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Differences, relationships, and risks of using digital technology with depression, anxiety, and stress during the COVID-19 pandemic

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Abstract

Background: The COVID-19 pandemic highlighted the critical need for mental health resilience and digital inclusion, particularly among vulnerable populations. To draw lessons from the pandemic for future public health initiatives, this study examined the mental health status of middle-aged and older Indonesians and its associations with sociodemographic factors, comorbidities, grief experiences, and digital technology use.

Methods: This cross-sectional study was conducted during the second wave of the COVID-19 pandemic (September–October 2021). An online questionnaire collected data on sociodemographic variables, comorbidities, grief experiences, and digital technology usage. Mental health was assessed using the Depression, Anxiety, and Stress Scale-21 (DASS-21).

Results: From total 199 enrolled in this study, prevalence rates for depression, anxiety, and stress were 11.1%, 33.7%, and 19.5%, respectively. Depression was associated solely with marital status, while anxiety was influenced by marital status, comorbidities, and the use of digital technology for health information access (p<0.05). Stress was impacted by gender, marital status, comorbidities, and digital technology usage (p<0.05). Multivariate analysis confirmed that infrequent digital technology use predicted higher levels of depression and anxiety (aOR, 2.82, CI 1.14-6.96; 2.36, CI 1.26-4.43; p<0.05). Females, unmarried individuals (aOR, 2.38, CI 1.08-5.25; 2.37, CI 1.11-5.09; p<0.05), and those with comorbidities were at greater risk for mental health challenges (aOR, 3.92, CI 1.43-10.75; p<0.05). However, inadequate digital technology skills were linked to lower stress likelihood (aOR, 0.37, CI 0.144-0.95; p<0.05).

Conclusion: This study underscores the importance of bridging the digital gap and addressing social determinants to strengthen mental health resilience among middle-aged and older adults in Indonesia. Post-pandemic, integrating digital inclusion strategies into public health initiatives is vital for fostering equitable mental health outcomes.

Keywords: Aging, COVID-19, Digital Gap, Equality, Mental Health, Indonesia

Background

The COVID-19 pandemic's impact extended beyond health systems, causing socioeconomic disruption and unprecedented challenges for individuals, especially in regions with high COVID-19 prevalence and prolonged lockdowns [1,2]. Indonesia became the pandemic epicenter in Asia during the second surge of COVID-19 in June–September 2021, with Java Island being the most severely affected region [3,4]. The government implemented a "public activity restriction program" to swiftly flatten the curve of the disease [5]. Public critiques of this policy were significant due to concerns about the severe economic impact and resulting damage to well-being [6]. Given the escalating risk factors for mental disorders, it is anticipated that this period would likely lead to an increase in mental health problems [7]. While previous studies focused on mental health issues in healthcare workers, patients, and youths, there's a lack of research on middle-aged and older adults [8]. A qualitative study conducted in March–April 2022 revealed challenges experienced by the elderly that appeared to be caused by social disconnection and financial problems [9]. Middle-aged and older adults, often grappling with existing health vulnerabilities, faced heightened risks of depression, anxiety, and stress due to social isolation, grief, and limited access to healthcare [10]. Recognizing the mental health disparities within this demographic is important for developing resilience-focused public health strategies post-pandemic.

Governments worldwide made full use of digital technology to overcome the COVID-19 pandemic [11]. Studies on older adults suggested that video calling was potentially effective in reducing depressive symptoms related to loneliness, indicating that digital communication technologies can diminish barriers to social interaction [12]. Consequently, the use of digital technologies for health purposes accelerated at individual levels to enable access to health information and health services [13]. Despite the considerable benefits of digital technologies during the pandemic, a digital divide persists, particularly affecting middle-aged and older adults who often lack access and the necessary skills [14]. This issue may increase the problem of social isolation and the mental health consequences in this population. In the aftermath of the COVID-19 pandemic, understanding the impact of various risk factors on mental health becomes crucial for rebuilding public health and enhancing healthcare resilience [15]. While studies have highlighted risk factors such as female sex, younger age, marital status, social isolation, financial hardship, low educational level, and comorbidities contributing to anxiety in general populations, limited research focuses on the mental health status of middle-aged and older Indonesians during the peak of COVID-19 cases in Indonesia [16]. This study aims to fill this gap by examining the mental health of this demographic using the Depression, Anxiety, and Stress Scale-21 (DASS-21). Furthermore, it explores the digital divide in access to digital technology devices, utilization of digital technology for communication, and accessing health information and services, elucidating their associations with mental health.

Methods
Study design
This cross-sectional study was performed on September 4th to October 10th, 2021.

Inclusion and exclusion criteria
This study enrolled adults aged more than or equal to 45 years, residing in Java Island, Indonesia, who were fully conscious and could read and comprehend the Indonesian language. Those with an acute illness, a positive confirmed COVID-19 test, under self-quarantine, and/or suffering from severe mental illness and/or cognitive impairment were excluded.

Study tool
An online questionnaire was primarily shared via a public webinar about mental health in the elderly, and respondents completed and submitted the questionnaire independently or with the assistance of their close relatives. The questionnaire was developed and disseminated following the Checklist for Reporting Results of Internet E-Surveys (CHERRIES), using an online survey platform (www.surveyplanet.com) that disabled multiple submissions. Information for consent was provided on the first page and included the voluntary participation of respondents and anonymization of published data.

Sample size
The minimum sample size was 196 as determined according to http://www.raosoft.com/samplesize.html, with a 7% margin of error, 95% confidence level, and an unknown total population number of adults aged ≥45 living on Java Island. Samples were selected for convenience.

Measures
The questionnaire comprised three sections: 1) question on basic demographic information, COVID-19-related comorbidities, and grieving experiences due to the loss of close relatives during the COVID-19 pandemic; 2) measurement of mental health status using DASS-21; and 3) question on digital technology usage. Economic levels were categorized as low or average-high by regional minimum wage. Comorbidities defined as self-reported history of chronic conditions (e.g., hypertension, diabetes). For grieving experience, participants were asked if they had lost a family or relative during the pandemic. The measurement of mental health status was done using Indonesian version of the DASS-21 instrument which had already been tested for validity and reliability. DASS-21 comprises 21 items, with seven items each assessing depression, anxiety, and stress. Responses were rated on a 4-point Likert scale (0–3), and scores for each domain were summed. The results of the measurements were reported both as the scores of each mental condition categorized as normal, mild, moderate, severe, and very severe [8]. Questions on digital technology uses included the ability to use digital technology devices (by independent use, categorized as adequate, or with assistance from others, categorized as inadequate ability) and the use of digital technology for communication and access to health information and health service; the three latter items were provided with optional answers of frequently, infrequently, and never. Answers were then clustered into two groups (frequent and infrequent–never).

Statistical analysis
Response rates were presented as percentages for the categorical variables. DASS-21 score comparisons against sociodemographic factors, presence of comorbidities, grieving experience, and several aspects of digital technology usage were tested with the Mann–Whitney U test. Associations between mental health status and the proposed determinant factors were tested using Fisher's exact test. Multivariate logistic regression was run to identify predictors of mental health. Data analyses were performed using SPSS 21.0 (IBM, Chicago, IL). The significant level was set at $p < 0.05$.

Results
Characteristics of respondents
A total of 204 respondents visited the informed consent page. Five respondents declined participation, and the remaining completed the questionnaire; 199 responses were valid for further analyses. The completion rate was 97.1%. Respondent characteristics are presented in Table 1. Respondents age ranged 45-80 years, and 82 (41.2%) were elderly. They were predominantly women (72.9%), self-described as at average–high economic levels (86.9%), having at least a bachelor's degree (60.3%), and being married (81.4%). A considerable number of respondents had COVID-19 comorbidities (52.8%). A quarter of respondents reported having a grieving experience due to the death of a close relative during the COVID-19 pandemic. Most respondents could use digital technology devices independently (52.8%) or frequently used digital technology for communication (87.48%) and for access to health information (63.3%). Nevertheless, only 21.6% of respondents frequently used digital technology for access to health services.

Table 1. Characteristics of respondents (n=199)

Characteristics	n (%)
Age (min–max)	45–80
60 or older	117 (58.8)
Younger than 60	82 (41.2)
Gender	
Male	54 (27.1)
Female	145 (72.9)
Economic levels	
Low	26 (13.1)
Middle–high	173 (86.9)
Education	
Senior high school or below	79 (39.7)
Bachelor's degree or above	120 (60.3)
Marital status	
Married	162 (81.4)
Unmarried/Widowed	37 (18.6)
Having comorbidities	
Yes	105 (52.8)
No	94 (47.2)
Grieving experience	
Yes	50 (25.1)
No	149 (74.9)
Ability to use digital technology	
Adequate	105 (52.8)
Inadequate	94 (47.2)
Digital technology for communication	
Frequent	174 (87.4)
Infrequent	25 (12.6)
Digital technology for health information	
Frequent	126 (63.3)
Infrequent	73 (36.7)
Digital technology for health service	
Frequent	43 (21.6)
Infrequent	156 (78.4)
Depression	
Normal	177 (88.9)
Mild	15 (7.5)
Moderate	7 (3.6)
Severe	0 (0)
Very severe	0 (0)
Anxiety	
Normal	132 (66.3)
Mild	19 (9.5)
Moderate	40 (20.1)
Severe	6 (3.1)
Very severe	2 (1.0)
Stress	
Normal	175 (87.9)
Mild	13 (6.5)
Moderate	9 (4.5)
Severe	2 (1.0)
Very severe	15 (7.5)

DASS-21 measurement suggested 11.1%, 33.7%, and 19.5% of respondents reported depression, anxiety, and stress, respectively. No respondents reported having depression at severe or very severe levels (Table 1). Women had significantly higher stress scores than men. Unmarried respondents showed significantly higher depression, anxiety, and stress scores than married respondents. Respondents with comorbidities reported higher scores for all mental health problems than those without comorbidities; however, these were only significant for anxiety and stress (Table 2). Significant associations were found between the levels of depression, anxiety, and stress with gender, presence of comorbidities, and grieving experience. The proportions of variable levels of the mental conditions according to these factors are shown in Figure. 1.
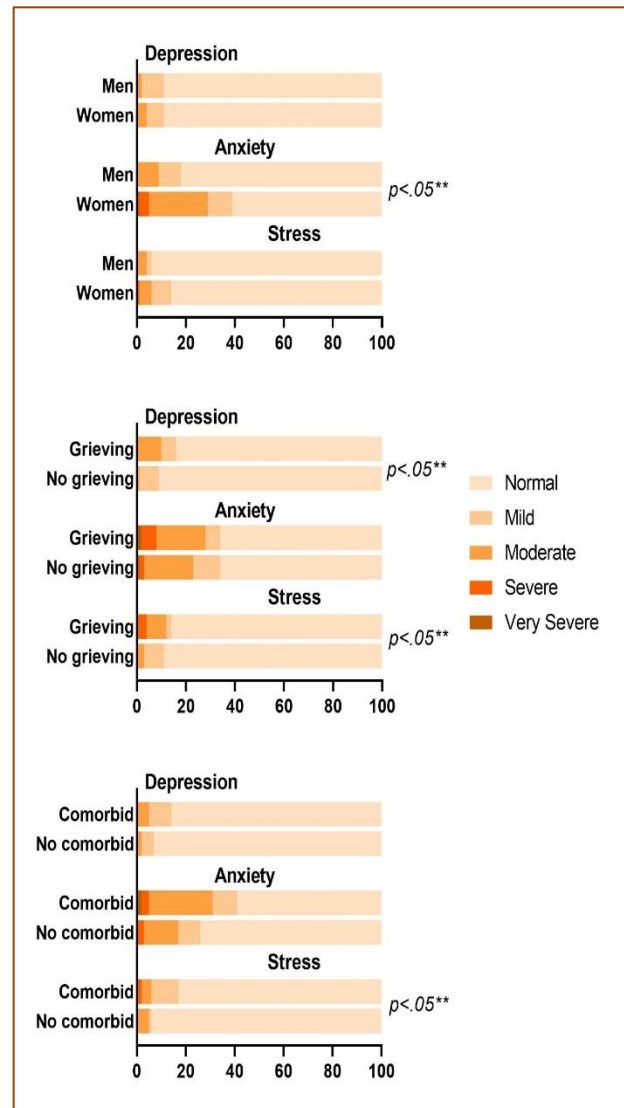

Figure. 1 The proportion of depression, anxiety, and stress levels according to gender, grieving experiences, and presence of comorbidities. p < .05** Fisher's exact test.

Women were at greater risk of having higher levels of anxiety. The presence of COVID-19 comorbidities placed respondents at greater risk of stress. Those who had grieving experiences were more prone to suffer from depression and stress. The respondents with inadequate ability to use digital technology tended to show higher anxiety and stress scores, although significant differences between the groups were absent. However, significance was only present regarding the use of digital technology for access to health information (Table 2).

Table 2. Comparison of DASS-21 scores according to sociodemographic factors, presence of comorbidities, grieving experience, and the uses of digital technology (N=199)

| Characteristics	Depression		Anxiety		Stress	
	Median (min–max)	p value	Median (min–max)	p value	Median (min–max)	p value
Age						
60 or older	2 (0–18)	0.298	4 (0–30)	0.193	8 (0–30)	0.803
Younger than 60	4 (0–16)		6 (0–22)		8 (0–24)	
Gender						
Male	4 (0–14)	0.943	4 (0–12)	0.054	6 (0–20)	0.042*
Female			6 (0–30)		10 (0–30)	
Economic level, n (%)	4 (0–18)					
Low	6 (0–12)	0.080	7 (0–14)	0.165	12 (0–20)	0.249
Average–high	4 (0–18)		4 (0–30)		8 (0–30)	
Education						
Senior high school or below	4 (0–16)	0.855	4 (0–16)	0.484	8 (0–24)	0.557
Bachelor's degree or above	4 (0–18)		6 (0–30)		8 (0–30)	
Marital status						
Married	2 (0–18)	0.027*	4 (0–30)	0.004*	8 (0–30)	0.032*
Unmarried/Widowed	4 (0–16)		8 (0–22)		12 (0–28)	
Having comorbidities						
Yes	4 (0–18)	0.124	6 (0–30)	0.003*	10 (0–30)	0.005*
No	3 (0–16)		4 (0–18)		6 (0–24)	
Grieving experience						
Yes	2 (0–18)	0.531	5 (0–30)	0.345	8 (0–22)	0.560
No			6 (0–22)		8 (0–30)	
Ability to use digital technology devices	4 (0–16)					
Adequate	4 (0–18)	0.831	4 (0–30)	0.198	6 (0–30)	0.449
Inadequate			6 (0–22)		8 (0–22)	
Digital technology for communication	4 (0–16)					
Frequent	4 (0–18)	0.381	4 (0–30)	0.806	8 (0–30)	0.287
Infrequent			6 (0–16)		8 (0–22)	
Digital technology for health information	4 (0–12)					
Frequent	2 (0–16)	0.059	4 (0–16)	0.031*	6 (0–24)	0.004*
Infrequent			6 (0–30)		12 (0–30)	
Digital technology for health service	4 (0–18)					
Frequent	2 (0–16)	0.075	4 (0–16)	0.248	6 (0–28)	0.171
Infrequent	4 (0–18)		6 (0–30)		8 (0–30)	

* < 0.05 (Mann–Whitney U Test
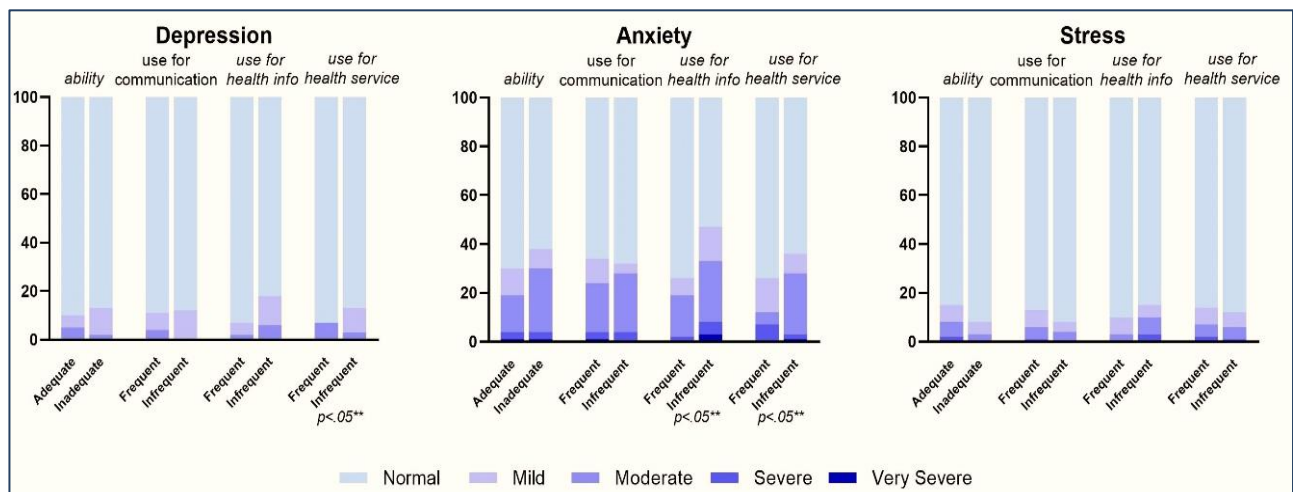
Figure. 2 The proportion of depression, anxiety, and stress levels according to digital technology use. p < .05** Fisher's exact test; infrequent = infrequent & never use

The proportions of the levels of mental health conditions against digital technology usage are presented in Figure. 2. The severity level of depression was associated with infrequent or no use of digital technology for access to health services. Infrequent or no use of digital technology for access to health information and health services were associated with a more severe anxiety level. Upon multivariate analysis, infrequent use of digital technology for access to health information predicted depression and anxiety (aOR, 2.82, CI 1.14-6.96; 2.36, CI 1.26-4.43; p<0.05). Females and unmarried individuals were more likely to develop anxiety (aOR, 2.38, CI 1.08-5.25; 2.37, CI 1.11-5.09; p<0.05). Having comorbidities posed individuals with a higher probability of developing stress symptoms (aOR, 3.92, CI 1.43-10.75; p<0.05). Inadequate ability to use digital technology devices was associated with less likeliness of developing stress (aOR, 0.37, CI 0.144-0.95; p<0.05).

Table 3. Multivariate analysis of significant factors associated with depression, anxiety, and stress (n=199)

Outcome Variable	Predictor	aOR	95% CI	p-value
Depression	Infrequent use of digital technology for health information	2.82	1.14–6.96	0.025*
Anxiety	Infrequent use of digital technology for health information	2.36	1.26–4.43	0.007*
	Female	2.38	1.08–5.25	0.032*
	Unmarried	2.37	1.11–5.09	0.026*
Stress	Having ccomorbidities	3.92	1.43–10.75	0.008*
	Inadequate ability to use digital technology devices	0.37	0.14–0.95	0.038*

*p < 0.05; aOR: adjusted Odds Ratio.

Discussion

This study found that the prevalence of depression and anxiety symptoms in middle-aged and older adults in Indonesia was lower than that previously reported by Yan et al [10] in the elderly in China during the first year of the COVID-19 outbreak, although the anxiety was higher in this study [10]. The second COVID-19 wave in Indonesia that drove the implementation of prolonged restrictions on public activity may be the primary factor for the development of mental health problems among respondents, with anxiety reported by one-third of them [9]. The scores for depression, anxiety, and stress did not significantly differ between middle-aged and older adults, although a higher resilience corresponding to psychological coping has been suggested for elderly individuals compared with that in younger ones [17]. However, this would be true when comparing with adolescents and early adult individuals since these age categories are recognized as being vulnerable to mental health problems during COVID-19 [18]. The results of this study paralleled those of other studies that found that women and individuals with chronic diseases were at greater risk for anxiety and stress [16,19]. The effects of female sex hormones on biological, behavioral, and cognitive pathways can predispose women to anxiety and stress disorders [20]. Whether this factor operates in postmenopausal respondents should pave the way for further research. Unmarried respondents in this study, reported higher scores for all DASS-21 subscales, and it was still a predicting factor for anxiety after adjusted analysis. Loneliness and grieving experiences could be moderating factors, as documented by a study on adults aged >50 years in the UK [21]. An infrequent use of digital technology for access to health information was a predictor for developing depression and anxiety symptoms. These results adding emphasis to the potential benefit of digital technology usage on the physical and psychological well-being of middle-aged and older adults [22]. The COVID-19 pandemic highlighted the longstanding age-based digital gap and even widened it. Thus, the elderly, who were disproportionately affected by both the virus and the lockdown measures, received the fewest benefits from digital solutions [14]. Respondents with inadequate digital technology skills struggled to effectively leverage it to mitigate the multiple impacts of the COVID-19 outbreak and related restrictions in their daily lives [23]. The associations among digital technology use for communication, access to health information, and health services suggested an interplay of these domains, serving as performance indicators of digital technology use in the elderly. Links between the COVID-19 pandemic and the digital technology revolution should help raise awareness of the critical importance of promoting digital inclusion, especially in the healthcare system, as one of the actions to address health inequity [24,25]. This study had several limitations. The cross-sectional design challenged the causal conclusion. Nonprobability sampling possibly created unrepresentative samples in this study, thereby complicating inferences to the population. Future studies on larger and more representative samples are necessary. However, this study successfully captured mental health conditions in middle-aged and older Indonesians during a critical period of the COVID-19 outbreak, complementing studies on mental health problems in Indonesian populations that have barely targeted these age categories.

Conclusion

This study established an association between mental health and the digital divide in the Indonesian middle-aged and older population, therefore, should be the basis for developing strategies to address mental health and digital gap problems in this population. The COVID-19 pandemic provided lessons on the necessity of incorporating digital technology into the health system and ensuring digital inclusion is provided to all age groups.

Abbreviation

CHERRIES: Checklist for Reporting Results of Internet E-Surveys; DASS-21: Depression, Anxiety, and Stress Scale-21

Declaration

Availability of data and materials
Data will be available by emailing nurina-h@fk.unair.ac.id

Authors' contributions
Nurina Hasanatuludhhiyah (NH) conceived and designed the analysis; collected the data; contributed data or analysis tools; performed the analysis; and wrote the manuscript. Brihastami Sawitri (BS) and Beny Aji Ifaudi Rahman (BAIR): conceived and designed the analysis; collected the data; contributed data or analysis tools; and wrote the manuscript. Atika Atika (AA) and Visuddho Visuddho (VV) contributed data or analysis tools; performed the analysis; and wrote the manuscript. Erikavitri Yulianti (EY) and Ancah Caesarina Novi Marchianti (ACNM) conceived and designed the analysis; collected the data; AND

wrote the manuscript. All Authors approved the final version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors read and approved the final manuscript.

Ethics approval and consent to participate

We conducted the research following the declaration of Helsinki. This study was approved by the Ethics Committee, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia (No 167/EC/KEPK/FKUA/2021). All participants provided informed consent before participation. To maintain confidentiality and anonymity, respondents were informed about the study's objectives, and details of informed consent were included on the first page of the survey. Participants were required to click the "BEGIN" button to indicate their consent before proceeding with the survey. Only aggregated data were analyzed and reported to ensure the anonymity of individual responses throughout the study.

Consent for publication

Not applicable

Competing interest

The authors declare that they have no competing interests.

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