

Assessment of Mental Workload and its Association with Workability among Nurses Working in the Care Units of Patients with Covid-19

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Received: 15 April 2023

Revised: 14 May 2023

Accepted: 19 June 2023

Abstract

Background: High mental workload can negatively affect nurses' mental and physical health, quality of life, and workability. Therefore, the present study aimed to determine the relationship between mental workload and the workability among nurses.

Methods: Using the multi-stage sampling method, the researchers selected 142 nurses working in Qazvin hospitals in Covid-19 patient care units to participate in a cross-sectional descriptive study. Data collection tools included a demographic information questionnaire, the NASA Workload Index, and Workability Index. Data were analyzed by independent t-test, Pearson correlation coefficient, and ANOVA in SPSS software.

Results: The mean age of participants was 31.3 ± 6.1 years, and the work experience mean was 7.6 ± 5.8 years. The results showed a high mental workload (80.4 ± 13.4) and moderate workability (31.8 ± 7.3). The number of nurses' shifts per month was negatively correlated with workability ($P=0.032$). ICU nurses had the highest mental workload score and the lowest workability score. Also, workability there was a significant negative correlation between mental workability and workload ($r=-0.579$ & $P<0.001$).

Conclusion: A reverse correlation was observed between mental workload and workability. To improve the performance and mental health of nurses, frequent training programs and management interventions should be practiced.

Please cite this article as: Sobhani S, Tabanfar S, Mohammadi Zeidi I, Sharif Hosseini M. Assessment of Mental Workload and its Association with Workability among Nurses Working in the Care Units of Patients with Covid-19. *J Health Sci Surveillance Sys*. 2023;11(Supplement 3):570-577.

Keywords: COVID-19, Hospitals, Nurses, Workability, Workload

Introduction

Hospitals play a key role in a community's health and the quality of health services, including medical, nursing, and rehabilitation services.¹ Nurses are the largest medical care providers in hospitals.²⁻⁴ Reports indicate that nurses are exposed to many stressors and negative consequences.^{3, 5} The NAPS (National Association of Professional Safety) report in the United States of America shows that the nursing profession is among the 40 professions with the highest level of stress and the prevalence of work-related pressure diseases.⁵⁻⁷

Since the beginning of the Covid-19 pandemic and the consequences of the rapid outbreak of the disease worldwide, such as the increase in Covid-19 mortality and the influx of hospitalizations, the stress on nurses has increased more than ever.⁸ In addition, research shows a relationship between increasing patient mortality and the increasing nurses' mental workload⁹ leading to their increased workload.⁴ According to previous research, the Covid-19 pandemic increases nurses' job stress and endangers their mental health and well-being.^{10, 11} Nurses directly in Covid-19 patients' care are at higher risk of mental health problems than other nurses.¹²

Mental workload is a vital factor affecting the nurses' behavior and performance. Mental workload is the same as mental effort or concentration required while performing tasks.⁵ A stressful factor in various occupations is excessive mental workload.² Studies show that individuals' performance in jobs with a high mental workload reduces for various reasons, including fatigue and lack of proper planning. This issue can lead to memory impairment, concentration, and thinking problems, increased irritability, and decreased learning power.¹³ In addition, a high mental workload can weaken the cooperation between nurses and physicians, poor communication between nurses and patients, and nurses' job dissatisfaction.^{14, 15} According to some studies' results, too much or too little mental workload is one factor leading to reduced workability.¹⁶

Nurses' workability is one issue raised in productivity when performing job-related tasks.¹⁷ Ability to work is based on the right balance between individuals' characteristics, abilities, and job demands.³ Workability is an indicator showing that a person can do his job best according to job demands, health status, and intellectual abilities. Workability can identify people who cannot balance their health, ability, and job needs.¹⁶

Accurate and timely assessment of nurses' psychological status is an effective and necessary step before designing interventions to improve nurses' efficiency and prevent physical, psychological, and social problems caused by high stress and high mental workload.¹⁸ Despite the importance of paying attention to the role of workload and the high mental workload of nurses in reducing efficiency and the relationship between mental workload with other occupational and health components, relatively little attention has been paid to measuring mental workload in nurses.¹⁹ Therefore, considering the importance of this issue in the current situation of the Covid-19 pandemic, as well as the high prevalence and high cost of these conditions, especially in high-risk occupational groups such as nurses, we aimed to determine the relationship between workability and mental workload in nurses working in the care units of patients with Covid-19.

Methods

Type of Study, Participants, and Sampling Method

The present study was a cross-sectional study. The target population in this study was nurses working in the care units of Covid-19 patients in the teaching hospitals of Qazvin. The researchers selected 142 nurses using G*Power software, 95% confidence interval, 80% test power, 40% effect size, and 25% loss calculation. The researchers prepared a list of nurses in two hospitals to select samples from nurses working

in units providing services to patients with Covid-19. Then, the necessary samples were selected using the random number table method. Inclusion criteria include voluntary participation, employment in the care unit of Covid-19 patients, having at least one year of work experience, no mental or physical disorders (based on medical record or individual report), not over one month leave because of illness in the past year and lack of chronic diseases. Exclusion criteria also included mental disorders such as depression, unwillingness to participate in the study, and lack of continued presence in the care unit of Covid-19 patients during the current study. The present study was funded by the Research Committee of the Qazvin University of Medical Sciences funded this study through a master's thesis; moreover, the Ethics Committee of the Qazvin University of Medical Sciences approved the study (IR.QUMS.REC.1399.440).

Data Collection Tools and Methods

The researchers collected data in the present study by self-reporting using a demographic information questionnaire, the NASA-TLX, and WAI.

A) demographic information questionnaire used to assess contextual and anthropological variables such as gender, marital status, age, work experience (year), education, number of shifts per month, and employment unit of the nurse in the hospital.

B) NASA Workload Index: (NASA-TLX): Hart and Staveland developed this questionnaire in 1988.²⁰ It is a multidimensional mental assessment tool measuring mental workload to assess performance, system, team, or other aspects of performance.^{2, 21} NASA-TLX comprises two parts. In the first part, the researchers divided the total workload into six subscales: mental, physical, performance, temporal, frustration, and effort. Each subscale was classified in the range of 0-100 points with 5-point intervals using a visual scale.^{5, 13, 22} There are descriptions that the subject should read for each of these subscales before ranking. This section determines the effect of these six subscales on creating a mental workload. In the second part, people compare the subscales separately in pairs to create a weighting based on their perceived importance. This section determines the priority of the six subscales. The number of times each subscale is selected is the weight of the subscale multiplied by the score of that subscale and then divided by 15.²¹ Interpretation of nurses' mental workload with the NASA-TLX tool is divided into three categories: low (<50), medium (50-80), and high (>80).¹ Psychometric properties of the Persian version of this questionnaire have been confirmed in studies.^{21, 23}

C) Workability Index: (WAI): is an appropriate tool that summarizes individuals' abilities and work capacities.²⁴ workability concept evaluates people's

current and future health according to their mental and physical abilities and job identity.²⁴ This index comprises seven items.¹⁶ Finally, the total score of this index is calculated by adding the scores obtained for each component. The final score of the WAI index will be from 7 to 49, which is classified as follows: A score of 7 to 27 is poor workability, 28 to 36 is average, 37 to 43 is good, and finally, 44 to 49 is excellent ability. In previous studies, the WAI has been evaluated and validated.^{17, 25-27}

The Process of Completing the Questionnaires

After coordination with the Qazvin University of Medical Sciences, the researchers explained the study's objectives to each of the selected nurses. After obtaining the written consent to participate in the research, the researchers, suggested a varied schedule to nurses to complete the questionnaire and a reminder text message was sent to each nurse the day before. The researchers distributed the questionnaires physically to the nurses and asked them to answer the questions in approximately 30 minutes. While completing the questionnaire, one of the research team members was present to clear the ambiguity and answer possible questions, ensure accurate and complete answers to all questions, and appreciate participating in the research while answering the questions.

Data Analysis

The researchers used SPSS software version 25 for the statistical analysis of data. The natural distribution

of each variable was examined by the skewness and kurtosis of the data. Descriptive statistics such as mean and standard deviation was used to describe the variables. Then, the researchers used an independent t-test to compare the means of quantitative variables in two independent groups and a one-way analysis of variance (ANOVA) to compare the means of quantitative variables in three independent groups and more. Besides, the Pearson correlation was used to examine the relationship between quantitative variables such as workability and workload. The significance level in the present study was considered less than 0.05.

Results

142 nurses in ICU (Intensive Care Unit), CCU (Cardiac Care Unit), and general and emergency units participated in this study. 105 (73.9%) were female, and 37 (26.1%) were male. The mean age and work experience were 31.3 ± 6.1 and 7.6 ± 5.8 , respectively. Table 1 shows other data related to contextual and demographic variables of nurses participating in the present study.

According to the different dimensions of the NASA-TLX, the minimum, and maximum scores belonged to the dimensions of "effort" and "mental demand", respectively. Also, the mean and standard deviation of the NASA-TLX score was 80.4 ± 13.4 , which is the average level of mental workload (Table 2).

According to the mean WAI score (31.8 ± 7.3), nurses' ability to work was moderate. Table 3 shows the distribution of workability levels in participants.

Table 1: Demographic information of nurses participating in the study (n=142)

Age		Mean (standard deviation)	31.3 (6.1)
		Min - Max	22-50
Work Experience		Mean (standard deviation)	7.6 (5.8)
		Min - Max	1-25
Number of Shifts per Month		Mean (standard deviation)	27.4 (4.3)
		Min - Max	14-38
BMI (Body Mass Index)		Mean (standard deviation)	23.9 (2.9)
		Min - Max	16.5-32.3
Marital Status	Single	Frequency (%)	54 (38)
	Married	Frequency (%)	88 (62)
Education	Bachelor	Frequency (%)	113 (79.5)
	Master	Frequency (%)	29 (20.5)
Working Unit	ICU (Intensive Care Unit)	Frequency (%)	32 (22.6)
	CCU (Cardiac Care Unit)	Frequency (%)	23 (16.2)
	General	Frequency (%)	57 (40.1)
	Emergency	Frequency (%)	30 (21.1)

Table 2: Scores of NASA-TLX subscales of nurses (n=142)

Dimensions of mental workload	Mean	Standard deviation	Min	Max
Mental	84.0	18.2	10	100
Physical	83.2	19.2	20	100
Temporal	82.1	16.9	10	100
Performance	83.5	18.3	10	100
Effort	72.6	21.7	5	100
Frustration	79.6	21.8	10	100
Total score	80.4	13.4	29.6	99.3

Table 3: Classification of nurses in different levels of workability (n=142)

Workability levels	Frequency (%)
Weak (7-27)	46 (32.4)
Moderate (28-36)	55 (38.8)
Good (37-43)	30 (21.1)
Excellent (44-49)	11 (7.7)

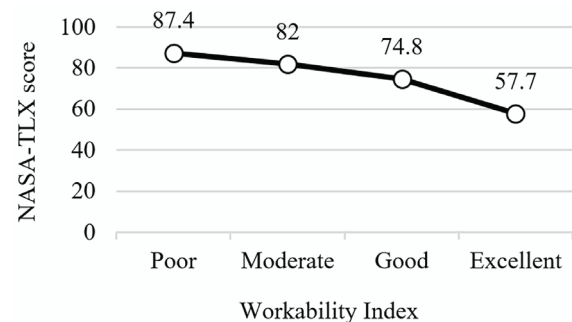
Accordingly, 32.4 percent of nurses have the poor working ability (<27), 38.8 percent have the average working ability (28 to 36), 21.1 percent achieved good working ability (37 to 44), and 7.7 percent have excellent workability (44 to 49). Therefore, 71.2 percent of the participants were in the poor and moderate level of workability.

Correlation between NASA-TLX and WAI Score

The Pearson correlation test examined the correlation between workload and workability. The obtained correlation coefficient ($r=-0.597$) showed an inverse correlation between these two indexes ($P<0.001$). Also, Figure 1 shows the workload mean scores at different levels of workability.

Based on the classification of demographic

variables, the mean and standard deviation of the mental workload and workability, two main variables, were examined (Table 4). Given that the average shift of nurses was 28 shifts per month, the mental workload and workability mean score of nurses who worked over 28 shifts per month were compared with nurses who worked less than or equal to 28 shifts per month. The researchers found that nurses who attended over 28 monthly shifts had significantly lower workability scores ($P=0.006$). In terms of education level, the nurses' mental workload score with a master's degree was significantly lower than the nurses' mental workload score with a bachelor's degree ($P<0.001$). Also, nurses with master's degrees

**Figure 1:** Different levels of workability**Table 4:** Comparison of the mean and standard deviation of the two main variables of workload and workability based on the classification of demographic variables (n=142)

Variable	Classification	Number	Mental workload	Workability
Age	Less than 30	80	79.5±14.4	32.2±7.4
	30-40	49	80.7±12.1	31.2±7.3
	More than 40	13	84.5±11.2	31.3±6.9
	P value		0.456	0.731
Gender	Male	37	79.1±13.0	31.4±7.6
	Female	105	80.8±13.6	31.9±7.2
	P value		0.521	0.683
Marital Status	Single	54	80.0±14.6	31.6±7.7
	Married	88	80.6±12.7	31.9±7.1
	P value		0.770	0.854
Work Experience (year)	Less than 5	75	80.0±14.8	32.0±7.4
	5-10	23	82.9±8.8	31.4±8.1
	More than 10	44	79.7±13.0	31.6±6.8
	P value		0.622	0.910
Number of Shifts per Month	Less than 28	89	79.1±13.3	33.1±7.1
	More than 28	53	82.5±13.4	29.6±7.1
	P value		0.141	0.006**
BMI (Body Mass Index)	Less than 25	97	82.2±12.5	31.3±7.4
	25-30	42	76.5±14.9	32.6±7.1
	More than 30	3	74.8±2.8	35.6±5.7
	P value		0.051	0.433
Education	Bachelor's degree	113	82.7±11.2	30.9±7.0
	Master's degree	29	71.2±17.0	35.1±7.8
	P value		0.000**	0.007**
Working unit	ICU (Intensive Care Unit)	32	87.5±11.9	29.7±7.1
	CCU (Cardiac Care Unit)	23	85.3±9.4	30.1±7.8
	General	57	75.1±13.6	33.8±6.8
	Emergency	30	79.1±12.8	31.5±7.2
	P value		0.000**	0.040*

*P value<0.05, **P value<0.01

had a higher workability than nurses with bachelor’s degrees (P=0.007).

The results obtained from linear regression indicated that only mental workload (P=0.000) and ‘Number of Shifts per Month’ (P=0.005) were significant contributing factors to workability among nurses (R²=0.39). Assumptions for multicollinearity were examined because of the combination of variables. According to the results, there was a statistically significant difference in the mental workload score of nurses working in different hospital units (P<0.001). Also, a statistically significant difference (P=0.040) was found among the workability scores of nurses working in different hospital units. The nurses working in the ICU had the highest NASA-TLX score and the lowest WAI score (Figure 2).

Discussion

This study aimed to evaluate mental workload and its relationship with the nurses’ workability working in the care unit of Covid-19 patients. The study’s overall results emphasized the negative and reverse correlation between workload and workability index in nurses. Also, difference in mental workload and workability in terms of some demographic variables, such as the number of shifts of nurses per month, education, and employment units, were statistically significant.

One important finding was the nurses’ high mental workload which was congruent with the study done by Ebrahimi et al.²⁸ Unlike the current study, Nasirzad Moghadam et al. found a moderate level of mental workload.²⁹ This finding may be due to the fact that nurses in the current study were working in hospitals with Covid-19 patients that increases work stress. In line with other studies, the highest score among the NASA-TLX dimensions belonged to the dimension of nurses’ mental demand.³⁰⁻³² The reasons can be: 1) mental and psychological conflict of nurses due to the high rate of disease outbreaks and people death, 2) The need to remember the diversity of medical instructions to handle a large number of patients per nurse, 3) The need for high accuracy and quick decision making in critical situations, 4)

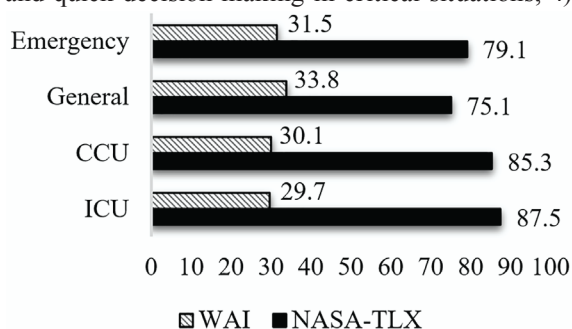


Figure 2: NASA-TLX and WAI scores among nurses working in different units of the hospital (n=142)

Increased mental and psychological burden due to fear of infection, 5) Nurses’ Infection, their absence at work, lack of workforce, and prolonged number of work shifts and mental fatigue.

Our findings showed that the nurses’ mental workload working in the ICU was higher than other nurses. In Pourteimour et al.’s (2021) study, nurses working in the infectious ward had the highest mental workload score.³² Hoonakker et al. (2011) conducted a study before Covid-19 and found that mental workload of nurses working in the ICU was moderate.¹⁹ One reason for the different scores could be the higher mortality rate due to Covid-19 in the ICU, which significantly impacts the nurses’ mental workload.³³ Further, according to our results, mental workload of the nurses with a master’s degree was significantly lower than those with a bachelor’s degree.

The current study results showed that ‘nurses’ workability was moderate, consistent with Dalky et al.’s results (2018).³⁴ A study conducted on Taiwanese nurses before the Covid-19 pandemic showed a good level of workability.³⁵ Many factors can affect the nurses’ workability. However, the effect of the high workload created by the Covid-19 pandemic on reducing the nurses’ workability cannot be ignored.

The researchers found that the workability of 71.2% of nurses was moderate and poor. A significant inverse correlation existed between the WAI score and some nurses’ shifts. This result was in line with Abbasi et al. results, stating that by reducing the number of nurses’ shifts per month, an increase in their workability could be seen.³⁶ Reducing the number of shifts per month by 1) reducing working hours, 2) reducing work-related psychological and physical stress, 3) increasing mental health and nurses’ general health can reduce mental workload and increase the ability of nurses to work.

Furthermore, it was found that nurses with higher education levels had a higher workability. These results were consistent with Rypicz et al.’s (2021),¹⁷ as they claimed that higher-educated nurses had higher levels of workability. One reason can be the higher nurses’ awareness by increasing level of education, which affects mental health, quality of life, and nurses’ workability.

Also, after reviewing the results, it was found that nurses working in the general units had the highest WAI score, and nurses working in the ICU unit had the lowest WAI score.

According to the Pearson correlation test results, a negative correlation was observed between mental workload and workability in nurses. In line with the present study, Roodbandi et al. reported a decrease in workability due to increased mental workload.¹⁶ If people involved in a lot of mental and physical workload, they will not want to continue doing it. As a result, higher mental workload decreases nurses’

morale and workability. So, it is necessary to provide conditions that lead to a lower mental workload and higher workability.

Based on the results of linear regression, it was found that mental workload and the Number of Shifts per Month can affect the workability of nurses.

In addition, no statistically significant relationship was found between demographic variables, including age, work experience, BMI (Body Mass Index), gender, and marital status of nurses with mental workload and workability. Besides, no statistically significant relationship was observed between the number of nurses' shifts per month and the NASA-TLX. These findings align with Pourteimour et al.'s study on nurses working in the Covid-19 unit.³²

Limitation

1) The present study was a cross-sectional descriptive study; consequently, it is impossible to study the cause-and-effect relationships accurately and comprehensively. Performing longitudinal studies with repeated measurements (Follow-up) can increase the decision-making power of the relationships between variables.

2) The selection of nurses from public hospitals and the city of Qazvin substantially affects the generalizability of the results. In future studies, it is recommended that nurses working in other hospitals, such as private hospitals and other cities and provinces, participate in evaluating the impact of cultural, social, and economic variables.

3) Self-administered questionnaires or self-report methods, despite being a valid and reliable method for data collection, will always be accompanied by biases such as the bias of remembrance (memory) and the bias of preserving the essence (hiding negative points and exaggerating the expression of positive attributes). Therefore, using methods such as reporting by supervisors or colleagues or recording daily, monthly, etc., performance is recommended in future research as effective indicators of the measured outcomes - if possible.

Conclusion

According to the findings, the mental workload of nurses was at a high level and the nurses' workability was at a moderate level. Increasing mental workload can reduce the nurses' workability. Therefore, it is suggested that hospital managers develop regular and frequent programs to reduce mental workload and increase the nurses' workability and productivity.

Acknowledgment

We thank all the nurses who collaborated in conducting

this study.

Conflict of interest: None declared.

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