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Workload Analysis of Rapid Response Team Regional Disaster Management Agency at The Support Command Post of the COVID-19 Task Force Special Region of Yogyakarta Indonesia

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Abstract

This Study evaluated mental workload of Rapid Response Team ((RRT) Regional Disaster Management Agency in Special Region of Yogyakarta as funeral team along COVID-19 pandemic. Mental workload is formed due to differences between individual abilities and performance demands of a task within a certain time. NASA TLX is the most widely used mental workload measurement, capable of being used in several levels of workload and sensitive to low workloads. The Rapid Response Team is a team to ensure that the disaster management process carried out quickly, accurately, skilled personnel to back up the medical team who continue to work hard so that the handling of the pandemic virus is better, and the virus does not spread. In this study, the subject of research is the funeral team of Rapid Response Team ((RRT) Regional Disaster Management Agency in Special Region of Yogyakarta Indonesia. Sampling data was collected online and offline using the Goggle Form in the range March-April 2021. There are 28 team members of the RRT who filled out the questionnaire. Workload assessment using the NASA-TLX and OWL methods falls within the range of medium (45.58458; 0.610535), high (74.73789; 0.739889), and very high (87.7969; 0.879976), with an average workload value of high (75.9935; 0.748672). Based on statistical tests using paired t-tests and one-way ANOVA, both methods are declared to be equivalent. The dimension that predominantly contributes to workload according to the NASA TLX method is Effort, followed by Mental Demands. Meanwhile, the factor that predominantly forms the workload according to the OWL method is S2 (Environmental Workloads, sub-factors: improper temperature, chemical exposure), followed by S3 (Body Motion and Postural Workloads, sub-factors: stooping, standing). The research findings offer manual guidance for workload identification, particularly utilizing OWL, serving as the foundation for workload assessment for teams involved in COVID-19, particularly in Indonesia. Additionally, this study also demonstrates that the OWL method possesses the same level of reliability as the NASA-TLX method.

Keywords: Workload, Pandemic COVID-19, RRT, NASA TLX, Overall Workload Level (OWL).

Introduction

The COVID-19 pandemic, the event that occurred for more than a year has caused many people to be infected, suffering leading to deaths. The rapid development of the virus, marked by the emergence of new variants such as the delta variant (B 1525, B117, E484 K), is considered more contagious, prompting many parties to remain vigilant, indicating that mutations are still occurring. With each new variant, the virus's infectiousness escalates, evident in the rising tally of COVID-19 cases. By June 2021, Indonesia had recorded 1,885,948 COVID-19 cases, with 53,373 fatalities, representing a mortality rate of 2.83%. This trend mirrors the situation in the Special Region of Yogyakarta, where the death rate among COVID-19 patients around 2.449%, based on 38,703 positive cases and 948 deaths as of April 27, 2021 (www. bnpb.com). The spread of the virus will lead to an increase in infected patients, potentially overwhelming healthcare facilities which make health teams and the government working together to ensure proper patient care and reduce the spread. One way to reduce transmission is to ensure that deceased individuals who tested positive for the virus are buried according to COVID protocols.

The Rapid Response Team is a team formed by Regional Disaster Management Agency of Special Region of Yogyakarta Indonesia to ensure that the disaster management process is carried out quickly, accurately, and by a team of skilled personnel to back up the medical team who continue to work hard so that the handling of the pandemic virus is improved, and the virus does not spread. Members of the RRT team are individuals who are trained in dealing with various types of disasters and sincerely carry out their duties. The soul's calling to serve humanity and sincerity in carrying out this task makes team members gain high respect from the community. although this is also commensurate with the high risk of the work carried out.

Job descriptions for the funeral team are the use of PPE; carrying out the funeral process with COVID-19 standards; decontaminating the burial area; decontaminating vehicles and equipment; and picking up from the hospital. The highly infectious nature of the virus requires the Rapid Response Team (RRT) to wear personal protective equipment (PPE) for extended periods (1-2 hours) per burial or 8-10 hours per shift, enduring heat due to limited air circulation and space constraints, and restricted movement. Additionally, caution is necessary when transporting bodies using ambulance vehicles to burial sites, handling the coffin carefully, and placing the coffin. The team also needs to decontaminate the area, vehicle, and equipment following a series of procedures. Apart from these, the high demand for COVID burials, which may occur at any time of day, poses pressure on team members, as they fear spreading the virus to family members. Based on the death data from April 27, 2021, with 5 administrative regions and 3 shifts, there would be approximately 63-65 bodies per shift, each comprising 20-25 individuals. The large role of the RRT team in dealing with the pandemic makes an assessment of the team's mental load (the level of workload, its dimensions, and the highest values) necessary so that it can be used as a basis for improving the disaster management system in Indonesia.

Garland and Robbins (2004) define mental workload as the gap that occurs between the needs of task performance and the individual's ability to meet the performance within a predetermined period. Mental burden arises because of a combination of task performance needs, time constraints, and the individual's resources (Emerson & MacKay, 2021). There are several subjective assessments in measuring mental load, such as: The Cooper-Harper Scale, SWAT (Subjective Assessment Technique), NASA-TLX (Task Load Index), Workload Profile, (Cao et al, 2009) and Overall Workload Level (OWL) (Jung & Jung, 2001). The National Aeronautics and Space Administration Task Load Index (NASA-TLX) is an assessment of mental workload using a 6-dimensional approach to measurement, that are: mental, physical, time, performance, stress, and effort (Hart & Lowell, 1988). NASA TLX is a mental workload assessment method that combines dimensions with the research subject's focus point, the assessment of subjects on mental, physical, and time constraints, task execution, and subject-task interactions, performance, level of effort, and frustration (Emerson & Mac Kay, 2021). NASA TLX is capable of being used at several levels of workloads, making it easier to analyze and more sensitive to low workloads (Hill et al, 1992). NASA TLX is one of the most widely used subjective workload measurements (Hart & Staveland, 1988; Hart, 2006; Huggins & Claudio, 2018).

For more than 20 years, NASA-TLX has been used to measure workload in some areas such as: aviation (Mansikka et al, 2006), healthcare (Huggins & Claudio, 2018; Bonfim et al, 2021., Sevinc et al, 2021., Hoogendoorn et al, 2023., Hoogendoorn et al, 2021., Chu et al, 2023., Lund et al, 2021), manufacturing (Khandan et al, 2018., Arellano et al, 2015), traffic (Fallahi et al, 2016; Janczewski et al, 2022). Research by comparing NASA TLX, MCH, and IBI in the world of aviation using the Flight Training Device proved that NASA TLX can identify workload levels and is positively correlated with MCH (Mansikka et al, 2006). Research on the mental burden of ICU nurses identifies the workload of nurses in the ICU using 8 other workload test instruments (TISS, APACHE, NAS, TOSS, PRN, OMEGA, SWAT, NASA-TLX). The study was conducted in eight hospitals and 21 ICU rooms in the Midwest, USA.

The results showed that NASA TLX was capable and valid in measuring the workload of nurses in the ICU (Hoonaker et al, 2011). Research on inpatient nurses in a hospital in Indonesia uses NASA TLX to determine whether there is an influence between gender and shift on workload and the value of male nurses' workload is greater than that of female nurses, with the night shift having the highest mental load value compared to the morning shift and afternoon (Paningkat & Farihah, 2014). While for ICU nurses, it was found that there was no difference in mental load between male and female nurses and the mental workload of nurses was at a high level (78.4) with the performance dimension (80.66) as the dimension with the highest mental workload (Ahmad F & Farihah, 2018). When viewed across dimensions, in colorectal surgery involving 122 procedures rated on a 20-point skill scale (0 = low, 20 = high), the perceived workload was highest for effort (mean [M] = 10.83, standard deviation [SD] = 5.66), followed by mental demand (M = 10) (Law et al, 2020).

NASA TLX has been proven valid in assessing mental workload in traffic tests (Janczewski et al, 2022). Workload research in Traffic has been proven that workload influenced by traffic density. In Iran, 16 operators underwent mental workload measurement while monitoring traffic density in a city traffic control centre. The research concluded that there was a higher mental workload during high traffic density compared to low traffic density (Fallahi et al, 2016). These findings align with research in the nuclear industry that aimed to explore the relationship between task complexity, knowledge, situation awareness, team situation awareness, and workload among six unlicensed operators and six licensed operators (including instructors), aged from 26 to 36 years old (mean = 29.3 and standard deviation = 3.2), in the main control rooms (MCRs) of nuclear power plants (NPPs). The operators were divided into three teams and conducted experiments on a steam generator tube rupture (SGTR) accident and a steam generator tube rupture plus loss of coolant accident (SGTR + LOCA), where SGTR was less difficult and SGTR + LOCA was more difficult. It was found that task complexity and the level of knowledge and experience significantly impacted the operator's workload. The higher the task complexity, the higher the operator's workload level, and the higher the knowledge and experience level, the lower the operator's workload level (Li et al, 2021).

In the field of education, the measurement of mental load was carried out on 59 respondents (85% female respondents, 15% male; 63% of respondents were in the age range of 18–26 years; 39 respondents used campus facilities during construction and 20 did not). The mental load measured on the respondent is the amount of mental burden of understanding the theory that has been agreed upon in advance. Respondents will be given 25 questions about the topic and given through the first learning method (offline). Then 25 questions will be given on the same topic using the second learning method (online). Respondents will be given an error explanation if there is an error in filling it out. The next stage is that respondents who have completed both learning methods are asked to fill out the NASA TLX questionnaire to determine the respondents' mental workload, and a significant difference is obtained between the two learning methods, with the online method having a higher mental load (Cao et al, 2009).

Overall Workload Level (OWL) is an approach to workload assessment that considers the characteristics of tasks (mental, physical), the environment, and working posture. The physiological effects of environmental factors in industrial conditions have been studied by numerous researchers, and the findings from these studies have been synthesized by Grandjean (1985). These include: (1) Physical job demand workloads (S1): workloads made from physical job demands in manual material handling, such as load weight, handling frequency, activity duration, and distance moved with a load. (2) Environmental workloads (S2): workloads formed from work environment, like improper temperature, lighting, noise, vibration, and exposure to chemicals (including dust and fumes). (3) Body motion and postural workloads (S3): workloads resulting from improper body motion and posture, including standing, stooping, squatting, and twisting. (4) Mental job demand workloads (S4): workloads arising from mental and perceptual activities required in performing a job, such as calculation, decision-making, communication, memory recall, visual attention, and information search (Jung & Jung, 2001).

Methods

In this study, the research subject is funeral team from Rapid Response Team ((RRT) Regional Disaster Management Agency in Special Region of Yogyakarta. The sampling methods used are snowball and purposive sampling. Snowball sampling is conducted based on willingness to participate and purposive sampling is conducted with the criteria that respondents are permanent members of the RRT team for at least one year (not volunteers) and in good health. Data collection is done using Google Forms and closed questionnaires. In this study, there are four main stages: determination of dimensional weights using AHP; assessment of dimensions with NASA TLX; assessment of weights and dimensions with OWL.

The first stage is to determine the dimensional weight of NASA TLX by making comparisons between its dimensions using the AHP method. The results of this weight assessment will be used as a multiplier in determining the overall mental load weight. The Analytical Hierarchy Process (AHP) is a decision-making method introduced by Saaty. This method aims to determine the priority of several criteria from several alternatives based on the judgment of the decision maker. This method uses a consistency test to ensure that pairwise comparisons between criteria made by decision makers are valid and consistent (Saaty, 1980).

In this section, respondents are asked to choose one of the two indicators that are felt to be more dominant in causing mental workload on the job. Pairwise comparisons were carried out on all dimensions expressed in the matrix A in each element a_{ij} (i,j = 1,2,....n), stating the weighting between criteria based on equation 1 (Amiri, 2010).

$$A = \begin{bmatrix} a_{11} \cdots\cdots\cdots & a_{12} \cdots\cdots\cdots & a_{1n} \\ \vdots & \vdots & \vdots \\ a_{21} \cdots\cdots\cdots & a_{22} \cdots\cdots\cdots & a_{2n} \\ \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots \\ a_{n1} \cdots\cdots\cdots & a_{n2} \cdots\cdots\cdots & a_{nn} \end{bmatrix} \quad a_{ii} = 1, a_{ji} = \frac{1}{a_{ij}}, \quad a_{ij} \neq 0 \qquad (1)$$

The next stage is the process of normalizing the assessment of each criterion to determine the relative weight of the dimensions. The relative weight value is expressed by the eigenvalue (λmax), where:

$$A_w = \lambda_{max} w \qquad (2)$$

If the pairwise comparison matrix is consistent, then the total weight of the criteria in the A matrix is 1, and max = n. While the weight value is obtained by normalizing each row and column, The consistency value is obtained by calculating the correlation between the assessments in the A matrix: aij x ajk = aik. The calculation of the consistency value (consistency index (CI)) is:

$$CI = (\lambda_{max} - n/n - 1) \qquad (3)$$

The value of the consistency ratio (CR) is obtained by comparing the consistency index with a predetermined random index. If the CR value exceeds 0.1, then the matrix is inconsistent. The consistency value states the consistency of decision makers' judgments in determining the weight of the criteria and the formation of the whole hierarchy (Wang et al, 2007).

The second stage is mental workload assessment using NASA TLX. There are 6 dimensions of mental workload measurement, which are stated in Table 1.

Table 1. Dimensions of NASA TLX.

Descriptor	Notation	Information
Mental Demand	MD	Activities required to: think, decide, count, see, remember and search. Work activities that are easy or demanding, simple or complex, demanding, or tolerable.
Physical Demand	PD	Physical activity required to: Push, pull, turn, control tools, activate tools. Work activities that are easy or demanding, quiet or tiring.
Temporal Demand	TD	The amount of pressure related to the time felt during the work. whether the job is demanding or not.

Descriptor	Notation	Information
Performance	P	How big is the level of success in the work and how satisfied with the results of achieving the work done.
Frustration	F	How much feeling stressed, insecure, hopeless, offended, disturbed, compared to feelings of security, satisfaction, comfort and self-satisfaction felt.
Effort	E	How much effort does it take to get the job done

Respondents were asked to rate the six indicators of mental load: MD, PD, TD, P, FR and EF. The rating given is subjective and depends on the mental burden felt by the respondent. The workload value is obtained by multiplying the rating by the weight factor for each descriptor. Thus, 6 workload values are generated for 6 indicators (MD, PD, TD, P, FR, and EF). Workload level categorize in low, medium, high and very high (Arellano et al, 2015).

The next stage is assessment workload using Overall Workload Level (OWL). Once these hierarchies have been established, a pairwise comparison matrix of each element within each level is constructed. Workload factor and sub factor can be seen at Table 2.

Table 2. Factor and Sub Factor of OWL.

Factor	Sub factor
Physical job demand workloads (S1)	Workloads that come from the demands of a physical job in manual part of materials handling. Sub factor: weight of a load, frequency of handling a load, duration of physical activity, moving distance with a load.
Environmental workloads (S2)	Workloads from a working environment (existing from unideal environment) Sub factor: improper temperature, lighting, noise, vibration, and exposure to chemicals (including dust and fumes)
Body motion and postural workloads (S3)	The workload that arises from the body movements required during activities Sub factor: improper body motion and posture in standing, stooping, squatting, twisting
Mental job demand workloads (S4):	Workloads caused by the mental and perceptual activity that is required in performing a job (e.g., calculating, thinking, deciding, communicating, remembering, looking, and searching)

Participants evaluate each factor or element in comparison to other factors within each sub-factor. Each sub-factor is interconnected with the one above and below it. A pairwise comparison matrix is established for workload factors/components such as physical job demands, environmental conditions, postural discomfort, and mental job demands. Based on the comparison matrix, the vector of priority weights can be calculated using the Analytic Hierarchy Process (AHP) method. To determine the overall workload level for each component (physical job demands, environmental demands, body posture, and body motion), the respective weighting factors for each contributing factor are multiplied by their corresponding workload levels and then summed up. Thus, the equation is as follows:

$$\hat{S}_{ij} = \sum_{j=1}^{3}\sum_{i=1}^{n} W_{ij}R_{ij}, \quad for\ R_{ij} > 0 \tag{4}$$

where $\hat{S}_{ij}$ indicates the workload level of total contributing factors for each workload component, W_{ij} represent priority weighting factors associated with n contributing factors, andR_{ij} denotes the value of the 5-point linguistic variable (i.e., 0.2, 0.4, 0.6, 0.8, or 1.0). The overall workload level will then be calculated by using the equation expressed as:

$$OWL = \sum_{i=1}^{3} W_i\hat{S}_i + W_4R_4 \tag{5}$$

Where $\hat{S}_i$ indicates the workload level of total contributing factors for each component workload (S1, S2, S3), Wi indicates respective priority weighting factors associated with n contributing factors, W4 denotes weighting factors for mental job demand workload, and R4 indicates the rating scale of S4. Classification for workload in very low (0.00-0.31), low (0.31-0.51), medium (0.51-0.67), High (0.67-0.84), Very High (0.84-1.00) (Jung & Jung , 2001).

Results

Respondent Characteristics Data

Data collection was carried out on The Rapid Response Team is a team formed by Regional Disaster Management Agency of Special Region of Yogyakarta Indonesia in March-April 2021. Data dissemination was carried out using the Snowball method, using the willingness and recommendations of previous respondents and purposive sampling is conducted with the criteria that respondents are permanent members of the RRT team for at least one year (not volunteers) and in good health.

The types of activities carried out by respondents were the use of PPE and preparation of the equipment used, picking up the bodies from the referral hospital to the burial site, burial of bodies according to health protocols, decontamination of the burial area, decontamination of personnel (team members, hearses, equipment used). Characteristics of respondents can be seen in Table 3.

Table 3. Respondent Data.

Gender	Respondent	Percentage (%)
Male	26	93
Female	2	7
Total	28	100

According to Table 3, there is a significant predominance of male respondents, accounting for 93% of questionnaire completions, while female respondents represent only 7% of the total.

Validity Test Results

A questionnaire test is conducted to show the extent to which the questionnaire measures the things to be studied in the research. Based on the validity test, it will be known whether the questions contained in the questionnaire meet the valid requirements to be used in research. Testing the validity of this questionnaire aims to see whether the statement variables can be understood by the respondents because the research questionnaire used is a language-interpreting questionnaire.

The data tested amounted to 28. The test was carried out using SPSS software. The results of the validity test, based on the Case Processing Summary table, show a total of 28 data points, and all of them are declared valid. The results of the inter-item correlation matrix show that there is no negative correlation.

There is no workload descriptor value in the Corrected Item-Total Correlation that has a negative correlation value, so this indicates that the direction of the coding of the questions (items) is opposite to the direction of coding for other questions (items). If the value of Cronbach's Alpha if Item Deleted is greater than the value of Cronbach's Alpha of the entire measurement scale, then the question item (item) must be deleted or revised.

Based on the results of SPSS processing, it shows the correlation value of an item with the total item (Corrected Item-Total Correlation) is greater than 0.463 (greater than the value of r table). Then it can be stated that H0 is accepted and H1 is rejected, so that all questions are accepted, and it can be concluded that all questions are valid.

Reliability Test Results

A reliability test is conducted to determine the extent to which the measurement results can be trusted or relied upon. Reliability testing using the Cronbach Alpha method. The level of reliability of the Cronbach Alpha method measured based on a variable construct is said to be good if alpha > 0.7. And for reliability testing, it is to test the questionnaire from each respondent to see whether it is reliable in answering the questionnaire. Based on the Reliability Statistics table, Cronbach's Alpha value is 0.781 out of 6 items analyzed. So, it can be concluded that the questioned items can be trusted.

Weighting using the AHP method

In this section, respondents are asked to compare the significance of the dimensions to other dimensions that they feel are more dominant in causing mental workloads on the work. Pairwise comparisons were performed on all dimensions expressed in matrix in every respondent. Paired matrix assessment from one respondent can be seen in Table 4.

Table 4. Comparison Matrix.

Comparison matrix						
	Mental	Physical	Effort	Performance	Frustration	Temporal
Mental	1	1	1	3	5	1
Physical	1.00	1	1.00	1.00	1.00	1.00
Effort	1.00	1.00	1	1.00	1.00	1.00
Performance	0.33	1.00	1.00	1.00	0.33	1.00
Frustration	0.20	1.00	1.00	3.00	1.00	1.00
Temporal	1	1	1	1	1	1
Total	4.533333	6	6	10	9.33	6

The next stage is normalization to form the same size in each dimension. The results of this normalization then, by using the equation, can be determined the weight of the dimensions and the consistency of the respondent's assessment. The results of weighted dimension calculation can be seen in Table 5 and 6.

Table 5. The results weighted dimension.

Dimension	Normalization								Weighted	
	Mental	Physics	Effort	Perform.	Frustration	Temporal	Total	EV	Aw	Aw/w
Mental	0.2206	0.1667	0.1667	0.3	0.535906	0.166667	1.5565	0.2594	11.223	7.2104
Physics	0.2206	0.1667	0.1667	0.1	0.107181	0.166667	0.9278	0.1546	6	6.4671
Effort	0.2206	0.1667	0.1667	0.1	0.107181	0.166667	0.9278	0.1546	6	6.4671
Performance	0.0735	0.1667	0.1667	0.1	0.03537	0.166667	0.7089	0.1181	4.325	6.101
Frustration	0.0441	0.1667	0.1667	0.3	0.107181	0.166667	0.9513	0.1585	6.1726	6.4886
Temporal	0.2206	0.1667	0.1667	0.1	0.107181	0.166667	0.9278	0.1546	6	6.4671
n	6									
CI	0.106712464									
RI	1.24									
CR	0.086058439									
Result	Consistent									

According to Table 5, can be stated that the mental dimension has the highest weight that can form the workload in doing this work, which is 0.259416. The next dimension which has a lower weight is frustration of 0.15855.

while the other three dimensions, physical, effort, and temporal demand, have the same weight, which is 0.154628. The dimension that has the lowest weight is performance with 0.11815. Meanwhile, in the consistency test listed in the table can be stated that the weighting by the respondents is consistent with the consistency test value of 0.086058, or less than the value of 0.1 or consistent.

Workload assessment using NASA-TLX

Perception measurements were obtained from 6 workload descriptors (Mental Demands (MD), Physical Demands (PD), Temporal Demands (TD), Performance (P), Effort (E) and Frustration level (F)). The first data was obtained from the pairwise comparison of the 6 workload descriptors. The second data is obtained from the results of rating the workload descriptors. Giving a rating refers to the perception of each respondent who is undergoing work activities. The scale used is 0 to 100, to assess the work activities. After a pairwise comparison and rating for each workload descriptor, the average workload for each respondent will be obtained. Mental load assessment using the NASA TLX method by respondents can be seen based on dimensions in Table 6.

Table 6. Assessment dan weighted value of all dimension.

	Dimension					
	Mental	Physics	Effort	Performance	Frustration	Temporal
Average Value	80.6429	77.82143	81.17857	52.32143	77.28571	78.92857
Stdev Value	9.8553	11.67477	4.312373	21.83957	7.816683	9.529403
Weighted Value	11.98146	17.4329	14.24869	6.931143	12.27658	13.13185
Stdev	5.334606	5.898272	5.228666	3.636187	4.783629	4.141824

Based on Table 6. effort has the highest average value with 81.17857 and 4.3123 for standard deviation followed by mental needs dimension: 80.6429 and 9.8553. Performance has the lowest average value with 52.32143 and the highest value of standard deviation 21.83957. For weighted value, physics needs has the highest average value and standard deviation with 17.4329 and 5.898272. Effort has the second highest average value as 14,24869 with standard deviation 5.228666 while Performance has the lowest average value 6.931143 and standard deviation 3.635187.

The workload value is obtained by multiplying the rating by the weight factor for each descriptor then categorize based on low, medium, high and very high. Overall workload can be seen at Figure 1.

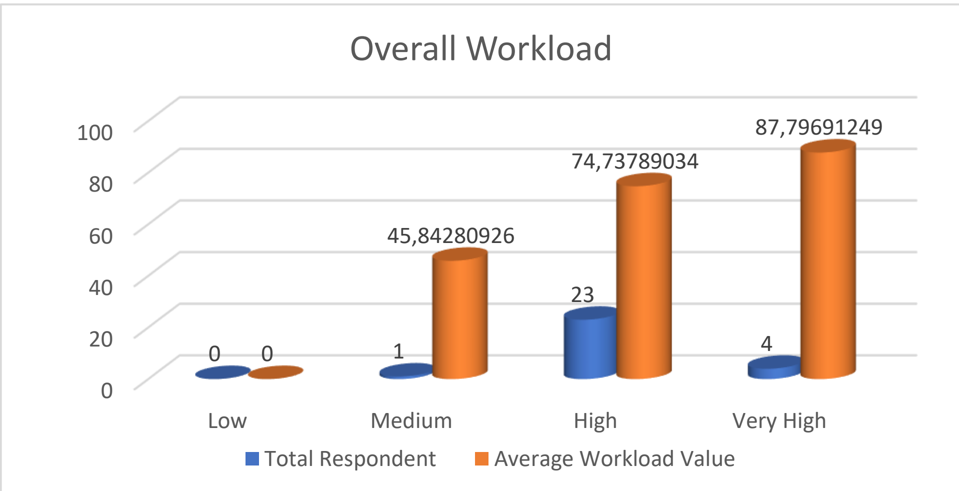

Figure 1. Overall Workload.

It can be seen in Figure 1, overall mental workload that there are 1 respondent who have a moderate mental load (45,58428), 23 respondents have a high overall mental workload with average value 74.73789 (range: 71.59017-75.89887), and 4 respondents have a very high overall mental load (87.79691) (range: 86.1474-89.82593). Average workload value is 75.99350432 with standard deviation value 6.236028962.

Workload assessment using OWL

The first step in assessing workload using OWL is to determine the weights for sub-factors within each factor. Respondents are asked to compare the weights between sub-factors using a pairwise comparison matrix and then normalized it followed by consistency testing. Normalization is intended to ascertain the weight of each sub-factor relative to other sub-factors. One of the normalization results of weighting and consistency testing by one respondent can be seen in the Table 7.

Table 7. Normalization and consistency testing result.

	Normalization						Weighted	
	Weight	Frequency	Duration	Distance	Total	EV	Aw	Aw/w
Weight	0.41667	0.41667	0.43478	0.38462	1.65273	0.41318	6.77815	4.10118
Frequency	0.41667	0.41667	0.43478	0.38462	1.65273	0.41318	6.77815	4.10118
Duration	0.08333	0.08333	0.08696	0.15385	0.40747	0.10187	1.6427	4.03146
Distance	0.08333	0.08333	0.04348	0.07692	0.28707	0.07177	1.1519	4.01262
N	4							
CI	0.020537165							
RI	0.9							
CR	0.022819073							
Result	Consistent							

Based on the table 5 can be stated that weight of a load and frequency of handling a load has the highest weight form the workload in doing this work as 0.431318. The next subfactor of physical job demand workloads factor which has a lower weight is duration of physical activity 0.10187. The sub factor that has the lowest weight is moving distance with a load, which is 0.07177. Meanwhile, in the consistency test listed in the table can be stated that the weighting by the respondents is consistent with the consistency test value of 0.022819703, or less than the value of 0.1.

Consistency testing is intended to ensure that the weighting between sub-factors conducted by respondents is consistent and serves as a requirement for the next stage. If the consistency ratio (CR) value is lower than 0.1, then the weighting conducted by the respondent is considered consistent and can be used for workload assessment. Consistency testing and weighting on S1 (Physical job demand workloads) have been conducted on 28 respondents, where all respondents have a CR value smaller than 0.1, indicating consistent. An example of weighting and consistency testing on 10 respondents can be seen in Table 7.

Tabel 8. Consistency testing result.

No.	Weight of sub factor				n	CI	RI	CR	Result
	Weight	Frequency	Duration	Distance					
1	0.41318	0.4131828	0.10187	0.071767	4	0.02054	0.9	0.02282	Consistent
2	0.34872	0.3137598	0.24691	0.0906006	4	0.02363	0.9	0.02626	Consistent
3	0.55486	0.1889624	0.17359	0.0825885	4	0.0758	0.9	0.08422	Consistent
4	0.41318	0.4131828	0.10187	0.071767	4	0.02054	0.9	0.02282	Consistent
5	0.42141	0.3975994	0.10861	0.072377	4	0.05415	0.9	0.06016	Consistent
6	0.25129	0.6135817	0.06757	0.0675652	4	0.07073	0.9	0.07859	Consistent

No.	Weight of sub factor				n	CI	RI	CR	Result
	Weight	Frequency	Duration	Distance					
7	0.25488	0.5773149	0.05061	0.1171894	4	0.02551	0.9	0.02834	Consistent
8	0.39352	0.3935223	0.13758	0.0753711	4	0.00139	0.9	0.00154	Consistent
9	0.14091	0.4387937	0.37701	0.0432905	4	0.08517	0.9	0.09463	Consistent
10	0.15081	0.3840083	0.41058	0.0545995	4	0.07796	0.9	0.08662	Consistent

Based on Table 7, it can be stated that the consistency test has been conducted on all subfactors (n=4) of pairwise comparison matrices from 10 respondents, as the CR values are smaller than the specified threshold (RI = 0.9), which is 0.1.

Assessment of weights between subfactors and consistency testing was also conducted on all respondents (28 respondents) for factor S2 (environmental workload) with subfactors: improper temperature, lighting, noise, vibration, and exposure to chemicals, and S3 (Body motion and postural workloads) subfactor: improper body motion and posture in standing, stooping, squatting. Weighting and consistency testing were also conducted on the relationships between factors S1 (Physical job demand workloads), S2 (environmental condition), S3 (Body motion and postural workloads), conducting 84 consistency tests. From these consistency tests, CR values were obtained below the RI value for both n=4 (S1 (Physical job demand workloads), S3 (Body motion and postural workloads), all factors) and n=5 (S2 (environmental condition)), indicating that the pairwise comparison is consistent and can be used for workload assessment using the OWL methods.

Assessment of perceived workload sub-factors by respondents is based on a 5-point linguistic variable (i.e., 0.2, 0.4, 0.6, 0.8, or 1.0) using a closed questionnaire, which describes individual needs and environmental conditions during activities. The assessment of sub-factors is multiplied by weights to form weighted values for factors S1 (Physical job demand workloads), S2 (environmental condition), and S3 (Body motion and postural workloads). The results of the assessment for these three factors can be seen in the Table 8.

Table 9. Factor Value.

No.	Factor Value		
	Physical	Environment	Body Posture
1	0.4826	0.6931	0.6151
2	0.4000	0.5629	0.5804
3	0.6000	0.6215	0.6000
4	0.3767	0.6853	0.5550
5	0.4000	0.5287	0.6000
6	0.4000	0.5233	0.5598
7	0.6787	0.6643	0.7342
8	0.8000	0.7256	0.7677
9	0.4000	0.7034	0.5837
10	0.4443	0.6000	0.6345
11	0.3491	0.5476	0.4000
12	0.4692	0.6947	0.5667
13	0.8000	0.6816	0.6887

Based on Table 8, it can be stated that respondent 8 and 13 have the highest values for the physical job demand factor, respondents 1, 3, 4, 9, 11, and 12 have the highest values for S2 (environmental condition), and respondents 2, 5, 6, 7, 8, and 10 have the highest values as workload-forming factors in the body motion and postural workload factor.

The next step is weighting through pairwise comparison matrices between factors. The assessment of weights between factors is to determine how much each factor contributes to the overall workload. Normalization of assessments and consistency testing are also conducted at this stage for the overall assessment of 28 respondents. Using the same concept of normalization and consistency testing for sub-factors S1, S2, and S3, a value of n=4 is obtained, with a Random Index (0.9); all CR values are below 0.1, indicating pairwise matrix weighting consistent. The results from one of the respondents can be seen in Table 9.

Tabel 10. Normalization and consistency testing factor.

	Normalization					Weighted		
	Physical	Environment	Body Posture	Mental	Total	EV	Aw	Aw/w
Physical	0.42353	0.44366	0.32787	0.375	1.57006	0.39252	6.61401	4.21258
Environment	0.42353	0.44366	0.57377	0.375	1.81596	0.45399	7.9927	4.40136
Body Posture	0.10588	0.06338	0.08197	0.20833	0.45956	0.11489	1.88357	4.09862
Mental	0.04706	0.0493	0.01639	0.04167	0.15441	0.0386	0.62255	4.03169
n				4				
CI				0.062020643				
RI				0.9				
CR				0.068911826				
Result				Consistent				

According to the table 9 can be stated that environmental condition has the highest weight form the workload in doing this work, 0.45399. The next factor which has a lower weight is **physical job demand workloads** 0.10187. The sub factor that has the lowest weight is **mental demand with** 0.0386. Meanwhile, in the consistency test listed in the table is 0.068911826 (less than the value of 0.1.) or the weighting by the respondents is consistent.

The average weighted value is used to determine the sub-factor contributing to each factor or forming the overall workload. The average weighted values can be seen in Table 10. Based on Table 10, the sub-factor with the highest value in S1 (physical job demand workloads) is frequency handling a load (0.312724), in S2 (environmental workloads) it is improper temperature (0.312528), and in S3 (Body motion and postural workloads) it is stooping (0.2785078). Meanwhile, the factor with the highest value is physical job demand (0.347081), followed by environmental condition (0.211108).

Table 11. Average Weighted Value.

Average Weighted Value			
S1 (physical job demand workloads)		S3 (Body motion and postural workloads)	
Weight of load	: 0.235805	Standing	: 0.173723
Frequency handling	: 0.312724	Stooping	: 0.2785078
Duration	: 0.134682	Squating	: 0.119138
Distance with load	: 0.05531	Twisting	: 0.089702
S2 (environmental workloads)		Overall Workload	
Temperature	: 0.312528	Physical demand	: 0.107806
Lighting	: 0.144648	Environmental	: 0.347081
Noise	: 0.073436	Body Motion	: 0.21108
Vibration	: 0.050744	Mental demand	: 0.08928
Chemical exposure	: 0.191134		

The next step is determining the overall workload value by multiplying the factor assessments and factor weighting above. The results of the overall workload assessment are categorized based on low, medium, high, and very high workload categories. The results of the overall workload assessment can be seen in Figure 2.

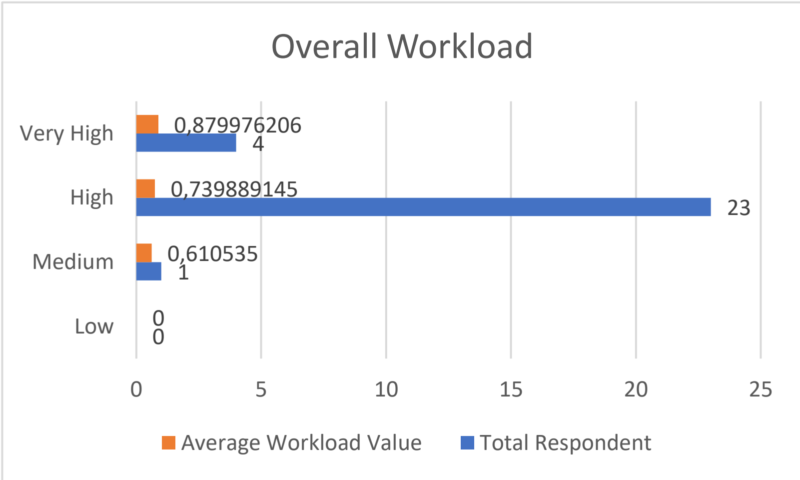

Figure 2. Overall Workload

It can be seen in Figure 2 overall workload that there are 1 respondent who have a medium workload (0.610535), 23 respondents have a high overall mental workload with average value 0.739889 (range: 0.714871- 0.759701), and 4 respondents have a very high overall mental load (0.879976) (range: 0.85450-0.89093). Average workload value using NASA TLX method is 0.755282 and standard deviation 0.059391.

Significance testing

Significance testing in this study was used to determine whether there is a difference between the two methods used, namely NASA TLX and OWL. The test was conducted using a paired t-test with a degree of freedom v: 27. The initial hypothesis was that both methods have the same average value. The data processing was performed using SPSS software. The results of the paired t-test yielded a t-value of 9.69873E-29, which is smaller than the critical t-value of 2.052. Therefore, it can be concluded that the means of both methods (NASA TLX and OWL) are the same. Furthermore, based on the variance test using ANOVA, f-value: 0.007872 and p:0.00000 were obtained, which is smaller than the critical f-value. Hence, it can be stated that both variances are the same.

Discussion

COVID-19 is a virus that spreads from person to person through droplets, with a high and dangerous infection rate, especially for individuals at high risk (elderly, children, individuals with underlying conditions). The high number of patients has led several countries to experience system fatigue due to the increased demand for care. Healthcare workers, as one of the key elements in handling and preventing the spread of this virus, must face various challenges, including the surge in patient numbers, limited medical equipment, the complexity of treatment, and the risk of fatigue or burnout. Research on the impact of COVID on the level of acute fatigue in healthcare workers has been conducted in Ireland, where 40% of radiographers experienced burnout (Foley et al, 2020). Research in Taiwan with two thousand nineteen participants completed the questionnaire over 2 consecutive years, including 132 visiting doctors, 105 resident doctors, 1371 nurses, and 411 medical technicians stated that poor sleep, lack of exercise, long working hours, and being a member of the nursing staff were risk factors regarding an increase in personal burnout, work-related burnout levels and depression among health care professionals (Chu et al, 2022). Other research in COVID-19 impact was cross-sectional study conducted among ICNs working in hospitals with ≥200 beds in South Korea from October 1 to 22, 2021. A total of 203 participants were included, of whom 95% were women. The results showed that work intensity in COVID-19 infection control was significantly associated with job stress (*P* < .001) and burnout (*P* = .035). Furthermore, job stress (*P* = .019) and burnout (*P* < .001) were positively correlated with turnover intention (Lee et al, 2024).

Additionally, the research results indicate a decrease in motivation as evidenced by the study of 19 neonatal nurses in Turkey, the COVID-19 pandemic process led to a decrease in nurses' and parents' touching newborns, nurses' experiencing problems with parents due to measures taken, heavier working conditions and a decrease in motivation for nurses (Simsek et al, 2022).

The workload study during COVID-19 has been conducted to identify, determine, and analyze workload-forming factors. The analysis of workload-forming factors is viewed from sociodemographic, work, environmental factors at the workplace, and personality variables of 201 emergency nurses from 13 different provinces in Spain. Result showed that the environmental conditions had a direct relationship with the mental workload, especially with respect to noise and lighting (Soto-Castell et al, 2023). Beside that research during 228 shifts in eight different Intensive Care Units which investigated the association of patient characteristics (severity of illness, comorbidities, age, body mass index, and planned or unplanned admission), education level of the nurse, and contextual factors (numbers of patients per nurse, the type of shift (day, evening, night) and day of admission or discharge) with perceived nursing workload concluded that The APACHE-IV Acute Physiology Score of a patient was significantly associated with the perceived nursing workload, also after adjustment for confounders (p = 0.02)(Hoogendoorn et al, 2021).

The impact of the care for COVID-19 patients on nursing workload and planning nursing staff on the Intensive Care Unit has been huge significant higher number of patients per nurse (1.1 versus 1.0, *p* < 0.001) and a significant higher Nursing Activities Score per Intensive Care nurse (76.5 versus 50.0, *p* < 0.001) in the COVID-19 period compared to the non-COVID period. The Nursing Activities Score was significantly higher in COVID-19 patients compared to both the pneumonia patients (55.2 versus 50.0, *p* < 0.001) and the non-COVID patients (55.2 versus 42.6, *p* < 0.001), mainly due to more intense hygienic procedures, mobilization and positioning, support and care for relatives and respiratory care (Hoogendoorn et al, 2023).

Other research measure the levels of anxiety and burnout among healthcare workers, including attending physicians, residents, and nurses in intensive care units during the coronavirus disease 2019 (COVID-19) pandemic with total of 104 participants completed the survey. This study revealed higher levels of anxiety and burnout in younger healthcare workers and those tested for COVID-19, which mainly included residents and nurses [28]. Another research that took place in Greece discovered that nurses working with COVID-19 patients had higher rates of fatigue and burnout compared with those working elsewhere (Sikaras et al, 2022).

This study measured the workload of the RRT team using NASA TLX and OWL, revealing medium (45.58428; 0.610535), high (74.73789; 0.739889), and very high (87.7969; 0.879976) levels of workload, with an average high workload (75.99350432; 0.748672). The workload position ranges from medium to high, according to both NASA-TLX and OWL methods, similar with a study conducted on 201 emergency nurses from 13 different provinces in Spain (Soto- Castell et al, 2023). In this study, the dimensions that most significantly contribute to the workload according to the NASA TLX method are Effort, followed by Mental Demands, consistent with workload research on surgeons involving 122 procedures. of 160 total procedures in nonprofit quaternary academic hospital Minnesota. Participating surgeons completed surveys on 49 colectomies (40%), 24 proctectomies (20%), nine anorectal (7%), and 40 miscellaneous procedures (33%). miscellaneous cases predominantly included procedures such as exploratory laparotomy and creation of ileostomy/colostomy. Mean surgeon-perceived workload was highest for effort (mean [M] = 10.83, standard deviation [SD] = 5.66) followed by mental demand (M= 10.18, SD = 5.17), and physical demand (M = 9.19, SD = 5.60). [13]. Effort represents the magnitude of both mental and physical exertion required to perform activities within a predefined period, while mental demand indicates activities involving analysis, memory, and calculation. Effort includes tasks such as: prolonged use of personal protective equipment (PPE) (8-10 hours), the number of bodies to be buried during a single shift, activities involving the use of PPE and lifting coffins, and placing them in graves while wearing PPE. Meanwhile, mental demand encompasses tasks such as: remembering the composition of chemicals for area decontamination, vehicle, personnel sterilization, and analyzing the sterilization of burial areas.

Meanwhile, the factor that most significantly contributes to workload based on the OWL method is S2 (environmental condition), followed by S3 (body motion and postural workloads). In S2, the subfactors with the highest values are improper temperature (0.312528) and chemical exposure (0.191134). This workload-forming factor aligns with a study conducted on 201 emergency nurses from 13 different provinces in Spain between November 2021 and July 2022. The predominant environmental subfactor contributing to workload consists of the adequacy/inadequacy of temperature, lighting, noise, space distribution, and the hygienic conditions of the workplace [25]. Factors such as high temperature due to the use of PPE during burial activities, insufficient air circulation while using PPE, exposure to chemicals during area decontamination, vehicle decontamination, and personnel decontamination contribute to workload. Additionally, body motion and postural workload during burial activities, including squatting, standing, and turning, also contribute significantly to workload.

The limitations of this research are that data collection was only carried out in one area with a limited number of respondents, there was no preliminary analysis of the basis for regional selection and workload determination only used subjective data. So it's recommended in further research to assess workload in several areas enhancing better understanding, using objective workload methods (eg: heart rate) in assessing workload and combining it with other approaches (eg: Analytical Neural Processes, Promethee, Bayesian Network, Fuzzy).

Conclusions

The workload assessment using the NASA-TLX and OWL methods falls within the medium (45.58458; 0.610535), high (74.73789; 0.739889), and very high (87.7969; 0.879976) ranges, with an average high workload value (75.9935; 0.748672). Moreover, based on statistical tests using paired t-tests with t-value of 9.69873E-29, it is concluded that both methods are equivalent. The dimensions that predominantly contribute to workload according to the NASA TLX method are effort, followed by mental demands. Conversely, the OWL method identifies S2 (environmental workloads, with sub-factors: improper temperature, chemical exposure) as the primary workload-forming factor, followed by S3 (body motion and postural workloads, with sub-factors: stooping, standing). These research findings offer manual guidance for workload identification, particularly emphasizing OWL, to serve as a basis for workload evaluation for teams involved in COVID-19, especially in Indonesia. Furthermore, the study demonstrates that the OWL method exhibits the same level of reliability as the NASA TLX method.

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