



The Association between Workload of Frontline Health Workers and The Risk of Perceived Stress During COVID-19 Mass Vaccination: A Cross-Sectional Survey

Kholisotul Hikmah^{1*}, Helda¹, Gea Melinda², M. Ibraar Ayatullah³, Lucky Prisandy⁴

¹ Department of Epidemiology, Universitas Indonesia, Depok, West Java, Indonesia

² Department of Public Health, Graduate School of Health Sciences, Kobe University, Kobe, Japan

³ Department of Dental Health, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia

⁴ Department of Nursing, Poltekkes Kemenkes Pontianak, Pontianak, West Kalimantan, Indonesia

ARTICLE INFO

Article Type:
Research

Article History:

Received: 14 March 2025

Accepted: 27 March 2025

Published: 29 March 2025

***Corresponding author**

Email:

kholisotul.hikmah@ui.ac.id

ORIGINAL ARTICLE

ABSTRACT

The COVID-19 pandemic has had an unprecedented impact on mental health, and in particular on health workers on the frontlines of pandemic response efforts, particularly in the context of COVID-19 vaccination. This study aimed to highlight the association of workload and adverse stress impact on healthcare workers during COVID-19 mass vaccination and its contributed factors. The method use a cross-sectional survey using a web-based questionnaire was conducted from the end of July to the beginning of August 2021. Participants were selected from all health facilities in Indonesia, with the minimal sample size 345 required. Logistic regression was performed using STATA 16.0 to assess the association between workload and perceived stress. This study revealed that prevalence of perceived stress was 36.2% among total of 447 eligible subjects. Health workers who had high-relatively levels of workloads (OR=1.76; 1.00-3.09) and without history of stress diagnosis (OR=5.23; 1.06-5.87) were more likely to develop perceived stress. The high level of workload was associated inversely with a decreased risk of stress according to age and stress diagnosis. The conclusions is a decreased risk of stress associated with workload among health professionals.

Keywords: Workload, Psychological, Stress, COVID-19, Mass Vaccination.

ABSTRAK

Pandemi COVID-19 telah memberikan dampak yang belum pernah terjadi sebelumnya terhadap kesehatan mental, terutama bagi tenaga kesehatan yang berada di garis depan dalam upaya penanggulangan pandemi, khususnya dalam konteks vaksinasi COVID-19. Penelitian ini bertujuan untuk mengetahui hubungan antara beban kerja dan dampak stres yang merugikan pada tenaga kesehatan selama vaksinasi massal COVID-19 serta faktor-faktor yang berkontribusi terhadapnya. Metode yang digunakan adalah survei cross-sectional dengan menggunakan kuesioner berbasis web, yang dilakukan dari akhir Juli hingga awal Agustus 2021. Peserta dipilih dari seluruh fasilitas kesehatan di Indonesia, dengan ukuran sampel minimum yang dibutuhkan sebanyak 345 responden. Analisis regresi logistik dilakukan menggunakan STATA 16.0 untuk menilai hubungan antara beban kerja dan stres yang dirasakan. Hasil penelitian ini mengungkapkan bahwa prevalensi stres yang dirasakan sebesar 36,2% di antara total 447 subjek yang memenuhi syarat. Tenaga kesehatan yang memiliki tingkat beban kerja yang relatif tinggi (OR=1,76; 1,00-3,09) dan tidak memiliki riwayat diagnosis stres (OR=5,23; 1,06-5,87) lebih mungkin mengalami stres yang dirasakan. Tingginya tingkat beban kerja dikaitkan secara terbalik dengan penurunan risiko stres berdasarkan usia dan riwayat diagnosis stres. Kesimpulannya adalah adanya penurunan risiko stres yang terkait dengan beban kerja di kalangan profesional kesehatan.

Kata kunci: Beban Kerja, Psikologis, Stres, COVID-19, Vaksinasi Massal.

INTRODUCTION

Indonesia, which has become the epicenter of the COVID-19 pandemic, has taken various measures to respond to the COVID-19 pandemic, from emergency social restrictions, increased testing, tracing and treatment, and now targeting to achieve herd immunity. The government began its COVID-19 Vaccination Program on January 13, 2021 (Directorate General of Disease Prevention and Control, Ministry of Health of the Republic of Indonesia, 2021). It is split into four phases with healthcare workers receiving the first batch of vaccines, followed by public servants and other members of the public.

The COVID-19 vaccination in Indonesia is an ongoing mass immunization with all the challenges the government is now confronting. The authority targeted to vaccinate 70% of the population, around 208 million people in order to achieve herd immunity, however, the implementation is still far from that target. As of August 11, Indonesia has administered the first dose to 52,280,687 people and the second dose to 25,723,609 people, which is around 12% of the population (Ministry of Health of the Republic of Indonesia, 2021). The government determine to vaccinate around 70 million people by August or September 2021. It seems possible since the country is now beginning to be able to vaccinate 1 million people daily. This policy force an increasing burden on health workers as the frontline to assist the implementation of the Government's program. It is a major challenge to chase the target, consequently health workers start to feel under pressure due to the amount of work they have to get done.

Previous studies found that the limited number of health workers with increasing workload demands can threaten their physical and lead to long-term mental effects (Denning et al., 2021; Carbajal et al., 2020; Birhanu, 2018). Frontline clinical staff are 1.4 times more likely to feel dread of infection and twice more likely to experience anxiety and depression (Lu et al., 2020). During the national vaccination, it is reasonable for them to be afraid of getting infected with COVID-19 and bring the source of infection home to their relatives (Kuo et al., 2020). Those feeling becoming worse since a personal protective equipment is a must, based on an investigation concluded those who wear protective equipment all day reported significant higher stress scores (Chen, 2021).

Although a number of studies have been conducted to examine the workload among health workers during COVID-19 pandemic and its impacts on mental health, to the best of our knowledge there is none studies have explored the workload-related perceived stress during mass COVID-19 vaccination in Indonesia. Therefore, the goal of this study was to determine factors contributed to the workload and the level of perceived stress. It is also crucial to examine factors that may confound, such as history of illness, to be considered in the present study.

RESEARCH METHODS

This study employed a cross-sectional survey conducted from the end of July 2021 through August 2021 to investigate the relationship between workload and stress among frontline health personnel during the massive COVID-19 vaccination campaign. Data were collected through a web-based questionnaire, which was distributed via social media platforms, including Instagram, Facebook, Twitter, and WhatsApp. The questionnaire gathered information on socio-demographic characteristics (age, sex, marital status, family size, work period, work duration, and institution), COVID-19 history, stress diagnosis, smoking status, incentives, workload, fear perception, Personal Protective Equipment (PPE) discomfort, and perceived stress.

Participants were asked about their COVID-19 history, specifically whether they or their family members had been diagnosed with COVID-19 in the past month. Additionally, they were questioned about any previous diagnosis of stress, including anxiety and panic disorder, made by a doctor or health professional. Smoking status was assessed by asking respondents whether they had been active smokers in the past year, including the type of cigarettes used and their daily smoking frequency. The questionnaire also included questions on incentives to determine whether participants received any form of compensation during the COVID-19 mass vaccination program. Furthermore, respondents were asked whether they experienced fear of contracting COVID-19 while administering vaccinations. PPE discomfort was evaluated by inquiring about their level of comfort and perceived safety when wearing protective equipment.

Workload was measured using the NASA Task Load Index (NASA-TLX), which assesses six dimensions: mental demand, physical demand, temporal demand, performance, effort, and

frustration level (Longo, 2018). Participants were asked to compare each pair of factors for weighting purposes, resulting in a total of 15 comparisons. They then rated each of the six dimensions on a scale of 0-100, with the overall workload score calculated by multiplying the weights and ratings and dividing the sum by 15. Higher scores indicated a greater workload.

Perceived stress was assessed using the Perceived Stress Scale (PSS-10) developed (Baik et al., 2019). This scale measures the degree to which situations in one's life are appraised as stressful (Van Kraaij et al., 2020). Participants rated the frequency of stress-related thoughts and feelings over the past month using a five-point scale ranging from never (0) to very often (4). Total scores ranged from 0 to 40, with stress levels categorized as normal to mild (0-12), moderate (13-20), and severe (>20). For this study, a perceived stress score of ≥ 13 was classified as stress, while a score < 13 was considered normal. The internal consistency of the PSS-10 in this study was reported with a Cronbach's α of 0.78 (Yang et al., 2020).

The sample size was determined using the proportion sampling formula for a cross-sectional design (Kelsey et al., 1996). The confidence level was set at 95%, with an odds ratio of 1.4 and an assumed proportion of 50.9% for individuals with low-optimal workload developing stress. Based on these parameters, a minimum sample size of 345 was required to achieve 95% statistical power. In total, 475 eligible subjects completed the questionnaire, but 17 refused to participate, and 11 provided incomplete responses, resulting in a final sample size of 447. This ensured a statistical power of 97.4% with an alpha level of 0.05.

Statistical analyses were performed using STATA 16.0. Logistic regression was employed to estimate the odds ratio (OR) of perceived stress among frontline health workers based on their workload during the COVID-19 National Vaccination Program. Risk factors associated with workload were included in the logistic models. The OR estimates were compared with and without each factor, and if the inclusion of a factor changed the estimate by more than 10%, it was considered a confounder and included in the final model. The final model included age and stress diagnosis as confounding variables.

To minimize the risk of bias, only medical staff directly involved in COVID-19 vaccination efforts were included in the study. The hypothesis and study objectives were masked from both investigators and participants to prevent response bias. Ethical approval for the study was obtained from the Ethical Committee of the Faculty of Public Health, Universitas Indonesia (Approval Number: Ket-466/UN2.F10.D11/PPM.00.02/2021). Participants were fully informed about the study's purpose and had the opportunity to ask questions before providing written consent. Data collection was conducted anonymously, adhering to principles of confidentiality and privacy.

RESULTS

Present study was included 447 respondents in total. Most of them were female and were married. More than 80% of subjects was working less than or equal to 8 hours in a day and was employed in healthcare services. Furthermore, Table 1 showed a comparison of characteristics between respondents with result of PSS-10 was classified as stress and normal. Among respondents showed stress symptoms, the majority of them was aged 20-29 years old; female; married; has been working for less than 10 years; working less than or equal to 8 hours in a day; and working in healthcare services. Almost all of the respondents also never been diagnosed with stress.

Table 1. The risk of perceived stress in relation to workload.

Workload	Perceived Stress		OR (95% CI)
	Stress (n, %) n=162	Normal (n, %) n=285	
Low-optimal	106 (65.4)	203 (71.2)	Ref. ^a
Over	56 (34.6)	82 (28.8)	1.67 (1.06-2.63)
Workload classification	24 (14.8)	39 (13.7)	1.57 (0.86-2.86)
Moderate High	32 (19.8)	43 (15.1)	1.76 (1.00-3.09)

^aReference category for all ORs is low-optimal workload

Table 1 shows that the OR for over workload during mass COVID-19 vaccination was 1.60 (95% CI: 1.03-2.48). Among health workers with moderate workload, the OR was 1.43 (95% CI: 1.03-2.48), meanwhile the odds that perceived stress would occur given a high workload during mass vaccination was higher than moderate (OR=1.75; 95% CI: 1.01-3.01).

Table 2. Factors associated with perceived stress in relation to workload.

Factor	Workload					
	Moderate		OR (95% CI)	High		OR (95% CI)
Stress	Normal	Stress		Normal		
Age (year)						
20-29	9	7	0.94 (0.26-3.37)	13	9	0.93 (0.29-2.94)
30-39	9	16	0.43 (0.12-1.57)	10	15	0.49 (0.15-1.59)
40-49	4	15	0.21 (0.05-0.91)	8	15	0.36 (0.11-1.23)
50-59	2	1	1.57 (0.12-21.10)	1	4	0.19 (0.02-2.08)
Stress diagnosis						
Ever	2	36	1.16 (0.17-8.05)	6	4	2.07 (0.51-8.50)
Never	22	3	3.04 (1.07-8.63)	39	26	5.23 (1.06-5.87)

^aReference category for all ORs is low-optimal workload

Table 2 shows that the Data on workload and its level among those identified perceived stress and normal controlled by age and stress diagnosis are shown in table 3. The OR were less than 1.0 for all categories of workload level based on age, with the exception the OR was 1.57 among subjects 50-59 years, however the CI was generally wide. The OR were significantly reduced for high level of workload among health staff 30 years and older. Inverse results shown for the OR of stress diagnosis, which the OR were more than 1.0 for all categories. For those with stress diagnosis, the OR estimate for high level of workload was 2.07 (95% CI: 0.51-8.50), higher than for moderate workload. However, the smaller proportion of participants with stress diagnosis result in a wider confidence interval.

DISCUSSION

The present study showed a positive association between workload and perceived stress among health workers during COVID-19 national vaccination program. It was 34.57% among those identified over mental workload who had stress in their life during the Government instruction to vaccinate at least 70% of the total people in Indonesia no later than the end of this year. While the degree of mental workload varied across respondents' characteristics, major significant influence in increasing stress was noted. There was a suggestion of an increased risk among frontline health workers who involved in mass COVID-19 vaccination program for over workload. It has been identified that stress increases the risk in those with higher levels of workload.

Recall bias is an unlikely explanation for our findings, because, the collected data are consistent with the current state of affair where large-scale vaccination is still taking place. All questions in the questionnaire relate to the conditions experienced during the study, except perceived stress is measured based on the feeling that an individual has about how much stress they are under at over the last month. To reduce recall bias, this paper uses blinding research objectives and hypotheses for investigators and study participants.

The possibility of confounding from influences factors of workload should be concern, therefore, age of respondent and previous stress diagnosis are considered in this study. Previous findings stated that each person had response differences, the working atmosphere, age, smoking and alcohol consumption should be considered as risk factors for the development of moderate to significant mental workload (López-López et al., 2018; Miyake et al., 1997; Repon, 2021). Those aged ≥ 30 years old had a risk of mental workload 2.42 times (95% CI: 1.22-4.80), meanwhile this investigation found opposite results. Investigators found the participants who were aged 30 and older, and had heavy workload tend to have less risk of stress. The exception is the risk of health workers with moderate workload, those who were aged 50-59 had higher risk 1,57 times compared to those who had low-optimal workload. The data presented more than 50% of young healthcare workers surveyed by this study reported experiencing stress during their work on a massive vaccination. It has been shown that younger age groups were more vulnerable to stress and depression indications (Varma et al., 2021; Hikmah et al., 2020). It is

possible since adult can control themselves against work pressure and have more strategy to minimize stress compared to youngster. Stress diagnosis is also should be considered since previous finding a link between previous stress diagnosis and tendency of anxiety in the current pandemic (Hikmah et.al., 2020), however, the current study revealed an inverse association. The result showed the experience of having diagnosed with stress acts as a confounder and negatively impact in the association of workload and perceived stress. The prevalence of people with stress diagnosis is only 11%. Those who do not have experience suffering from stress tend to be at higher risk of subjective stress, both in those with moderate and high workloads. Therefore, confounders cannot be precluded since they contribute to the inverse correlation.

Of note, the vast majority of health workers were exposed to at least one risk factor for the mental workload in the work environment. However, the prevalence of over workload in this study is below half of the respondents. It is determined 30.87% among 447 health workers who were in charge of mass vaccination experienced over workload based on NASA-TLX scoring. Among those with over workload, it is estimated 54.3% identified as had high workload. Consequently, heavy workload could influence the performance of health workers from trigger human error and increase work stress (Wihardja et al., 2019; Yosiana et al., 2020). Excessive workload in doing their job to vaccine million people daily could degrade their performance to suboptimal level (Hernata et al., 2017). Mental distraction and fatigue during vaccination service are the impact of high workload. These conditions consequences weaken and disenable the performance of health workers, who are exposed to a greater risk of stress due to inadequate working demands (Carbajal et al., 2020). The impact on their stress are likely to be severe, forcing them to collapse and weaken immune system. There is bidirectional correlation between stress and the immune system and can affect each other (Bae, 2019). It is known that if stress could modify components of the immune response as well as confer vulnerability to adverse medical outcomes that are either mediated by or resisted by the immune system (Segerstrom, & Miller, 2004). If this condition persists without genuine management, it is possible cause an increasing the number of medical personnel getting infected COVID-19 although they have been vaccinated.

It is known that the pandemic has put the frontline healthcare workers in an unprecedented situation and work under intense pressure. According to *LaporCOVID-19*, a COVID-19 sharing information platform, across Indonesia, at least five specialists and one medical attendant have died due to COVID-19 in spite of being immunized. As the number of COVID-19 cases increasing, threaten health facility service collapse, the authority took real action to vaccine at least 70% of the total population. This policy is likely force the health workers to work harder and intense work schedule. This led to higher work stress on health staff as several previous studies have found positive association of workload and stress (Sandianto et al., 2018; Macdonald, 2003; Zhang et al., 2021). In the study that conducted in the midst of massive vaccination, it is also reasonable that over workload can encourage an increasing risk of stress and significantly lead to lower professional efficacy, injuries, accidents, and other health issues (Greenglass et al., 2003). In the UK, evidence suggested high workload, in particular tight deadlines, as the predominant cause of work-related stress, depression and anxiety (Health and Safety Executive, 2020). This study displayed consistent results with most found that the reduction of stress was related to low to optimal workload.

The effect of workload among health professional should not be underestimated. Individuals who experience an increase workload may put them in an increase emotional exhaustion and anger, as a result distress occur. Those with relatively high-stress levels consistently over a long period of time can cause chronic stress that depletes energy. A long-term stress can have serious consequences on human body and psychological function and nervous system (Yaribeygi et al., 2017; McEwen, 2006; McEwen, 2008). The long-term activation of the stress response system lead to overexposure to cortisol and other stress hormones. As a consequences, this develop high heart rate, dysfunctions on cardiovascular, diabetes, cancer, autoimmune syndromes and mental diseases such as depression and anxiety disorders (Mariotti, 2015; Van Kraaij et al., 2020).

It is fundamental to note that consideration of the health condition of the frontline resources is fatal for a nation to survive in the current uncertain state. Unmanaged workloads can put health workers at risk, particularly in the current pandemic. The high-level of workload as a strategy to achieve the minimum target of COVID-19 vaccination and the limited number of health workers who also have burdens other than vaccination must be taken into consideration in determining policies. If such conditions continue, their well-being becoming even worse. It is possible for health

services to collapse, as it was the concern that arose a few months earlier when a large number of cases hit Indonesia. It is important to pursue the percentage target of vaccination coverage, but it would be even better if the target was adjusted to the optimal capacity of health workers in the field. In addition, access to mental health counselling is critical to reduce the burden on minds and to relieve their stress as healthcare providers were continuously working in tense atmosphere and under threat of getting infected (Kumar & Nayar, 2020).

CONCLUSION

In summary, this study suggested a positive correlation between workload and perceived stress tendency among medical workers during COVID-19 mass vaccination, however age and previous stress diagnosis confound the association inversely and bias related to history of diseases was not taken into account. Further study addressing our limitation is needed to improve the power of study. Based on this results, we urge the policy makers to consider the mental health of healthcare workers affected by the workload during the pandemic. A proper working hours and counseling program could reduce their stress levels.

ACKNOWLEDGMENT

The authors would like to acknowledge the support of Universitas Indonesia and The Indonesia Endowment Fund for Education (LPDP), Ministry of Finance, Indonesia. The authors also thanks to all the participants who sincerely in completing the survey out of their tense workload and the significant contribution of enumerators from various healthcare providers.

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