ORIGINAL RESEARCH ARTICLE

Mental Health Outcomes and Their Correlates in The Post-COVID-19 Era Among University Students and Staff in Indonesia

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ABSTRACT

Background: The COVID-19 pandemic has profoundly affected global health, particularly mental health in academic communities. While its impact on mental health is well-documented, studies on the post-pandemic "new normal" remain scarce. This study examines the prevalence and factors linked to anxiety, depression, and QoL among Indonesian university students, lecturers, and staff post-pandemic.

Methods: This cross-sectional study examines the impact of risk factors on anxiety, quality of life, and depression among university students, staff, and faculty post-Covid-19 vaccination. An online website link was sent to the participants comprising instruments such as PHQ-2, WHOQOL-BREF and GDS. Chi-square tests were used for bivariate analysis, and multivariate logistic regression modelled associated factors.

Results: Poor QoL, depression, and anxiety were reported by 51.68%, 40.83%, and 44.19%, respectively. Unmarried individuals and those without a COVID-19 booster had higher odds of poor QoL (AOR: 3.32; 1.62). Unmarried individuals also faced greater depression risk (AOR: 2.56), while females and those with unvaccinated family members were more prone to anxiety (AOR: 2.42; 1.50).

Conclusion: This study highlights mental health challenges post-pandemic, especially for those with incomplete vaccination and limited social support. It emphasizes the need for targeted interventions and complete vaccination to boost resilience in academic settings.

Keywords: COVID-19, mental health, quality of life, anxiety, depression, academic community, post-pandemic

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INTRODUCTION

Starting in early 2021, the novel coronavirus disease (COVID-19) has become a pandemic that affects the health and welfare of world society with millions of cases and deaths all over the world.[1] Various intervention strategies have been applied to reduce COVID-19 cases by restricting human mobility and contact, such as prohibition of travel and social contact, social distancing, and lockdown, but none of them successfully eliminated COVID-19 spread.[2] Finally, the introduction of the COVID-19 vaccine followed by a vaccination campaign program at the end of 2020 and early 2021 has significantly reduced the case fatality rate and the emergence of new cases.[3]

The World Health Organization (WHO) estimated that the COVID-19 pandemic has increased mental health problems worldwide. This is seemingly due to decreased human mobility and increased COVID-19 potential infection in the society during COVID-19 pandemic.[4] Currently, COVID-19 is on the edge of reverting back to the pre-pandemic era. The term "new normal" was introduced to reflect post-pandemic socio-economic restoration.[5] At the end of 2020, the majority of Indonesian households experienced a dramatic decrease in financial income compared to early 2020.[6] Due to the burden of the covid-19 affecting households' income, the households have been reported to experience stressed, depressed and unhappy condition.[6] However, this finding seems to be contradictory with the Indonesian economic growth rate that increases steadily between 2020-2022.[7] Therefore, this paradox indicates interpreting factors associated with mental health problems are quite challenging.[4]

There are various studies reporting mental health cases during the COVID-19 pandemic setting.[8–15] It was reported that COVID-19 survivors experience a considerable psychological impact with decreased quality of life.[16–18] Multiple factors have been identified and associated with mental health outcomes during the COVID-19 pandemic.[10,12,13] Unfortunately, study assessing mental health problems and its associated factors post-pandemic COVID-19 is hardly accessible. This gap is particularly pronounced in research concerning the academic community, which has shown heightened concerns during and after the pandemic.[19] Therefore, it is essential to examine how various aspects influence mental health in the academic community. Members of this community may face continuous pressure from their professional activities in addition to personal challenges, especially in the post-pandemic era. These insights may uncover factors that could inform the development of sustainable mental wellbeing interventions objected to this community.

Mental health problems increase steadily each year world-wide. The aggression of the COVID-19 pandemic seemingly complicates mental health situation. Previous research only discovered mental health problems and their associated factors during the COVID-19 pandemic. However, there is a limited study that reveals the mental health problems during a post-pandemic situation where the "new normal" term has been applied. Additionally, based on previous research that found the academic community has a high urgency of concern, in this research we specifically focus on the academic community setting.[19] We aim to fill this gap by examining the long-term impacts of the COVID-19 pandemic on mental health within this group, hypothesizing that the academic community faces unique challenges in post-pandemic mental health outcomes that have yet to be fully understood. Therefore, the primary objective of this study is to identify and analyze the factors contributing to mental health problems in the academic community during the post-pandemic period.

METHODOLOGY

Study Design: This research is an epidemiological study with *cross-sectional* approach to assess the relationship between risk factors and the level of anxiety, quality of life and depression among university students, lecturers and employees after Covid-19 vaccination program. The risk factors were referred to the demographic characteristics of study participants. The study provided a snapshot of mental health outcomes in these population after the vaccination program.[20] Its advantage allows to capture the immediate impact and risk factors that can create an informed-targeted interventions and support strategies in the academic setting. This method was chosen for its practicality, cost-effectiveness, and ability to reach a large, geographically dispersed population within a short timeframe. An online website link comprising the questionnaire was then sent to the participants.

Setting: The research was conducted in three cities in Indonesia namely Surakarta, Semarang and Yogyakarta. A university in each location was taken to conduct this research, namely Universitas Muhammadiyah semarang (UNIMUS) in Semarang city, Universitas Muhammadiyah Surakarta (UMS) in Surakarta city and Universitas PGRI Yogyakarta (UPY) in Yogyakarta city. These universities were selected based on the availability of desirable data. These universities represent a cross-section of academic communities in urban Indonesia, providing a diverse participant pool that enhances the generalizability of the findings.

Study Population: Population in this research was academic community (lecturers, employees and students) from a university in Surakarta, Semarang and Yogyakarta. The selected universities were UNIMUS in semarang city, UMS in Surakarta city and UPY in Yogyakarta city. Every research subject was obligated to fill informed consent in order to participate.

Inclusion and Exclusion Criteria: Lecturer, student, or employee resided in UMS/UNIMUS/

UPY who were vaccinated for Covid-19 infection (either completely or partially vaccinated) and willing to participate in the research were included in the study.

The student is already graduated at the time this research is conducted and those who moved away to other university at the time this research is conducted were excluded from the study.

Sample Calculation was calculated by using formula $n= = \frac{(Z^2 P\ (1-P))}{d^2}$ where, n is the number of samples, Z is Level of confidence, P is hypothetical Prevalence, and d is allowable error. Based on previous information, reinfection prevalence in the Covid-19 survivors is 25% (0.25). The level of confident used in this research was 95% with 4% precision. With this information, the required number of samples that need to be collected is 284. With additional 10%, thus the number of samples is 300.

Variables and Measurements

Reinfection: Reinfection was defined as a positive result of COVID-19 antigen swab testing in survivors who had been vaccinated.

Risk Factors: Risk factors were defined as demographic and other variables that might statistically influence the levels of QoL, anxiety, and depression among COVID-19 survivors.

Mental Health Variables: Three mental health variables were measured: anxiety, QoL, and depression.

Anxiety: It is defined as the intensity and frequency of bothersome of anxiety symptom that the participants have been felt. The measurement of anxiety was based on patient health questionnaire-2 (PHQ-2) with modification to reflect COVID-19 post-pandemic situation.[21] The questionnaire is self-administered with scaling system which is consisted of 9 questions. The scaling system was a Likert scale ranging from 0 (not at all in a couple of days) to 3 (every day). The median score of all items was used to categorize the anxiety among participants (yes (above median) or no (below median)). The modified PHQ-2 was piloted for validity and reliability in a small sample of participants prior to the full-scale study.[22]

Quality of Life (QoL): QoL is a perception of individuals regarding their goals, expectations, standards and concerns as defined by WHO. The QoL in academic community in this research was measured using the WHO quality of life BREF (WHOQOL-BREF) with minor modification which comprised of 26 items that is categorized into 4 domains (physical health, psychological, social relationship and environment).[23] Each question has a Likert scaling system ranging from 1 (very bad, very unsatisfied, not at all or never) to 5 (very good, very satisfied, in excessive quantities, fully experienced or always). The individual values of each respondent were then converted into a new scale based on WHOQOL-BREF transformation scale standard by summing the values into a scale from 0 to 100[17], the higher transformed values represent a preferable quality of life. The median score of items over all domain was used to calculate the QoL level of the participants. Scores were subsequently classified into three levels of QoL such as Poor (<mean-SD), fair (between mean-SD to mean+SD) and good (>mean+SD).[24]

Depression: It is a depressed feelings of the participants regarding Covid-19 stressor. The assessment of depression among study participants used a modified short-form Geriatric Depression Scale (GDS) questionnaire which comprised of 7 questions.[25] The answers of the questions used a Likert system which have scales between 0 (not at all) to 3 (almost every day). The scores were then categorized into two group (yes or no) using a median score (above median or below median).

Analysis: Descriptive analysis was used to depict sociodemographic characteristics of the study participants, anxiety scores, QoL scores and depression scores which includes frequency, percentage and 95% CI. A relationship between sociodemographic characteristics and anxiety, QoL and depression status was carried out using A chi-square test. The significance of correlated factors was depicted by exhibiting the value of odds ratios (OR) along with its 95% confidence interval (CI). The final model of significantly associated factors was assessed using multivariate logistic regression.[26]

Ethical Clearance: This research was approved by the Ethical Commission of the Universitas Muhammadiyah Surakarta Review Board under the ethical clearance number: 4304/B.2KEPK-FKUMS/VI/2022.

RESULTS

The total number of samples included in the final analysis were 387 from three cities in Central Java and Yogyakarta provinces. According to demographic characteristics of the included samples (**Table 1**), the majority of the samples were females (73.39%). Due to the location of the study was in universities, the majority of respondents' education (77.78%) were bachelor or above. In this study, 81.14% of the respondents were either lecturers or academic staff, while the rest of the respondents (18.86%) were students. The marital status of the respondents was mostly single (86.82%). There is only 19.38% of the samples that have previously been infected with Covid-19. However, based on family history on Covid-19 infection, 39.02% of the family members of the respondents have ever been infected with Covid-19. Most of the samples (97.67%) were vaccinated for Covid-19 infection. Although, only half of the vaccinated respondents (54.01) have taken booster vaccination.

The quality of life among respondents is 48.32% good and 51.68% bad (**Table 2**). Detailed QoL scores

Table 1: Baseline of Respondents

Variable	Respondent (%)
Sex	
Male	103 (26.61)
Female	284 (73.39)
Education	
Elementary/Senior High School	86 (22.22)
Bachelor/Master/Doctoral	301 (77.78)
Occupation	
Lecturer/Academic Staff	314 (81.14)
Student	73 (18.86)
Marital Status	
Married	51 (13.18)
Single	336 (86.82)
Ownership of Health Insurance	
No	123 (31.78)
Yes	264 (68.22)
History of COVID-19 Infection	
Never	312 (80.62)
Ever	75 (19.38)
History of COVID-19 Infection in Family	
Never	236 (60.98)
Ever	151 (39.02)
History of COVID-19 Vaccination	
Not Yet Vaccinated	9 (2.33)
Vaccinated	378 (97.67)
Vaccination Status	
Booster	209 (54.01)
Second Dose Only	178 (45.99)
History of Vaccination in Family	
All Family Members Vaccinated	315 (81.4)
All Family Members Not Vaccinated	14 (3.62)
Only some family Members Vaccinated	58 (14.99)

Table 2: Prevalence of Outcome

Variable	Respondent (%)	95% CI
QoL		
Good	187 (48.32)	0.43 – 0.53
Bad	200 (51.68)	0.46 – 0.57
Depression		
No	229 (59.17)	0.54 – 0.64
Yes	158 (40.83)	0.36 – 0.46
Anxiety		
No	216 (55.81)	0.51 – 0.61
Yes	171 (44.19)	0.39 – 0.49

across domains show that the psychological domain had the lowest mean score (39.33 ± 11.59), indicating significant distress in this area (**Table 3**). There are several demographic characteristics that have been associated with quality of life among included respondents (**Table 4**). Occupation was associated with bad QoL with P value <0.001 where lecturers and academic staffs have 2.42 odds ratio. Unmarried individuals are more likely to have bad QoL with OR and P value of 3.67 and <0.001, respectively. Naïve individuals with no history of previous Covid-19 infection have OR of 1.92 to have bad QoL (P value 0.013). Those who are vaccinated but without booster (only 2nd dose) have higher percentage of bad QoL (OR: 1.80, P value: 0.004).

The depression prevalence among sampled respondents is 40.83% (**Table 2**). There are only two demographic factors associated with depression (**Table 5**). The first demographic factor was occupation where lecturers or academic staffs were more likely to be depressed compared to students (OR: 1.92, P value: 0.021). The other factor is marital status where the majority of depressed people are unmarried individuals (OR: 2.82, P value: 0.004).

The prevalence of people who have anxiety in the sampled respondents is 44.19% (**Table 2**). Sex and history of Covid-19 vaccination in family members are the only demographic variables found to be associated with anxiety (**Table 6**). Females have a greater number of anxieties in this study with OR of 2.40 (P value: <0.001). On the other hand, individuals whom all family members have not yet received vaccination have a higher number of anxieties in this study with OR of 1.54 (P value: 0.030).

Multivariate analysis (**Table 7**) revealed that marital status (95% CI; 1.69-6.51) and Vaccination status (95% CI; 1.07-2.45) were associated with QoL. On the other hand, sex (95% CI; 1.05-2.80) and marital status (95% CI; 1.26-5.21) were associated with depression.

Finally, sex (95% CI; 1.48-3.94) and history of Covid-19 vaccination in family members (95% CI; 0.53-0.97) were associated with anxiety in this study.

Table 3: Mean±SD Median and Categorized QoL from Each Domain Among Respondents

Domain	Mean ± SD	Median	QoL	Respondent (%)
Physical	55.25±11.78	56	Poor	77 (19.9)
			Fair	242 (65.5)
			Good	68 (17.6)
Psychological	39.33±11.59	38	Poor	287 (74.16)
			Fair	94 (24.29)
			Good	6 (1.55)
Social Relationship	50.81±19.38	50	Poor	139 (35.92)
			Fair	154 (39.79)
			Good	94 (24.29)
Environment	60.32±14.92	56	Poor	52 (13.44)
			Fair	199 (51.42)
			Good	136 (35.14)

Table 4: Factors Associated with QoL (Simple Logistic Regression – Bivariate)

Variable	N	% of Bad QoL	OR	P Value	95% CI
Sex					
Male	103	49.51	1	0.608	0.72 – 1.77
Female	284	52.46	1.3		
Education					
Elementary/Senior High School	86	55.81	1	0.385	0.50 – 1.31
Bachelor/Master/Doctorate	301	50.50	0.81		
Occupation					
Student	73	34.25	1	<0.001	1.42 – 4.12
Lecturer/Academic Staff	314	55.73	2.42		
Marital Status					
Married	51	25.49	1	<0.001	1.89 – 7.14
Single	336	55.65	3.67		
Ownership of Health Insurance					
No	123	58.54	1	0.066	0.43 – 1.27
Yes	264	48.48	0.67		
History of COVID-19 Infection					
Ever	75	38.67	1	0.013	1.15 – 3.22
Never	312	54.81	1.92		
Vaccination Status					
Booster	209	44.98	1	0.004	1.20 – 2.70
Second dose only	178	59.55	1.80		

Table 5: Factors Associated with Depression (Simple Logistic Regression – Bivariate)

Variable	N	% of Depression	OR	P Value	95% CI
Sex					
Male	103	30.10	1	0.010	1.16 – 3.04
Female	284	44.72	1.88		
Education					
Elementary/Senior High School	86	38.37	1	0.600	0.70 – 1.86
Bachelor/Master/Doctorate	301	41.53	1.14		
Occupation					
Student	73	28.77	1	0.021	1.10 – 3.33
Lecturer/Academic Staff	314	43.63	1.92		
Marital Status					
Married	51	21.57	1	0.004	1.40 – 5.70
Single	336	43.75	2.82		

Table 6: Factors Associated with Anxiety (Simple Logistic Regression – Bivariate)

Variable	N	% of Anxiety	OR	P Value	95% CI
Sex					
Male	103	29.13	1	<0.001	1.48 – 3.90
Female	284	49.65	2.40		
History of Vaccination in Family Member					
All family members have been vaccinated	315	46.35	1	0.030	0.54 – 0.97
All family members have not been vaccinated	14	57.14	1.54		
Only part of family members has been vaccinated	58	29.31	0.48		

Table 7: Multiple Logistic Regression – Multivariate

Variable		cOR	aOR	P Value	95% CI
Factors Associated with Anxiety	Sex	2.40	2.42	<0.001	1.48 – 3.94
	History of Vaccination in Family Member	1.54	1.50	0.028	0.53 – 0.97
Factors Associated with QoL	Marital Status	3.67	3.32	<0.001	1.69 – 6.51
	Vaccination Status	1.80	1.62	0.023	1.07 – 2.45
Factors Associated with Depression	Sex	1.88	1.71	0.031	1.05 – 2.80
	Marital Status	2.82	2.56	0.009	1.26 – 5.21

cOR – Crude Odds Ratio; aOR – Adjusted Odds Ratio

DISCUSSION

This study explores the mental health outcomes in the academic community during the post-pandemic era, focusing on the prevalence of low quality of life (QoL), depression, and anxiety, and their associated factors. The findings reveal important insights into the ongoing mental health challenges faced by individuals even after the COVID-19 vaccination program has been widely implemented.

Quality of Life (QoL): Our findings indicate that a significant proportion of the academic community experiences poor QoL (51.68%), with key factors influencing this outcome being marital status and vaccination status (**Table 2, Table 4**). The association between incomplete vaccination and lower QoL aligns with prior studies that have demonstrated the mental health benefits of vaccination, primarily through the reduction of fear and anxiety related to COVID-19 infection.[27,28] Unvaccinated or partially vaccinated individuals may continue to feel vulnerable, which negatively impacts their overall well-being and quality of life.

Interestingly, this study found that unmarried individuals are more likely to experience poor QoL, with an odds ratio of 3.67 compared to their married counterparts. This result contradicts some earlier studies that suggested unmarried individuals may have more flexibility and fewer responsibilities, leading to higher QoL.[29] However, our findings support research indicating that marriage provides emotional support and stability, which are critical for mental health.[30] The complexity of this relationship suggests that marital status interacts with various other factors, such as economic stability and household dynamics, which were not fully explored in this study but merit further investigation.[31]

Furthermore, Sri Wahyuni Imron et all[32] found that logotherapy could significantly improve the quality of life in patients with chronic health conditions, such as stroke. This indicates that psychological interventions may also be beneficial for the broader population, including those who are unmarried and at higher risk of poor QoL.

Depression: The prevalence of depression among the study participants was 40.83%, with gender and marital status being significant predictors (**Table 2, Table 5**). Consistent with existing literature, our study found that females are more likely to experience depression than males.[33] This gender disparity in depression could be attributed to several factors, including greater stress, caregiving responsibilities, and hormonal differences that predispose women to depression.[34] Moreover, our findings emphasize the protective role of marriage against depression. Married individuals had lower odds of depression compared to unmarried individuals (OR: 2.82, P = 0.004). This is consistent with studies showing that marriage offers emotional and social support, which mitigates stress and reduces the risk of depression.[35] The presence of a spouse can provide a buffer against the psychological stressors associated with the pandemic, highlighting the importance of social connections in mental health.

Anxiety: Anxiety was prevalent in 44.19% of respondents, with significant associations found with gender and family vaccination status (**Table 2, Table 6**). Our study corroborates previous research indicating that females are more prone to anxiety.[36] The higher levels of anxiety observed in women could be due to increased vulnerability to stressors, both biologically and socially.[37] Additionally, Anxiety could affect sleep quality and trigger insomnia, and long-term insomnia can worsen a person's anxiety condition.[38] Anxiety was also proven to have a relationship with insomnia and poor sleep quality in university students.[39] This suggests that anxiety related to COVID-19, particularly in the context of family vaccination status, may exacerbate sleep disturbances, further impacting mental health.

Multivariate Logistic Regression Analysis: The multivariate logistic regression analysis presented in **Table 7** provides critical insights into the factors that independently influence QoL, depression, and anxiety in the academic community during the post-pandemic period. By controlling for multiple variables simultaneously, this analysis allows us to identify the most significant predictors of mental health outcomes, highlighting the complex interplay between demographic factors and mental well-being.

Quality of Life (QoL): The analysis reveals that marital status and vaccination status are significant predictors of QoL. Specifically, unmarried individuals have a higher likelihood of experiencing poor QoL (Adjusted OR: 3.32, 95% CI: 1.69-6.51), which similar sound with some previous study that the lower of marriage quality, the lower of quality of life.[40,28] However, our results are more aligned with studies that emphasize the protective effects of marriage on mental health, particularly in times of crisis such as the COVID-19 pandemic.[30] The presence of a spouse may provide emotional support and stability, which are crucial during periods of heightened stress and uncertainty.

Vaccination status also emerged as a significant factor, with individuals who had only received the second dose of the COVID-19 vaccine, without a booster, being more likely to report poor QoL (Adjusted OR: 1.62, 95% CI: 1.07-2.45). This finding underscores the importance of complete vaccination in safeguarding not just physical health but also mental well-being. Recent studies have highlighted that individuals who are fully vaccinated, including receiving booster shots, experience reduced levels of anxiety and improved overall mental health compared to those who are not fully vaccinated.[28,41] The sense of protection afforded by full vaccination likely contributes to a more positive outlook on life and greater psychological resilience.

Depression: Regarding depression, the multivariate analysis indicates that gender and marital status are significant predictors. Females are more likely to suffer from depression than males (Adjusted OR: 1.71, 95% CI: 1.05-2.80). This finding is consistent with a large body of research showing that women are generally more prone to depression due to a combination of biological, psychological, and social factors.[32,33] Additionally, the role of marital status in depression is particularly noteworthy; unmarried individuals are at a higher risk of depression (Ad-

justed OR: 2.56, 95% CI: 1.26-5.21). The protective effect of marriage against depression has been well-documented, with studies suggesting that married individuals benefit from emotional support, companionship, and shared responsibility, all of which mitigate the impact of stress and reduce the likelihood of depressive symptoms.[35]

Anxiety: In the context of anxiety, both gender and family vaccination status were significant predictors. Females were found to be more susceptible to anxiety (Adjusted OR: 2.42, 95% CI: 1.48-3.94), which is consistent with existing literature indicating higher rates of anxiety disorders among women.[41] The impact of family vaccination status on anxiety is particularly interesting; individuals whose family members were not fully vaccinated had a higher likelihood of experiencing anxiety (Adjusted OR: 1.50, 95% CI: 0.53-0.97). This finding highlights the ongoing psychological impact of COVID-19, even in a post-pandemic world where the immediate threat has diminished. The fear of potential COVID-19 transmission within the family remains a significant source of anxiety, emphasizing the need for continued public health messaging and mental health support.[42-45]

Practical Implications and Policy Recommendations: The results of this multivariate analysis have several important implications for policy and practice. First, academic institutions should consider the differential impact of marital status and gender on mental health when designing support services. Programs that provide tailored mental health resources for unmarried individuals and women, who are at higher risk of poor mental health outcomes, could be particularly beneficial. Additionally, the findings underscore the importance of promoting full COVID-19 vaccination, including booster doses, as a means of enhancing not just physical immunity but also mental resilience.

Limitations and Future research

Despite the valuable insights provided by this study, certain limitations should be acknowledged. The cross-sectional design limits the ability to establish causality and observe the long-term effects of COVID-19 on mental health. Future research should employ longitudinal designs to better understand how these relationships evolve over time. Moreover, further investigation into the mechanisms through which marital status and vaccination status influence mental health could provide deeper insights into the factors that contribute to resilience or vulnerability in the face of public health crises.

Conclusion

This study highlights the significant and lasting impact of the COVID-19 pandemic on the mental health of the academic community, with a particular focus on quality of life (QoL), depression, and anxiety. The findings reveal that marital status and vaccination status are critical factors influencing these outcomes, with unmarried individuals and those who are not fully vaccinated being at higher risk for poor mental health. This study uniquely addresses the post-pandemic period, emphasizing the ongoing challenges faced by the academic community despite the widespread implementation of vaccination programs. The results suggest that while vaccination has helped reduce the physical threat of COVID-19, its psychological aftermath continues to affect many, particularly those with incomplete vaccination or lacking social support systems like marriage. This highlights the need for targeted mental health interventions and policies that address these vulnerabilities, particularly within academic settings. Overall, this study contributes to the growing body of literature on post-pandemic mental health, offering valuable insights for public health strategies aimed at improving mental resilience and well-being in the academic community. Future research should explore these relationships over time to better understand the long-term effects of the pandemic on mental health.

Recommendations

We recommend that academic community should be ensured to be fully vaccinated to hinder any physical threat from the disease. Secondly, in order to avoid mental health problems, the university must provide sufficient social support environment to guarantee mental health security for the academic staff.

Statement Availability of Data

The raw data of this research can be accessed by readers from zenodo by accessing the following: 10.5281/zenodo.14201542

No use of generative AI tools

We declare that no generative AI tools have been used to write the manuscript in any kind.

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