of disasters, such as COVID-19, on teachers' mental health could contribute to formulating strategies for mitigating crises or policies for teacher support, mental health recovery in schools, and stabilizing schools for similar crises. However, few systematic, large-scale studies focused on teachers' mental health during the COVID-19 pandemic 2020, and most studies in Korea concentrated on students. The Daegu Metropolitan Office of Education (DMOE) conducted a mental health survey on middle and high school students and teachers immediately after the first wave in Daegu [11]. The current study conducted an in-depth analysis of stress and psychopathology (e.g., depression and anxiety), its causative factors, and the influencing factors of negative emotions, focusing on teachers.

2. Methods

The study retrospectively analyzed data on a "COVID-19-related school mental health assessment project" conducted by DMOE from May to June 2020, with the institution's approval.

2.1 Survey Design and Performance

The Daegu Student Suicide Prevention Center conducted this survey at the request of the DMOE. Since the survey was conducted immediately after the reopening of schools, with COVID-19 infections ongoing and teachers facing heavy workloads, schools were sampled by the district to reduce regional response deviations. We mitigated selection bias by applying the following selection principles at the school unit level. First, since Daegu Metropolitan City comprises eight districts, we randomly selected schools from each district. Second, the number of schools allocated per district ranged from a minimum of three to a maximum of seven, proportional to the number of schools in each district. Third, the ratio of general and non-general high schools (e.g., technical/specialized) aligned with the district's proportion. Of the 124 middle schools, 43 were surveyed, with 2,038 teachers working in these schools. Out of these, 1,185 teachers (58.1%) responded to the survey, and 1,041 (51.1%) were analyzed after excluding 144 teachers with inadequate responses. For high schools, 39 out of 93 schools were surveyed, with 2,951 teachers working in these schools. Among them, 1,481 teachers (50.1%) responded to the survey, and 1,281 (43.4%) were analyzed after excluding 214 teachers with inadequate responses. The regional response rates of those analyzed were at least 39.1% in middle schools and up to 63.7%, whereas in high schools, they ranged from at least 27.6% to a maximum of 52.8% (Figure 1).

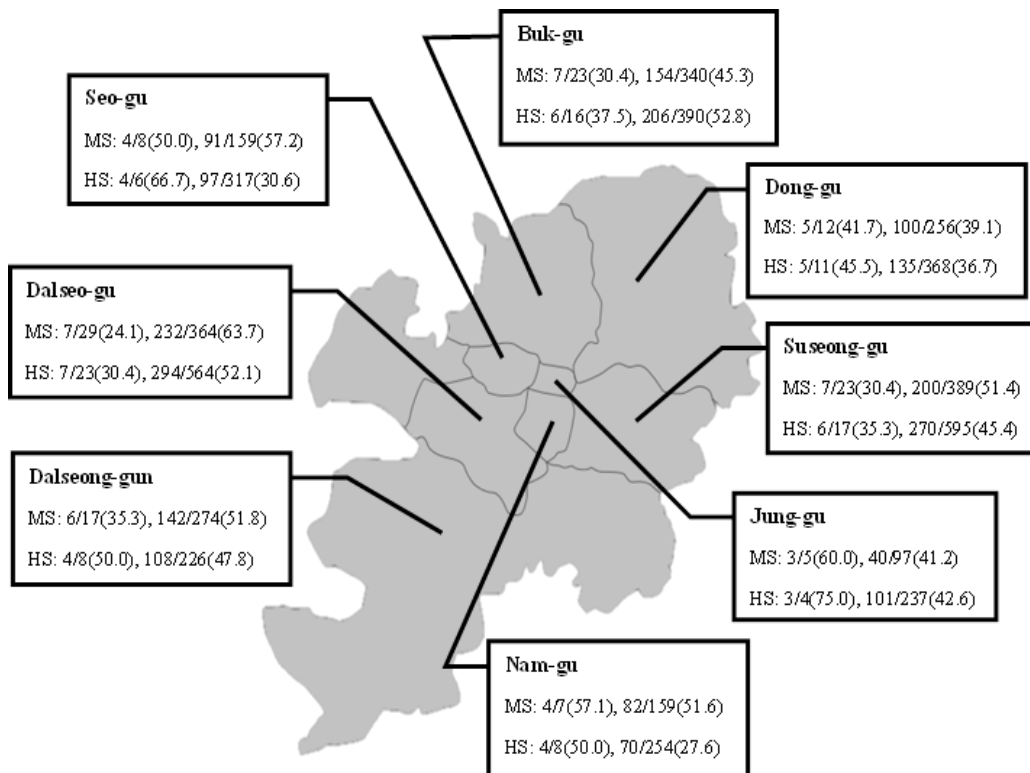


Figure 1 Distribution of schools and teachers per district in Daegu. MS: middle school, HS: high school, number of participating schools/ number of total schools per district and (%), number of teachers analyzed in participating schools/ number of teachers in total schools per district and (%).

The research team at the Department of Psychology at Daegu Catholic University conducted the survey using the Korea Social Science Data Center online survey platform from May 29 to June 14, 2020 [11]. The survey focused on three major areas: demographic characteristics, COVID-19 experience, and mental health status. The survey questionnaire took between 20–and 30 minutes to complete. Before the survey, the DMOE informed the teachers about the contents, precisely the objective, subjects, adverse effects of the study, and confidentiality of personal information. Participants completed the survey only after voluntary consent, and all survey responses were anonymous [11].

2.2 Survey Materials

2.2.1 Demographic Characteristics and Health Status

The researchers developed the questionnaires and collected data to compare demographic characteristics and understand the effect of these factors on mental health. The questionnaire contains 16 items on gender, age, school, position, marital status, religion, years of employment, average monthly household income, health status, etc. Positions comprised managerial (principals, vice-principals, and senior teachers) and general (ordinary and temporary teachers and others). Other items focus on health status, specifically the experience of a confirmed diagnosis of COVID-19 and isolation for teachers and their family members, physical health status, and psychiatric clinic visits before and during the COVID-19 pandemic.

2.2.2 Experiences Related to COVID-19

Twelve questions queried experiences related to COVID-19, including the degree of basic knowledge of COVID-19 and experiences of unbearable stress at three points: December 2019 (before the outbreak), March 2020 (peak), and May–June 2020 (after school reopening). The survey described *unbearable stress* as stress that causes severe psychological and physical responses that impact daily life or work beyond one's control. Teachers who responded that they experienced unbearable stress selected three of 14 causes (fear of infection, negative emotions, unusual experiences, quarantine activities, health, students, lectures, professional competencies, colleagues, working environments, family, friends, financial problems, and others), extracted from a preliminary survey on the factors of unbearable stress.

2.2.3 Assessment Scales

We used several scales to assess participants' psychopathology and psychological status. We evaluated anxiety using the Korean version of the Generalized Anxiety Disorder 7 (GAD-7) scale [12] (total scores of 5–9: mild, 10–14: moderate, 15–21: severe levels); depression using the Korean version of the Patient Health Questionnaire 9 (PHQ-9) [13] (total scores of 5–9: mild, 10–19: moderate, 20–27: severe levels); and the levels of posttraumatic stress symptoms using the Primary Care-Post-traumatic Stress Disorder Screen (PC-PTSD) [14, 15] (total score of 2: mild–moderate, 3–5: severe level). The Korean version of the Connor–Davidson Resilience Scale (CD-RISC) [16] (high scores indicate high levels of resilience) enabled evaluation of the degree of psychological resilience. The study measured job stress with the Job Stress Assessment Tool (JSAT) developed by Kang and Song [17] (subscales: low-spiritedness, job burden, and time pressure; high total scores indicate high levels of job stress). We can define teacher well-being as the positive evaluation of the work and school environments and healthy functioning as a teacher. [18] The Korean version of the Teacher Well-being Scale (K-TWBS) [19] consists of 16 items with three subscales: teaching efficacy, school connectedness, and teacher well-being. High scores indicate high levels of teacher well-being.

2.3 Statistical Analysis

The study utilized SPSS 21.0 (IBM SPSS, IBM Corp., Armonk, NY, USA) for data analysis. First, we conducted frequency analysis and chi-square tests to analyze demographic data, followed by a frequency analysis of health-related experiences and COVID-19 and a chi-square test to compare categorical data. Lastly, we conducted a linear regression analysis on 1,006 teachers who experienced unbearable stress to identify the degree of association between anxiety or depression and significant variables and calculated the odds ratio (OR). We set the cut-off scores of the CD-RISC, JSAT, and K-TWBS, whose reference values are unclear, as the total average scores.

We analyzed demographic data that influenced unbearable stress as the independent variable. We set the statistical significance at 0.05.

This study is a retrospective data analysis in which we did not collect or record personal identification information using public survey data. Institutional review boards excluded the study from deliberation because the risk to subjects was insignificant. The Institutional Review Boards of the Kyungpook National University Chilgok Hospital (Reg. No. 2020-12-004) reviewed and approved the study protocol.

3. Results

3.1 Participants and Demographic Data

The participants comprised 811 (34.9%) male and 1,511 (65.1%) female teachers in 1,041 (44.8%) middle and 1,281 (55.2%) high schools, respectively. Among them, 675 (29.1%) teachers were in managerial positions and 1,647 (70.9%) were in general positions. Eighty-five (3.7%) teachers or their families were confirmed cases of COVID-19. Table 1 provides other detailed information.

Table 1 Participants and demographic data.

Characteristics		Values number (%)
School	Middle School	1,041 (44.8)
	High School	1,281 (55.2)
Gender	Male	811 (34.9)
	Female	1,511 (65.1)
Age, year	20–29	191 (8.2)
	30–39	644 (27.7)
	40–49	733 (31.6)
	50–59	665 (28.6)
	60–69	89 (3.8)
Position	Managerial ^a	675 (29.1)
	General ^b	1,647 (70.9)
Years of employment	<5	471 (20.3)
	≤5 and <15	750 (32.3)
Marital status	≤15	1,101 (47.4)
	Single	657 (28.0)
Religion	Married ^c	1,665 (71.7)
	Yes	1,210 (52.1)
Average monthly household income (1,000,000 won)	No	1,112 (47.9)
	≤1 and <3	368 (15.9)
	≤3 and <5	614 (26.4)
Experience of confirmed COVID-19 diagnosis ^d	≤5	1,340 (57.7)
	Yes	85 (3.7)
	No	2,237 (96.3)

Note: Values are presented as number (%), COVID-19 = coronavirus disease 2019, ^a Principal, vice-principal, and senior teacher. ^b Ordinary teacher, temporary teacher, and others. ^c Cases in which changes in marriage relationships occur due to separation, divorce, and bereavement, among others. ^d Teachers or their family members have been diagnosed with COVID-19.

3.2 Experiences of Unbearable Stress

The proportion of participants experiencing unbearable stress before the COVID-19 pandemic reached 15.8%, which increased to 43.3% at the peak and decreased to 33.1% after school reopening

(Figure 2). The three main reasons for unbearable stress at each time point are in (Figure 3). After school reopening, these reasons included fear of infection (46.4%), unusual experiences (46.2%), and working environments (45.5%).

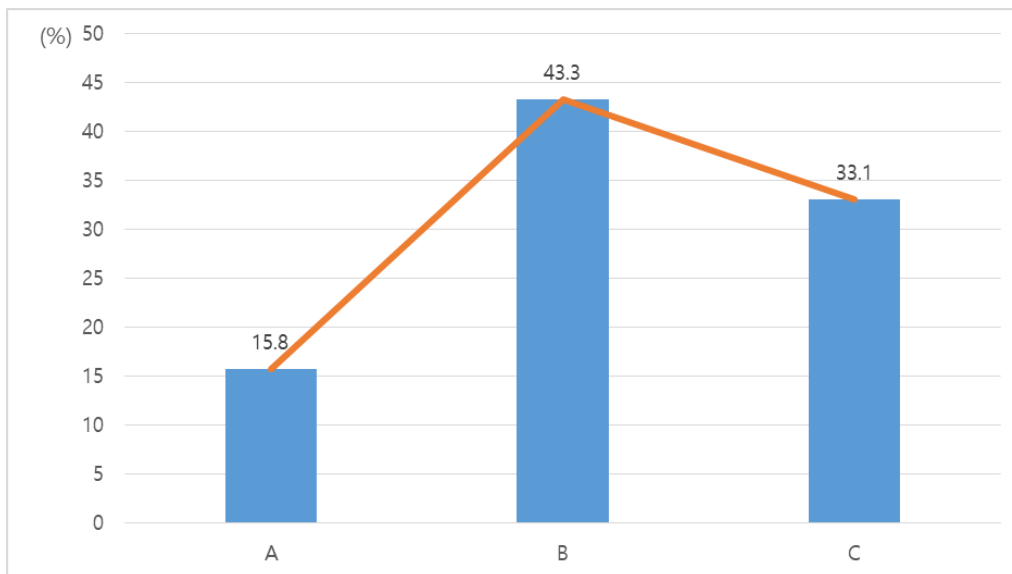


Figure 2 Unbearable stress experiences of participants at three points. (A) Before the COVID-19 pandemic (B) At the peak of the COVID-19 pandemic (C) After school reopening.

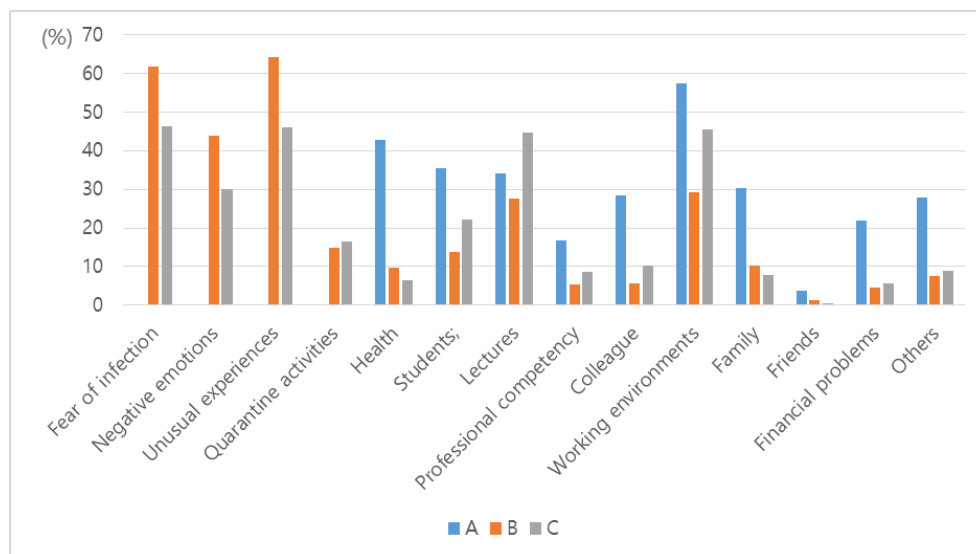


Figure 3 Factors causing unbearable stress at three points. (A) Before the COVID-19 pandemic (B) At the peak of the COVID-19 pandemic (C) After school reopening.

Teachers reporting unbearable stress included females (49.2% versus 32.4% for males; $p < 0.001$), in middle schools (46.5% versus 40.7% in high schools; $P = 0.026$), in general positions (45.4% versus 38.4% in managerial positions, $P = 0.032$), and with confirmed COVID-19 diagnosis (60.0% versus 42.7% without diagnosis, $P = 0.002$). There was a significant difference in the proportion of unbearable stress by age group (the highest, 30s; the lowest, 60s; $P < 0.001$) and years of employment (the highest, <15 years; the lowest, >15 years, $P = 0.001$) (Table 2).

Table 2 The distribution of unbearable stress at the peak of the COVID-19 pandemic.

Characteristics	Variables	Total	Unbearable stress		p-Value
			Yes (%)	No (%)	
Total		2,322	1,006 (43.3)	1,316 (56.7)	
Gender	Male	811	263 (32.4)	548 (67.6)	<0.001
	Female	1,511	743 (49.2)	768 (50.8)	
Age, year	20–29	191	84 (44.0)	107 (56.0)	<0.001
	30–39	644	321 (49.8)	323 (50.2)	
	40–49	733	331 (45.2)	402 (54.8)	
	50–59	665	245 (36.8)	420 (63.2)	
	60–69	89	25 (28.1)	64 (71.9)	
School	Middle school	1041	484 (46.5)	557 (53.5)	0.026
	High school	1,281	522 (40.7)	759 (59.3)	
Position	Managerial ^a	675	259 (38.4)	416 (61.6)	0.032
	General ^b	1,647	747 (45.4)	900 (54.6)	
Years of employment	<5	471	217 (46.1)	254 (53.9)	0.001
	≤5 and <15	750	356 (47.5)	394 (52.5)	
	≤15	1,101	433 (39.3)	668 (60.7)	
Marital status	Single	657	796 (47.8)	869 (52.2)	0.486
	Married ^c	1,665	300 (45.7)	357 (54.3)	
Religion	Yes	1,201	472 (39.0)	738 (61.0)	0.211
	No	1,121	534 (48.0)	578 (52.0)	
Average monthly household income (1,000,000 won)	≤1 and <3	368	178 (48.4)	190 (51.6)	0.231
	≤3 and <5	614	265 (43.2)	349 (56.8)	
	≤5	1,340	563 (42.0)	777 (58.0)	
Experience of confirmed COVID-19 diagnosis ^d	Yes	85	51 (60.0)	34 (40.0)	0.002
	No	2,237	955 (42.7)	1,282 (57.3)	

Notes: COVID-19: coronavirus disease 2019, ^a Principal, vice-principal, and senior teacher, ^b Ordinary teacher, temporary teacher, and others, ^c Cases in which changes in marriage relationship occur due to separation, divorce, and bereavement, among others, ^d Teachers or their family members have been diagnosed with COVID-19.

3.3 Psychological Data

Table 3 summarizes the average scores of the psychological tests and compares the average scores of the participants with and without experiencing unbearable stress. The average scores for anxiety (GAD-7), depression (PHQ-9), and PTSD symptoms (PC-PTSD) were 4.71 ± 5.32 , 4.80 ± 5.66 , and 1.23 ± 1.46 , respectively, which were within normal ranges. The participants who experienced unbearable stress produced significantly higher scores in anxiety, depression, PTSD, and job stress and lower scores in resilience and teacher well-being than those without (all P s < 0.001).

Table 3 Psychological data.

Assessment tools	Total (n = 2,322)	Unbearable Stress		P-value
		Yes (n = 1,006)	No (n = 1,316)	
GAD-7	4.71 ± 5.32	7.06 ± 5.71	2.90 ± 4.17	<0.001
PHQ-9	4.80 ± 5.66	7.22 ± 6.29	2.93 ± 4.24	<0.001
PC-PTSD	1.23 ± 1.46	1.51 ± 1.57	0.78 ± 1.19	<0.001
CD-RISC	92.12 ± 17.38	88.59 ± 17.30	94.82 ± 16.96	<0.001
TWBS	34.80 ± 6.47	33.83 ± 6.48	35.55 ± 6.36	<0.001
JSAT	39.41 ± 16.35	46.54 ± 15.58	33.96 ± 14.76	<0.001
Low-spiritedness	15.96 ± 6.94	18.82 ± 6.76	13.78 ± 6.26	<0.001
Job burden	15.36 ± 6.98	18.31 ± 6.72	13.09 ± 6.30	<0.001
Time pressure	8.09 ± 3.73	9.41 ± 3.62	7.08 ± 3.50	<0.001

Notes: Values are presented as number (%) and scores are the mean ± SD, SD = standard deviation, GAD-7 = Seven-Item Generalized Anxiety Disorder, PHQ-9 = Nine-Item Patient Health Questionnaire, PC-PTSD = Primary Care Post-traumatic Stress Disorder Screen, CD-RISC = Connor–Davidson Resilience Scale, JSTA = Job Stress Assessment Tool, TWBS = Teacher Well-Being Scale

3.4 Distribution of Anxiety Levels by Major Variables

In terms of anxiety, 41.5% experienced anxiety (mild: 25.1%, moderate: 10.0%, and severe: 6.4%). Among them, anxiety was more common in females (45.4% versus 34.4% for males, $P < 0.001$) and in general positions (43.4% versus 37.0% in managerial positions, $P = 0.004$).

The proportion of complaints about anxiety differed by age group (the highest, 40s; the lowest, 60s; $P < 0.001$) and years of employment (the highest, 5 to 15 years; the lowest, less than 5 years, $P = 0.002$) (Table 4).

Table 4 Distribution of anxiety levels (measured by GAD-7) across significant variables.

Variables		No. of teachers	With anxiety (%)	p-Value	Mild ^a (%)	Moderate ^b (%)	Severe ^c (%)
Total		2,322	41.5		25.1	10.0	6.4
Gender	Male	811	34.4	<0.001	21.9	8.1	4.3
	Female	1,511	45.4		26.8	11.1	7.5
Age, year	20–29	191	34.0	<0.001	18.8	9.9	5.2
	30–39	644	43.9		25.8	11.5	6.7
	40–49	733	45.7		27.4	11.1	7.2
	50–59	665	38.3		24.4	8.1	5.9
	60–69	89	30.3		20.2	5.6	4.5
School	Middle school	1,041	43.0	0.210	35.6	11.0	6.4
	High school	1,281	40.4		24.7	9.3	6.4
Position	Managerial ^d	675	37.0	0.004	23.3	8.1	5.6
	General ^e	1647	43.4		25.9	10.8	6.7

Years of employment	≤5	471	37.6	0.002	21.9	10.4	5.3
	<5 and ≤15	750	46.7		27.9	10.9	7.9
	<15	1,101	39.8		24.6	9.3	5.9
Marital status	Single	657	41.7	0.835	25.5	9.7	6.5
	Married ^f	1,665	41.1		24.0	11.0	6.1
Religion	Yes	1,210	41.8	0.857	25.5	10.4	5.9
	No	1,112	41.3		24.7	9.6	7.0
Average monthly household income (1,000,000 won)	≤1 and <3	368	46.3	0.889	20.7	15.5	10.1
	≤3 and <5	614	40.9		27.7	8.6	4.6
	≤5	1,340	40.6		25.1	9.2	6.3
Experience of confirmed COVID-19 diagnosis ^g	Yes	85	40.1	0.143	22.4	11.8	5.9
	No	2,237	41.5		25.1	10.0	6.4

Notes: GAD-7 = Seven-Item Generalized Anxiety Disorder, ^aMild: 5–9 points, ^bModerate: 10–14 points, ^cSevere: 15–21 points, ^dPrincipal, vice-principal, and senior teacher, ^eOrdinary teacher, temporary teacher, and others, ^fCases in which changes occur in marriage relationship due to separation, divorce, and bereavement, among others, ^gTeachers or their family have been diagnosed with COVID-19, COVID-19 = coronavirus disease 2019.

3.5 Distribution of Depression Levels by Major Variables

We noted depression in 40.4% of the participants (mild: 23.6%; moderate: 14.0%; severe: 2.8%). Among them, depression was more common in females (43.9% versus 33.7% in males, $P < 0.001$) and general positions (42.3% versus 35.70% in managerial positions, $P = 0.003$).

The proportion complaining about depression was significantly different by age group (the highest, 40s; the lowest, 60s; $P < 0.001$), years of employment (the highest, 5 to 15 years; the lowest, less than 5 years; $P = 0.019$), and average monthly household income (the highest, 1,000,000 to 3,000,000 won; the lowest, more than 5,000,000 won; $P = 0.006$) (Table 5).

Table 5 Distribution of depression levels (measured by PHQ-9) across significant variables.

Variables	No. of Teachers	With depression (%)	<i>p</i> -Value	Mild ^a (%)	Moderate ^b (%)	Severe ^c (%)	
Total	2,322	40.4		23.6	14.0	2.8	
Gender	Male	811	33.7	<0.001	21.5	9.7	2.5
	Female	1,511	43.9		24.8	16.2	2.9
Age, year	20–29	191	36.7	<0.001	20.4	12.6	3.7
	30–39	644	43.5		25.6	15.4	2.5
	40–49	733	45.9		25.5	16.6	3.8

	50–59	665	34.2		21.7	10.5	2.0
	60–69	89	25.8		15.7	10.1	0.0
School	Middle school	1,041	41.8	0.204	24.8	14.7	2.3
	High school	1,281	39.1		22.7	13.3	3.1
Position	Managerial ^d	675	35.7	0.003	21.3	12.0	2.4
	General ^e	1,647	42.3		24.6	14.8	2.9
Years of employment	<5	471	37.8	0.019	20.6	14.4	2.8
	≤5 and <15	750	44.5		26.1	15.5	2.9
	≤15	1,101	38.6		23.3	12.7	2.6
Marital status	Single	657	39.4	0.164	23.5	13.1	2.8
	Married ^f	1,665	42.6		23.9	16.1	2.6
Religion	Yes	1,210	39.2	0.280	22.2	14.2	2.8
	No	1,112	41.6		25.2	13.7	2.7
Average monthly household income(1,000,000 won)	≤1 and <3	368	47.3	0.006	21.7	20.7	4.9
	≤3 and <5	614	41.1		26.4	13.4	1.3
	≤5	1,340	38.1		22.9	12.4	2.8
Experience of confirmed COVID-19 diagnosis ^g	Yes	85	43.5	0.690	30.6	8.2	4.7
	No	2,237	40.3		23.4	14.2	2.7

Notes: PHQ -9 = Nine-Item Patient Health Questionnaire, ^aMild: 5–9 points, ^bModerate: 10–19 points, ^cSevere: 20–27 points, ^dPrincipal, vice-principal, and senior teacher, ^eOrdinary teacher, temporary teacher, and others, ^fCases in which changes occur in marriage due to separation, divorce, and bereavement, among others, ^gTeachers or their family members have been diagnosed with COVID-19, COVID-19 = coronavirus disease 2019.

3.6 Factors Influencing Anxiety and Depression in Teachers Who Experienced Unbearable Stress

The study conducted a logistic regression test on 1,006 teachers who experienced unbearable stress during the COVID-19 pandemic to determine the factors affecting their anxiety (GAD-7 score) and depression (PHQ-9 score). It identified the following characteristics: being female (OR: 1.52; $P < 0.001$), years of employment (≤5 and <15; OR: 1.36; $P = 0.042$; reference: <5), average monthly household income (≤3,000,000 and <5,000,000; OR: 0.69; $P = 0.012$; ≤5,000,000: OR: 0.67; $P = 0.005$; reference: ≤1,000,000 and <3,000,000 won), depression (OR: 19.14; $P = 0.000$), PTSD symptoms (OR: 11.65; $P = 0.000$), job stress (OR: 9.13; $P = 0.000$), resilience (OR: 0.37; $P = 0.000$), and subjective well-being (OR: 0.45; $P = 0.000$).

The following factors predicted depression: being female (OR: 1.51; $P < 0.001$), being in their 40s (OR: 1.70; $P = 0.003$; reference: aged 20s), average monthly household income (≤3,000,000 and <5,000,000; OR: 0.75; $P = 0.049$; ≤5,000,000: OR: 0.66; $P = 0.002$; reference: ≤1,000,000 and <3,000,000 won), anxiety (OR: 19.14; $P = 0.000$), PTSD symptoms (OR: 4.03; $P = 0.000$), job stress (OR: 14.04; $P = 0.000$), resilience (OR: 0.29; $P = 0.000$), and subjective well-being (OR: 0.33; $P = 0.000$; Table 6).

Table 6 Factors influencing anxiety and depression in teachers with unbearable stress after the COVID-19 pandemic.

Variables		OR (95% CI)	P-value
FACTORS INFLUENCING ANXIETY			
Gender (ref: male)	Female	1.52 (1.27–1.86)	<0.001
Aged (ref: 20s)	30s	1.28 (0.87–1.89)	0.217
	40s	1.41 (0.90–2.23)	0.138
	50s	1.17 (0.71–1.91)	0.541
	60s	0.88 (0.46–1.70)	0.706
Position (ref: managerial ^a)	General ^b	1.24 (0.10–1.53)	0.051
Years of employment (ref: <5)	≤5 and <15	1.36 (1.01–1.82)	0.042
	≤15	1.24 (0.86–1.80)	0.248
Average monthly household income (1,000,000 won) (ref: ≤1 and <3)	≤3 and <5	0.69 (0.51–0.92)	0.012
	≤5	0.67 (0.50–0.88)	0.005
Depression (ref: ≤ PHQ-9 score 4 ^c)	≤5	19.14 (15.49–23.66)	0.000
PTSD symptoms (ref: ≤ PC-PTSD score 1 ^d)	≤2	11.65 (4.25–31.95)	0.000
Resilience (ref: ≤ CD-RISC score 92 ^e)	<92 score	0.37 (0.31–0.44)	0.000
Subjective well-being (ref: ≤ K-TWBS score: 35 ^f)	<35 score	0.45 (0.38–0.53)	0.000
Job stress (ref: ≤ JSAT score: 39 ^g)	<39 score	9.13 (7.48–11.14)	0.000
FACTORS INFLUENCING DEPRESSION			
Gender (ref: male)	Female	1.51 (1.26–1.82)	<0.001
Aged (ref: 20s)	30s	1.40 (0.99–1.95)	0.055
	40s	1.70 (1.20–2.41)	0.003
	50s	1.13 (0.79–1.63)	0.504
	60s	0.82 (0.46–1.46)	0.497
Position (ref: managerial ^a)	General ^b	0.89 (0.72–1.09)	0.260
Average monthly household income (1,000,000 won) (ref: ≤1 and <3)	≤3 and <5	0.75 (0.57–1.00)	0.049
	≤5	0.66 (0.51–0.86)	0.002
Anxiety (ref: ≤ GAD-7 score: 4 ^h)	≤5	19.14 (15.49–23.66)	0.000
PTSD symptoms (ref: ≤ PC-PTSD score: 1 ^d)	≤2	4.03 (2.18–7.46)	0.000
Resilience (ref: ≤ CD-RISC average score: 92 ^e)	<92 score	0.29 (0.24–0.35)	0.000
Subjective well-being (ref: ≤ K-TWBS average score: 35 ^f)	<35 score	0.33 (0.27–0.39)	0.000
Job stress (ref: ≤ JSAT score: 39 ^g)	<39 score	14.04 (11.28–17.46)	0.000

Notes: ^aPrincipal, vice-principal, and senior teacher. ^bOrdinary teacher, temporary teacher, and others. ^{c, d, e, f, g, h}The mean scores of all participants are set as cut-off values.

Ref. = reference value, PHQ-9 = Nine-Item Patient Health Questionnaire, PC-PTSD = Primary Care Post-traumatic Stress Disorder Screen, CD-RISC = Connor–Davidson Resilience Scale, TWBS = Teacher Well-Being Scale, GAD-7 = Seven-Item Generalized Anxiety Disorder, COVID-19 = coronavirus disease 2019, JSTA = Job Stress Assessment Tool, OR = odds ratio, CI = confidence interval

4. Discussion

This study conducted an in-depth data analysis from a survey of middle and high school teachers in Daegu City, South Korea, who experienced a significant COVID-19 outbreak before its declaration as a pandemic. The findings indicate that COVID-19 had a multifaceted effect on teachers' mental health.

In general, the participants were middle and high ($n = 1,281$; 55.2%) school teachers with more females, mainly aged in their 30s–50s, more regular teachers than managers, 79.9% working for more than five years, more married people, more non-religious people, and 84.1% (57.7% more than 5 million won) with an average monthly household income of more than 3 million won. Regarding COVID-19, 3.7% of them or their family members were confirmed cases.

The study classified stressful situations with higher-than-usual stress levels as unbearable stress, defined operatively as psychological and physical reactions caused by a current daily or work–life situation beyond one's control. The participants who experienced unbearable stress displayed significantly higher average scores for anxiety, depression, PTSD symptoms, and job stress and significantly lower average scores for resilience and teachers' well-being, which indicate that they were well classified as stressed.

The study found that the proportion of participants who reported experiencing unbearable stress before the COVID-19 pandemic reached 15.8%, which increased to 43.3% at the peak and reached 33.1% after school reopening, even after the spread subsided. Compared with before the COVID-19 pandemic, the number of teachers who experienced unbearable stress during the peak of the COVID-19 contagion nearly tripled. After school reopening at the time of the survey, it had not recovered to the usual level. Thus, in professions known to experience high levels of stress, such as teachers, the pandemic may potentially worsen or trigger psychiatric pathologies and negative feelings [8]. We also administered the survey [11] to students at the same school during the same period using a questionnaire with the same operational criteria. Using data derived from students, the percentage of students who experienced unbearable stress was 9% before the COVID-19 pandemic, which increased to 16% at the peak and then decreased to 12.7% at the time of the survey [11, 20]. Thus, teachers are under much higher levels of stress than students.

At the peak of the COVID-19 contagion, the most common reasons were unusual experiences, fear of infection, and negative emotions. During the COVID-19 pandemic, fear of disease, increasing numbers of cases and deaths, loss of livelihood, sanitary measures (social restrictions and lockdowns), and lack of economic income imposed a complete change to the environment, which substantially affected the mental health of the population [3]. The spread of COVID-19 was particularly threatening to individuals from low socioeconomic levels, resulting in increased psychological distress and, in severe cases, leading to suicide, thereby contributing to an increase in the suicide rate [21]. During school closure due to COVID-19, teachers experienced difficulty adapting quickly from face-to-face to online teaching [5]. Changes in work without adequate training for the new teaching modality generated an unprecedented challenge for education professionals, such as the difficulty of using digital platforms, lack of resources for teaching remote classes, work overload, and excessive use of screens [22].

The three leading causes of unbearable stress experienced by teachers immediately after school reopening were fear of infection, unusual experiences, and working environments; COVID-19 created many challenges for teachers. Returning to school amid the uncertainty of COVID-19

exacerbated these fears, exposing students and teachers to potential infection. Teachers were at the forefront of daily efforts to monitor and prevent the spread of the virus among themselves and their students. In the case of married teachers, infection at school increased the risk of spreading it to their families. In addition, teachers needed to quickly adapt to an entirely different educational environment before the COVID-19 outbreak. They mainly pointed out the difficulty in acquiring the qualifications and skills required for new information and communication technologies, workload, social support, work-family role conflict, and new learning strategies [5, 6]. These factors led to excessive burden, fatigue, and burnout for teachers [8, 10]. Although Amri et al. [23] had few participants and targeted only elementary school teachers through a survey in April and May 2020, they reported that 54% of the teachers were in states of burnout (mild: 38%, moderate: 12%, and severe: 6%).

During school reopenings, the proportion of participants with unbearable stress was high for females in their 30s in general positions, with five to 15 years of work experience, and COVID-19 confirmed cases for teachers and their family members. This study found that these variables are risk factors for experiencing excessive stress, considered related to gender and disease experience vulnerability, and excessive work. When schools reopened in May–June 2020, the average score of the participants for anxiety (GAD-7) reached 4.71 ± 5.32 , which was within the normal range; however, the current study identified anxiety in 41.5% of teachers (25.1% mild, 10.0% moderate, and 6.4% severe levels), which was higher than in students (12.3% mild and higher levels) [11, 20]. In other words, more teachers experienced anxiety than did students at the same time.

In June 2020, Daegu Metropolitan City sampled 1,000 citizens and conducted an online mental health survey [24]. The results revealed the average GAD-7 score was 6.2 points, noting anxiety in 57.2% of citizens (mild: 33.3%, moderate: 16.2%, and severe: 7.7%). In May 2020, a national mental health survey of 1,002 individuals across the country produced an average GAD-7 score of 4.2 in 39.8% of respondents (mild: 24.0%, moderate: 9.4%, and severe: 5.6%) [25]. At that time, Daegu City had the most widespread infection in the country, so the average anxiety level in Daegu was higher than the national average. Although the number of respondents is small compared with the total population in Daegu City and the country, and the study presented response bias and online surveys as limitations, the proportion of teachers who complained of anxiety is lower than Daegu citizens and slightly higher than the entire nation. Researchers conducted a comparable study after school reopenings in Spain [26] with a mental health survey of 1,633 teachers of compulsory and non-compulsory education (from nursery education to university studies) in various education centers (public and private) in September 2020. Using the Depression Anxiety and Stress Scale-21, the study found that 49.5% of teachers suffered from anxiety [26]. Regardless of whether schools reopened, a systematic review on school mental health released between 2020 and 2022 highlighted the prevalence of GAD symptoms among teachers, which ranged from 38.4% to 73% between studies [8].

Levels of anxiety were high in females, those in general positions, and those aged in their 40s and working for five to 15 years. Our study proposes that these variables are risk factors for anxiety, considered related to gender vulnerability and excessive work. The results of linear regression analysis of variables significantly related to anxiety suggest that depression, PTSD symptoms, job stress, being female, working for five~15 years, and having a lower average monthly household income are risk factors, while resilience and subjective well-being act as protective factors for anxiety. In the general population, studies found an association between lower socioeconomic status,

including financial insecurity, and higher anxiety and psychological issues [21]. Systematic studies found a significant association between the occurrence of GAD symptoms in females, fear of infection, concerns about the course of the pandemic, problems in school communication for facilitating a smooth transition between face-to-face and remote teaching, and the deficient development of technologies [8].

The average score for depression (PHQ-9) was 4.80 ± 5.66 , within the normal range; however, we noted depression in 40.4% of teachers (mild: 23.6%, moderate: 14.0%, severe: 2.8%). Among the students [11, 20], PHQ-9 scores indicated that 19.8% displayed mild or high levels of depression, which stated that more teachers experienced depression than did students at the same time. Based on data from Daegu Metropolitan City [24], the average PHQ-9 score was 7.5 points, with anxiety observed in 59.3% of citizens (mild: 27.1%, moderate: 26.7%, and severe: 5.5%). A national survey on mental health [25] had an average PHQ-9 score of 5.1, and 41.3% of respondents with depression (mild: 22.7%, moderate: 16.5%, and severe: 2.1%) indicated depression. Thus, the current study's results align with those of other studies. In the data from Spain [26], 32.2% of the teachers reported suffering from depression. A systematic review illustrated the prevalence of depressive symptoms among teachers, which ranged from 38.4% to 73% between studies [8]. Thus, teachers' levels of emotional distress, such as anxiety and depression, were lower than those of residents, similar to the national population, where the spread of infection was less severe and not as high as in other countries. Despite the uncertainty surrounding infection risks and the burden of a heavy workload, this outcome might be attributable to a comprehensive approach by the school response system, drawing from past experiences with infectious disasters such as SARS in 2003, H1N1 in 2009, and MERS in 2015. This approach involves rapid and accurate dissemination of information, integrated support systems from local governments and education offices, teachers' dedication, and local community cooperation [5, 11, 20].

Levels of depression were high for females and those in general positions, aged in their 40s, working for five to 15 years, and with average monthly household income of 1,000,000–3,000,000 won. This study found that these variables are risk factors for experiencing depression, which relates to gender vulnerability, excessive work, and economic burden. The results of linear regression analysis of variables significantly associated with depression suggest that anxiety, job stress, PTSD symptoms, being in their 40s, being female, and having a lower average monthly household income are risk factors; resilience and subjective well-being act as protective factors for depression. Systematic studies found a significant association between the occurrence of depression and high levels of stress, professionals' psychological states (e.g., levels of mental resilience, fear of COVID-19, and social, emotional, and instrumental support), changes in social relationships with spouse and family, and changes in work aspects (e.g., increased working hours, need for distance learning, and job instability) [8].

This study has its limitations. First, given its cross-sectional design and the lack of follow-up, the study faces challenges in tracking changes over time, establishing causality, evaluating long-term effects, and ensuring the sample's representativeness, ultimately compromising the depth and generalizability of its findings. The second pertains to the reliability of online surveys, response bias, and respondent attitudes toward the survey. These factors may introduce uncertainties and affect the accuracy and validity of the study's findings. Third, although schools were sampled at a specific percentage by district, the response rate was not high, and there are differences by district and variations in academic achievement, environment, and resources available to each school. Therefore,

caution is needed to generalize the results to Daegu City. Fourth, asking questions spaced across three points may pose limitations regarding retrospective memory. It includes issues with memory accuracy, recall bias, memory reconstruction, temporal inconsistencies, variability across individuals, and limited precision. These factors can also introduce inaccuracies, biases, and variability in the data, affecting the reliability and validity of study findings.

The data used presents the following characteristics. First, schools were closed in February 2020 due to COVID-19, and we surveyed within one to two months after schools reopened in May, which reflects the conditions of the initial outbreak of COVID-19 in 2020. Second, with the cooperation of the DMOE, the study targeted middle and high schools throughout the city. Third, the sample reflected various city characteristics with the selection of three to seven schools (in proportion to the number of schools per district) from each of the eight districts of Daegu. Fourth, the number of participants is relatively large. The final analysis included 1,041 middle and 1,281 high school teachers. Lastly, studies that analyzed the psychological effects of the COVID-19 pandemic on teachers in Korea are lacking thus far, which is a significant strength of this study.

However, the findings pose substantial practical implications. First, disseminating and establishing a context-specific system for psychological support for schools during crises are highly desirable. When teachers are increasingly responsible for student management, establishing a psychological support system during emergencies is urgent in response to the spread of COVID-19 in schools. Second, identifying vulnerable teachers during the COVID-19 pandemic and accordingly providing screening support are necessary initiatives. By closely monitoring the psychological state of teachers, practical measures may prevent burnout. If teachers are stable, then students are also stable. Third, implementing countermeasures according to changes in teacher duties or roles due to the COVID-19 pandemic is crucial. For example, not all teachers are proficient in teaching and conducting online lectures. As job stress is an essential factor that influences psychological distress, providing opportunities for continued competency development is required. Fourth, economic factors are a vital risk factor during crises, necessitating emergency support for teachers with financial issues. Finally, teachers need to take care of themselves. The era of remote learning triggers social disconnection, which leads to increased stress. Thus, subjective well-being through self-care is essential. Therefore, providing programs to teachers and students can improve resilience.

5. Conclusion

This study indicates many emotional difficulties experienced by teachers in Daegu since the COVID-19 pandemic. A significant number of teachers experienced unbearable stress and emotional crises during its peak and beyond, which caused anxiety and depression. Risk factors influencing anxiety and depression among teachers experiencing unbearable stress due to the COVID-19 pandemic include emotional distress, being female, job-related stress, having worked for five to 15 years, being in their 40s, and having a lower average monthly household income. Conversely, we identified resilience and subjective well-being as protective factors. These findings indicate that during the spread of an infectious disaster such as COVID-19, teachers face psychological vulnerability due to increased workload and general risks like fear of infection and social isolation. Consequently, the government has implemented a systematic teacher support system to address infection disasters at the school level. This system aims to screen vulnerable teachers early from the onset of the spread and implement step-by-step, personalized preventive measures, including work

coordination, technical support, psychological assistance, and economic support.

Acknowledgments

The authors thank Professor Chang-gu Huh and his research team, the Department of Psychology at Daegu Catholic University, for conducting the online survey and for their technical assistance in this study. We would also like to extend our gratitude to Yeseul Noh and Ji Young Seo for their efforts and dedication while working at the Daegu Suicide Prevention Center. Additionally, We are grateful for the support and cooperation of the officials at the Daegu Metropolitan Office of Education, particularly Superintendent Eun-hee Kang.

Author Contributions

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Funding

The 2020 Research Budget from the Daegu Student Suicide Prevention Center supported this research, with approval from the Daegu Metropolitan Office of Education.

Competing Interests

All authors declare no potential conflicts of interest.

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