

Workload and Performance of Nurses During The Covid-19 Pandemic: A Meta Analysis Study

Gde Palguna Reganata¹, I Gusti Ngurah Made Yudhi Saputra²

^{1,2}Hospital Administration, Bali International University, Indonesia

Article Info

Article history:

Received : 01-11-2022

Revised : 03-07-2022

Accepted : 04-19-2022

Keywords:

Covid-19;
Meta-Analysis;
Nurses;
Workload;
Performance.

ABSTRACT

The surge in Covid-19 cases has caused hospitals and health workers to experience functional collapse. The high workload in handling Covid-19 cases by nurses is happening everywhere. Many studies have been conducted to look at the effect of workload on nurse performance during a pandemic. This research was conducted to determine the effect of workload on the performance of nurses with a meta-analysis approach. This type of research is observational with a retrospective approach. This research conducted through secondary data obtained from relevant sources related to the workload of nurses and nurse performance in various journals. The population and samples were taken from studies that met the criteria. Data analysis using meta-analysis. The result showed that there is a negative correlation between workload and performance of nurses, with $\rho = 0.334$ are in the reception area of the 95% (0.334 ± 0.219) confidence interval with p-value < 0.0001 . Workload has a contradictory effect on performance, where when the workload of nurses is high, nurses tend to experience a decrease in performance. This needs to be a serious concern, because nurses are at the forefront of health services. If the nurse's performance has started to decline, then the patient's handling becomes not optimal and can increase the risk of death for the patient.



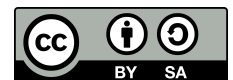
Accredited by Kemenristekdikti, Decree No: 200/M/KPT/2020

DOI: <https://doi.org/10.30812/varian.v5i2.1657>

Corresponding Author:

Gde Palguna Reganata,
Hospital Administration, Bali International University
Email: palgunareganata@iikmpbali.ac.id

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



A. INTRODUCTION

The Covid-19 pandemic is still a world health issue that gets high attention in handling. Starting from December 2019 until now the number of cases of Covid-19 worldwide is still relatively high. Even in July 2021, Indonesia had experienced the peak phase of the number of cases of Covid-19. Although in some cases the incidence has decreased because of effectiveness of the vaccine (Side et al., 2021). This certainly has an impact on increasing public access to health service providers.

As part of the front line in dealing with Covid-19 cases, not a few nurses experience fatigue both physically and mentally. The high workload in handling Covid-19 cases and the use of level 3 Personal Protective Equipment (PPE) greatly affect the decline in body immunity, so the risk of contracting the virus increase.

In addition, in this era of COVID-19, new factors can greatly affect the workload of nurses (Lucchini et al., 2020a). COVID-19 patients require prophylactic measures to prevent or contain the spread of the virus to other patients: wearing protective clothing, special decontamination procedures, specially isolated areas where certain supplies are stored. All these actions increase the workload of nursing (Giuliani et al., 2018), not only for the time required for its implementation but also for its organization and management.

Several early reports identified a very high nursing workload in COVID-19 patients (Lucchini et al., 2020a); (Lucchini et al., 2020b) (Kiba, 1969). In addition to the severity of the illness, the workload of nurses increases because of the need to provide humanistic care in the absence of a family. The introduction of cell phone calls (Negro et al., 2020) also helps patients to reduce their

sense of isolation and keeps them and their relatives updated, about what is happening outside and within the "hospital walls". When people with COVID-19 enter the hospital, they completely disappear from the lives of their relatives.

The heavy workload of hospital nurses is a major problem for the health care system because nurses are the cornerstone of any health care system regardless of the country. (Barton, 2009) for example have observed that globally, it appears that nurses are progressively experiencing an increase in workloads than before because of factors including inadequate supply of nurses, increased demand for nurses, reductions in patient length of stay, staff reductions. and increased overtime. Even more worrying is the consequences of a high nurse workload or perceived workload. For example, studies have shown that heavy nursing workloads have a negative impact on patient safety (Hegney et al., 2003). Another study also found that heavy nursing workloads adversely affect nurse job satisfaction, contributing to high nurse turnover and nurse shortages (Duffield and O'Brien-Pallas, 2003). Furthermore, it has been found that higher patient acuity, work system factors and expectations also contribute to nurses' workload: nurses are expected to perform schedules including delivery and collection of trays of food; transporting patients; and other household tasks, all of which are non-professional or service ancillary tasks (Aiken et al., 2002).

Research on the relationship between workload and nurse performance has been widely carried out around the world. From a quantitative point of view, the large number of studies conducted on this topic increases the possibility of variations in the results or research conclusions. In fact, it is not uncommon for studies on the same topic to show conflicting results. This situation, of course, creates problems, especially in constructing a comprehensive theory or making it the basis for decision making. Meta-analysis could find trends in the magnitude of the observed effect in a set of quantitative studies and all of them are included in the same research problem. Meta-analysis appears to address research problems in various fields, especially health. Various study findings that initially seemed contradictory and difficult to accumulate eventually became more integrative and systematic with meta-analysis.

Based on the explanation above, it can be concluded that the large number of studies that have been conducted on similar topics open space to draw more precise conclusions by integrating various study findings into a solid foundation for theory development as well as decision making and policy determination, so that these results provide an overview for health policy makers to evaluate the workload of nurses in pandemic era.

B. LITERATURE REVIEW

1. Meta-Analysis

Meta-analysis is one type of systematic review. According to (Xiao and Watson, 2019) systematic literature review means identifying, evaluating, and interpreting all existing relevant studies for a specific research question, or a particular topic area or phenomenon of interest to the researcher. (Gough et al., 2012) revealed several reasons for the need for a systematic review including: individual research may be wrong, either by changes or because of how the research was designed and carried out; individual research is likely to be of limited relevance because of its scope and context; a review provides a more comprehensive and robust picture based on multiple studies and settings than a single study; and findings from a review provide context for interpreting the results of the new primary study. The goal of the meta-analysis is to provide estimates of results that represent results at all research levels. An important feature of meta-analysis is the ability to incorporate information about the quality and reliability of primary studies by giving greater weight to larger and more well-reported studies (Mikolajewicz and Komarova, 2019).

There are at least 11 artifacts that can be used as criteria to understand why there are differences in research results on the same topic that need to be corrected (Dennis et al., 2012). Statistical artifacts are evidenced as the main cause of variation across individual studies in meta-analysis. The artifacts are (1) Sampling error; (2) Measurement error on the dependent variable; (3) Measurement error on the independent variable; (4) Dichotomy on the dependent variable; (5) Dichotomy on independent variables; (6) Variation of the range in the independent variable; (7) Artifacts of attrition; (8) Imperfect construct validity on the dependent variable; (9) Imperfection of construct validity on independent variables; (10) Reporting or transcriptional errors; and (11) Variance caused by external factors.

The steps that must be taken in the meta-analysis include the following procedures:

1. Identify and formulate research problems.
2. Collecting data through the selection of articles or research results that are relevant to the research problem.
3. Explanation and evaluation of data
4. Analysis and interpretation of the results of the analysis itself.

2. Nurse Workload

According to Health Law No. 36 of 2009 states that workload is the product of the number of jobs with time and the amount of work that must be hit by a position or organizational unit. The nurse's workload is all activities in the nursing service unit carried out by a nurse (Marquis and Huston, 2017). The high workload can result in poor communication between nurses and patients, failure of collaboration between nurses and doctors, nurses leaving and job dissatisfaction.

C. RESEARCH METHOD

This study includes an observational study to analyse the relationship between variables with a meta-analytical approach, recursive (cause and effect), with approach retrospective that aims to determine the effect of workload on nurse performance during the Covid-19 pandemic. This study uses secondary data obtained from relevant sources related to the workload of nurses and nurses' performance in various journals. The data collection method used in this research is the documentation method which will be combined with meta-analysis. The criteria for an article to meet the requirements for a meta-analysis in this study are:

1. Primary studies that have primary data or data obtained directly from research subjects through questionnaires, interviews, or observations regarding the variables of a study.
2. The primary study contains results in the form of informative data or statistical values, namely the characteristics of the subject, the number of n (samples), r (correlation coefficient), d (Somers D test), t (t -student), and f (regression coefficient) which is the result of the statistical test of the study. Search for literature studies is done by accessing online media articles, namely Google Scholar with search keywords are workload and nurse performance.
3. The limitation of the research year starts from January 2020 to September 2021, where this range is chosen to show the impact of the Covid-19 pandemic in the hospital work environment, especially for nurses. From the search results that have been carried out, 14 studies have been published from 2020 to 2021.

D. RESULTS AND DISCUSSION

1. Inclusion Criterion

The research used in this study contain sufficient statistical information to be used. The inclusion criteria and sample descriptions are presented in Table 1.

Table 1. Cataract maturity prediction system result

Study	Researcher	Sample
1	(Chustianengseh, 2020)	72
2	(Kusuma et al., 2021)	62
3	(Kusumaningrum, 2020)	59
4	(Rianto et al., 2020)	78
5	(Maudul & Riskiyani, 2020)	67
6	(Enrico, 2020)	73
7	(Dasrin et al., 2020)	487
8	(Pourteimour et al., 2021)	139
9	(Yamin et al., 2020)	103
10	(Russeng et al., 2020)	96
11	Yosiana et al., 2020)	113
12	Hermawati & Yosiana, 2021)	30
13	(Nurulwiyah, 2020)	125
14	(Suryani et al., 2021)	135

2. Meta-Analysis Procedures

Based on the data that has been obtained, the stages of analysis according to the guidelines using the meta-analysis technique are described as follows (Dennis et al., 2012).

1. Convert the value of F to the values of t , d , and r .

Based on the 14 primary studies that were used as research data, there were eleven studies that needed to convert the t -value into the r -value, namely studies number 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, and 14. The equation formula for converting the value

of t to the value of r is:

$$d = \frac{2t}{\sqrt{N}} \text{ or } d = \frac{2r}{\sqrt{(1-r)^2}} \quad (1)$$

$$r = \frac{t}{\sqrt{t^2 + (n-2)}} \quad (2)$$

$$r = \frac{d/2}{\sqrt{1 + \left(\frac{d}{2}\right)^2}} \quad (3)$$

$$t = \sqrt{F} \quad (4)$$

$$D = \frac{\sum W_i d_i}{\sum N_i} \quad (5)$$

Here is the result of the conversion value t to the value r :

Table 2. Result of conversion study into t and r value

Study	t	r
1	2.982	0.336
2	3.240	0.386
4	0.125	0.014
5	1.794	0.217
6	17.344	0.899
7	-3.104	-0.140
11	4.773	0.442
11	-2.471	-0.228
12	-2.471	-0.423
13	14.722	0.799
14	1.981	0.169

2. Bare bones meta analysis of sampling error correction.

The steps in bare bone meta-analysis of sampling error are as follows:

- (a) Calculating the mean population correlation (r_{xy} or \check{r} or σ_{xy})

The formula for calculating the mean population correlation:

$$\rho_{xy}(\check{r}) = \frac{\sum N_i r_i}{\sum N_i} \quad (6)$$

The result of calculating the mean population correlation after correction is 0.334.

Table 3. Sample error correction

Study	N	r_{xy}	$N \times r_{xy}$
1	72	0.336	24.173
2	62	0.386	23.925
3	59	0.282	16.638
4	78	0.014	1.118
6	67	0.217	14.553
7	73	0.899	65.661
8	100	0.140	13.957
9	139	0.057	7.923
10	103	0.287	29.561
11	96	0.442	42.401
12	113	0.228	25.803
13	30	0.423	12.693
14	125	0.799	99.840
15	135	0.169	22.855
Total	1252	4.679341	401.1002
Mean	89.429		0.320

(b) Calculating the population correlation variance (σ_r^2)

The formula for calculating the population correlation variance:

$$\sigma_r^2 = \frac{\sum N_i(r_i - \bar{r})^2}{\sum N_i} \quad (7)$$

The result of calculating the population correlation variance after correction is 0.064.

Table 4. Population correlation variance

Study	N_i	r_{xy}	$r_i - \bar{r}$	$(r_i - \bar{r})^2$	$N_i * (r_i - \bar{r})^2$
1	72	0.336	0.001	0.000	0.000
2	62	0.386	0.052	0.003	0.165
3	59	0.282	-0.052	0.003	0.161
4	78	0.014	-0.320	0.102	7.982
6	67	0.217	-0.117	0.014	0.918
7	73	0.899	0.565	0.319	23.322
8	100	0.140	-0.195	0.038	3.790
9	139	0.057	-0.277	0.077	10.684
10	103	0.287	-0.047	0.002	0.230
11	96	0.442	0.107	0.012	1.108
12	113	0.228	-0.106	0.011	1.267
13	30	0.423	0.089	0.008	0.237
14	125	0.799	0.464	0.216	26.968
15	135	0.169	-0.165	0.027	3.673
Total	1252	4.679	3.33E-16		80.505
Mean	89.429	0.334	2.38E-17		0.064

(c) Calculating the sampling error variance (σ_ϵ^2)

Here is the formula to calculate the sample variance error:

$$\sigma_\epsilon^2 = \frac{(1 - \bar{r}^2)^2}{\bar{N} - 1} \quad (8)$$

Sampling error variants obtained by knowing the average correlation (\bar{r}) and the mean number of samples (\bar{N}), then:

$$\sigma_\epsilon^2 = \frac{(1 - 0.334^2)^2}{89.429 - 1} = 0.009$$

- (d) Estimation of the actual population correlation variance or true score (
- σ_{xy}^2
-)

The formula for calculating the actual population correlation variance:

$$\sigma_{\rho_{xy}}^2 = \sigma_r^2 - \sigma_\epsilon^2 \quad (9)$$

So, the results are:

$$\sigma_{\rho_{xy}}^2 = 0.064 - 0.009 = 0.055$$

Based on the results of the actual correlation variance ($\sigma_{\rho_{xy}}^2$), it can be calculated the size of the Standard Deviation

$$(SD) = \sqrt{\sigma_{\rho_{xy}}^2} = \sqrt{0.055} = 0.235$$

- (e) Confidence interval (
- M_ρ
-)

Here is the formula to calculate the confidence interval:

$$M_\rho = \tilde{r} \pm 1.96(SD)$$

$$M_\rho = \tilde{r} \pm 1.96(0.235) \quad (10)$$

$$M_\rho = 0.334 \pm 0.444$$

Based on a meta-analysis on the above calculation, it can be concluded that there is a relationship between workload and performance of nurses, with $\tilde{r} = 0.334$ are in the reception area of the 95% confidence interval (0.334 ± 0.444). When the r value is less than 2 SD, the relationship that occurs is negative, then $0.334 < 0.888$, meaning that there is a negative relationship between the two variables.

- (f) Impact of sampling error

The error in sampling is obtained by using the formula:

$$1 - \text{Reliability} = \frac{\sigma_{\rho_{xy}}^2}{\sigma_r^2}$$

$$1 - \text{Reliability} = 1 - \frac{0.05}{0.064} = 1 - 0.861 = 0.139$$

The correlation reliability in this study is 0.861, so the impact of sampling error is 0.139. These results indicate that the error in sampling is 13.9%.

3. Correction in measurement error

Another artifact that is corrected after sampling error is to correct the measurement error (Dennis et al., 2012). To calculate the measurement error requires statistical data or information, namely the reliability value of the measuring instrument of the two variables used. Based on the 14 studies used in this meta-analysis, only 5 studies contained data on the reliability of the independent variable (r_{xx}) and the dependent variable (r_{yy}). Systematically, calculating measurement error correction is carried out through the following steps:

- (a) The formula for calculating the combined mean:

$$\hat{A} = Ave(a) \times Ave(b)$$

$$\hat{A} = 0.877 \times 0.882 = 0.773 \quad (11)$$

Description:

$$(a) = \sqrt{r_{xx}}$$

$$(b) = \sqrt{r_{yy}}$$

$$Ave(a) = Average(a)$$

$$Ave(b) = Average(b)$$

- (b) Calculating the measurement error correction in
- x
- and
- y
- , ie the real correlation of population (
- ρ
-).

The formula to calculate an estimate of the population correlation:

$$\rho = Ave(\rho_i) = \frac{\tilde{r}}{\hat{A}}$$

$$\rho = Ave(\rho_i) = \frac{0.320}{0.773} = 0.414 \quad (12)$$

Estimation of the population correlation after correction of measurement error (ρ) that is equal to 0.414

- (c) The sum of the squared coefficients of variation (
- V
-)

The formula for calculating the sum of the squared coefficients of variation:

$$V = \frac{SD(a)^2}{Ave(a)^2} + \frac{SD(b)^2}{Ave(b)^2} \quad (13)$$

$$V = \frac{0.083}{0.877} + \frac{0.062}{0.882} = 0.014$$

- (d) Variant referring to artifact variation (
- σ_2^2
-)

The formula for calculating variance referring to artifact variation:

$$\sigma_2^2 = \rho^2 A^2 V \quad (14)$$

$$\sigma_2^2 = 0.773^2 \cdot 0.414^2 \cdot 0.014 = 0.0014$$

- (e) Varian real or true score correlations (
- ρ
-)

The formula for calculating the correlation variants real or true score:

$$Var(\rho) = \frac{\sigma_{\rho_{xy}}^2 - \rho^2 A^2 V}{A^2} \quad (15)$$

$$Var(\rho) = \frac{0.009 - 0.0014}{0.773^2} = 0.013$$

Based on the results of these calculations, standard deviation (SD) can be calculated using the formula below:

$$SD = \sqrt{Var(\rho)} = \sqrt{0.013} = 0.112$$

The estimated population correlation after correction of measurement error (ρ) is 0.334 with an SD of 0.112.

- (f) Confidence interval (
- M_ρ
-)

The formula for calculating the confidence interval:

$$M_\rho = \tilde{r} \pm 1.96(SD)$$

$$M_\rho = 0.334 \pm 1.96(0.112) \quad (16)$$

$$M_\rho = 0.334 \pm 0.219$$

Based on the meta-analysis calculation above, it can be concluded that there is a relationship between workload and nurse performance, with $\tilde{r} = 0.334$ being in the 95% confidence interval acceptance area (0.334 ± 0.219). Because the value of is smaller than $2 SD$, then the relationship that occurs is negative, then $0.334 < 0.528$, meaning that there is a negative relationship between the two variables.

- (g) Impact of variation in reliability or measurement error

The formula for calculating the variation in reliability or measurement error:

$$Var Rel = \frac{\rho^2 A^2 V}{A^2} \quad (17)$$

$$Var Rel = \frac{0.0014}{0.773^2}$$

$$Var Rel = 0.00239$$

This result then used as a percentage $0.00239 \times 100\% = 0.24\%$. Based on the calculation of the variation in reliability, the results of the measurement error correction in this meta-analysis study are 0.24%.

E. CONCLUSION AND SUGGESTION

Based on the results of this meta-analysis study, it can be concluded that there is a negative relationship between workload and nurse performance. This study cannot be separated from weaknesses, thus, the researcher hopes that further research on workload and performance of nurses can use a more homogeneous primary study covering the study sample population area. In addition, further research is also expected to use research articles that thoroughly discuss these two variables, especially regarding the performance of nurses.

This study illustrates that the workload of nurses has a worrying impact on the handling of Covid-19. This needs to be taken seriously, because nurses are at the forefront of health services. If the nurse's performance has started to decline, the patient's handling will not be optimal and can increase the risk of death for the patient. In addition, the slow handling also has an impact on other aspects, such as negative economic growth and domestic security instability.

Further researchers are also advised not to use Google Scholar to search for primary studies online because the scope is too broad and results in many articles that do not meet the research criteria. In addition, it is also recommended to use a statistical program in analyzing research data to be more accurate in carrying out data analysis calculations

ACKNOWLEDGEMENT

Acknowledgments are addressed to the Bali International University who have provided support so that this research can be realized properly.

REFERENCES

- Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J., and Silber, J. H. (2002). Hospital Nurse Staffing and Patient Mortality, Nurse Burnout, and Job Dissatisfaction. *Jama*, 288(16):1987–1993.
- Barton, A. (2009). Patient Safety and Quality: An Evidence-Based Handbook for Nurses. *Aorn Journal*, 90(4):601–602.
- Dennis, A., Wixom, B. H., and Roth, R. M. (2012). *Systems Analysis and Design* 5th Edition.
- Duffield, C. and O'Brien-Pallas, L. (2003). The Causes and Consequences of Nursing Shortages: a Helicopter View of The Research. *Australian Health Review*, 26(1):186–193.
- Giuliani, E., Lionte, G., Ferri, P., and Barbieri, A. (2018). The Burden of Not-Weighted Factors–Nursing Workload in a Medical Intensive Care Unit. *Intensive and Critical Care Nursing*, 47:98–101.
- Gough, D., Oliver, S., and Thomas, J. (2012). *An Introduction to Systematic Reviews*. Sage.
- Hegney, D., Plank, A., and Parker, V. (2003). Workplace Violence in Nursing in Queensland, Australia: A Self-Reported Study. *International journal of nursing practice*, 9(4):261–268.
- Kiba, F. (1969). Nurse-Patient Relations. [*Kango gijutsu*]:[*Nursing technique*], 34(4):326–337.
- Lucchini, A., Giani, M., Elli, S., Villa, S., Rona, R., and Foti, G. (2020a). Nursing Activities Score is Increased in COVID-19 Patients. *Intensive & critical care nursing*, 59:102876.
- Lucchini, A., Iozzo, P., and Bambi, S. (2020b). Nursing Workload in the COVID-19 Era. *Intensive & critical care nursing*, 61:102929.
- Marquis, B. and Huston, C. (2017). Socializing and Educating Staff in a Learning Organization. In *Leadership roles and management functions in nursing*. Wolters Kluwer, Philadelphia.
- Mikolajewicz, N. and Komarova, S. V. (2019). Meta-Analytic Methodology for Basic Research: a Practical Guide. *Frontiers in physiology*, 10:203.
- Negro, A., Mucci, M., Beccaria, P., Borghi, G., Capocasa, T., Cardinali, M., Pasculli, N., Ranzani, R., Villa, G., and Zangrillo, A. (2020). Introducing the Video Call to Facilitate the Communication Between Health Care Providers and Families of Ppatients in the Intensive Care Unit During COVID-19 Pandemia. *Intensive & critical care nursing*, 60:102893.
- Side, S., Hulinggi, P. K. M., Syam, H. K., Irfan, M., and Taufik, A. G. P. (2021). The Effectiveness of Vaccination Against The Spread of COVID-19 with SEIR Mathematical Modeling in Gowa District. *Jurnal Varian*, 5(1):17–28.
- Xiao, Y. and Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, 39(1):93–112.