




# Nurses' Satisfaction with a Web-Based Application for Calculating Nursing Staff Based on Patient Dependency Levels and Unit Workload in Hospitals

Tuti Afriani<sup>1</sup>  , Rr. Tutik Sri Hariyati<sup>1</sup>  Hanny Handiyani<sup>1</sup>  Dyah Fitri Wulandari<sup>2</sup>

<sup>1</sup>Basic Science and Fundamental of Nursing Department, Faculty of Nursing, Universitas Indonesia, Indonesia

<sup>2</sup>Khidmat Sehat Afiat Regional General Hospital, Depok, West Java, Indonesia

 Corresponding author: [tuti.afriani@gmail.com](mailto:tuti.afriani@gmail.com)

## ARTICLE INFO

### Article history:

Received 20 May 2025

Revised 10 July 2025

Accepted 21 July 2025

Available online

<https://talenta.usu.ac.id/IJNS>

E-ISSN: 2685-7162

How to cite: Afriani, T., Hariyati, R.T.S., Handiyani, H, Wulandari, D.F., (2025). Nurses' satisfaction with a web-based application for calculating nursing staff based on patient dependency levels and unit workload in hospitals. *Caring: Indonesian Journal of Nursing Science*, 7(1), 123-130.



This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International

<https://doi.org/10.32734/ijns.v7i1.20903>

03

## ABSTRACT

Complaints from nurses are often received by nursing managers regarding staff shortages, which leads to increased workload. Determining the unquantifiable level of workload poses a challenge, as the head nurse cannot accurately assess the number of staff shortages in the hospital room. Therefore, this study aims to develop a web-based application for the calculation of nursing staff needs based on patient dependency levels and unit workload. The application is accessible through both mobile and web platforms. A pre-experimental one-shot case study design, including 25 nurses, was used at a hospital in West Java. Measurements were conducted only during the post-test phase. The results showed that the majority of respondents were female (80%), who held a Diploma degree (76%), and worked as managers (48%). The average age of respondents was  $34.3 \pm 7.27$  years, with a median experience of  $5.0 \pm 728$  years. Generally, nurses' satisfaction with the application was at a moderate satisfaction, with an average satisfaction rate of 72.4%. A more detailed breakdown showed satisfaction scores of 74%, 71.4%, 75%, 70%, and 70.8% for content, format, accuracy, timeliness, and ease of use, respectively. Satisfaction with the application needs to be improved, specifically for timeliness and ease of use. This application was developed as a potential method for efficiently assessing staffing needs. Providing adequate training for nurses is essential to enhance the effectiveness and usability of the application in hospital settings.

**Keywords:** Web-based application, Patient dependency, Nursing staff, Workload

## 1. Introduction

Hospitals are complex organizations that manage a diverse range of resources, including nurses, considered crucial in the implementation of health services. BPPSDM data in 2023 showed approximately 1,380,568 health workers across Indonesia, with nurses comprising 638,829 individuals, or around 46.47% of the total workforce across nine categories of health professionals (Kementerian Kesehatan, 2023). Although the number of nurses is the largest among other health workers in hospitals, staff shortages are common and often lead to a decline in the quality of nursing care. A previous study reported a relationship between staffing levels and nursing outcomes (Nantsupawat et al., 2015).

An insufficient number of nurses in hospitals affects both the quality of patient care and the well-being of nurses. This leads to various factors, including increased workload, which compromises the delivery of

quality patient care, endangers patient safety, and negatively impacts nurses' well-being (Afriani et al., 2022; Banda et al., 2022). Workload factors have been associated with an increase in reported cases of physical and emotional abuse among nurses. Each additional patient assigned per nurse is associated with higher levels of job dissatisfaction and emotional exhaustion (Havaei & MacPhee, 2020). Fatigue causes many injuries to nurses, and a high workload is a contributing factor to an increased risk of medication errors (86.2%), patient falls (88.3%), urinary tract infections (86.4%), and emotional exhaustion (55.4%) (MacPhee et al., 2017). Patient safety incidents often occur due to nurses' fatigue, which is frequently caused by inadequate staffing levels. The application developed in this study enables the measurement of nurses' suitability to the workload, allowing for rapid and accurate calculation of staffing needs—even on a per shift basis.

A shortage of nursing staff in inpatient settings leads to an increased workload. However, the workload is often difficult to quantify in a way that accurately determines the staff shortage in a unit. To address this issue, an application was developed to calculate the required number of nurses in a unit based on patient dependency levels and total unit workload. The calculation method has been integrated into a user-friendly web-based application designed to calculate the appropriate number of nurses based on the workload. The application can be integrated into the hospital information system and is also accessible through mobile devices.

The earliest computer-based application to calculate nursing staffing needs was Workload Indicators of Staffing Needs (WISN) method. Since the development, this method has been widely used in various healthcare settings to estimate staffing needs, address the uneven distribution of nurses, and assess staff productivity (WHO, 2016), as well as to calculate the number of staff required in dialysis rooms (Gupta et al., 2023) and general inpatient wards (Niaraces Zavare et al., 2023). WISN is frequently used and often plays an important role in determining nurses' workload, but does not fully account for the complexity of nursing roles, including the management of multiple additional tasks, the number of patients, and patient dependency levels (Asres & Gessesse, 2024).

Developing a nursing staff application in this study will assist managers in calculating workload and determining staffing needs on a shift basis. When the application identifies a shortage of nurses in a ward, the managers can promptly take corrective actions to address the staffing gap. This method is important because at one time, a room requires additional nurses from outside due to the increasing number of patients or the condition of patients with total dependence on nurses. During a decrease in workload in one room, nurses rotate to other rooms that have a high workload. The innovation applied to the application product is rapid and measurable calculation. No single tool is universally applicable, showing a need for more evaluation to clarify the practicality of usage (Greaves et al., 2018). Therefore, this study aims to develop a mobile or web-based application to calculate staffing requirements for each shift and assess nurses' satisfaction with the application.

## **2. Method**

### **2.1 Population and Sample**

This study was conducted at a hospital with a total population of 90 nurses, where one inpatient unit comprising a total sampling of 25 nurses was used to test the application and evaluate user satisfaction. The small number of samples facilitates rendering easier assistance to nurses individually in using the application, but serves as a limitation. The inclusion criteria were nurses who had worked for a minimum of 6 months and were willing to participate as respondents. The exclusion criteria were nurses in the hospital room who failed to attend training and were not on leave during the study period.

### **2.2 Data Collection**

Data collection was conducted and the design applied was a pre-experimental one-shot case study, in which the application was tested through a training session, followed by seven days of guided usage. Post-test data were collected when the guidance period was completed, compared to immediately after the training, because of technical issues such as signal disruption and application error during the training sessions. The application for counting nursing staff was developed using literature studies and by discussing with two management experts to ensure construct validity. The experts included a member of the study team, while the other was an external consultant. End User Computing Satisfaction (EUCS) was the tool used to measure the level of satisfaction with the computerization of the system. This model evaluates satisfaction by comparing users' expectations of the system with actual experiences (Doll & Torkzadeh, 1988). EUCS focuses on end-user satisfaction from a technological perspective and assesses five key dimensions, namely content, accuracy, format, ease of use, and timeliness. Additionally, the questionnaire used during evaluation comprised a 4-point Likert scale with response options, including Strongly Agree, Agree, Disagree, and Strongly Disagree.

### 2.3 Analyses

The data collected in this study were analyzed using a computerized process. Furthermore, the test carried out was the proportion and percentage analysis of the average value.

### 2.4 Ethical Clearance

The ethical clearance for this study was received from the Faculty of Nursing, University of Indonesia, under the number KET-172/UN2.F12. D 1.2.1/PPM.00.02/2023.

## 3. Results

### 3.1 Application Development

#### 3.1.1 Application Description

This study developed an application that can be accessed through mobile devices or integrated with existing hospital information systems. The algorithm used in the application was obtained from nurses' fatigue calculation models found in the literature and was further modified. The application functions through several steps, namely (1) Nursing manager or team leader opens the application using a registered username and password; (2) Manager initially prepares data, including the number of current patients, patients expected to be admitted and discharged during the upcoming shift, internal transfer patients (those who will move to other rooms inside the same hospital), external transfer patients moving to other hospitals, as well as transport patients who will be escorted by nurses in the context of supporting examinations and shuttle operations; (3) The implementing nurse enters data in the application by filling in, specifying the number of patients under Minimal care, Partial care, and Total care dependency levels; (4) The results of operating this application can determine the workload of nurses; and (5) The application operating results help calculate the number of nurses according to the unit workload.

#### 3.1.2 Modification of Nursing Staff Calculation Application

The optimal number of nurses in a unit can be calculated using methods that incorporate nursing time and patient classification system (Jang et al, 2022). This method includes quantifying the time required according to patient care needs. Since the number of staff is calculated based on the time required per patient, nursing time should be accurately measured and estimated using the appropriate tools (Ko & Park, 2023). The level of nursing staffing needs is determined based on workload (Kim et al., 2018), and the time measurement requires a separate study. Therefore, a standardized allocation time to perform direct and indirect nursing activities as well as non-nursing activities was provided (Ko & Park, 2023). During practice, some nursing activities change throughout the day depending on the number and plan of patient care that have not been calculated in the workload. To address this gap, additional nursing activities that are not calculated individually are included in the unit workload.

Nurses in Indonesia perform many activities that affect care time, including receiving new patients, managing internal and external transfers, carrying out discharges, and taking patients to the operating room or for diagnostic procedures. These activities, which cannot be determined for individual nurses, are incorporated into the unit workload calculation.

The application for staff calculation is developed based on Unit Workload (UW), consisting of all nursing activities, such as direct patient care, indirect care, and non-nursing tasks. Unit Workload can determine the workload of nurses in a unit and is calculated based on Unit Activity Score (UAS) summed with the number of patient care hour scores per day based on patient dependency levels using Nursing Hours per Patient Day (NHPPD).

$$UW = [(NHPPD \times NA) + (NHPPD \times NB) + (NHPPD \times NC)] + UAS$$

Note:

- NHPPD: *Nursing Hours per Patient Day*

- N (A, B, C). NA= Number of Patients in Minimal Care, NB= Number of Patients in Partial Care, NC= Number of Patients in Total Care

- UAS: Unit Activity Score

UAS is calculated based on the number of admission patients (Admission), discharge patients (Discharge), transfer patients in the hospital (Internal), transfer patients outside the hospital (External), Transport patients (Transport), and the number of patients (Shift End Census). This calculation is carried out using the following formula:

$$UAS = \frac{(A+D+I+E+T)}{(SEC+A+D+I+E+T)}$$

Note:

- A: Patient Admission
- D: Patient Discard
- I: Intra-hospital (Internal) Patient Transfer
- E: Inter-hospital (External) Patient Transfer
- T: Patient Transport due to picking up patients to the operating room, supporting examinations, and other factors.
- SEC: Shift End Census

NHPPD used in this study was derived from previous investigations, which reported 4.6, 4.9, and 6.2 hours for minimal, partial, and total care, respectively. To calculate the number of nurses required in a shift, Unit Workload Score (UWS) is divided by the effective hours per shift. All calculations are performed by the application using the formula  $\text{Total Nurses} = \text{UWS} / \text{effective working hours per shift}$ .

### 3.2 Nurses' Satisfaction with the Application

#### 3.2.1 Characteristics of Respondents

Table 1 shows the demographic characteristics of respondents, with an average age of 34 years and an average experience of 5 years. Respondents were mostly female (20 nurses, 80%), while the majority had a diploma education level (19 nurses, 76%) and a third-level qualification in clinical nursing (12 nurses, 48%).

**Table 1** Demographic characteristics of nurse respondents (N= 25)

	Mean (SD) Frequency	Percentage
Age (years)	34.3 ( $\pm 7.27$ )	
Years of Experience	5.0 ( $\pm 7.28$ )	
Education		
Diploma	19	76
Bachelor of Nursing	6	24
Gender		
Male	5	20
Female	20	80
Level Clinical Nursing		
Level 1 (Novice)	9	36
Level 2 (Advanced Beginner)	4	16
Level 3 (Competent)	12	48

#### 3.2.2. Nurses' Satisfaction with Web-Based Application

According to Table 2, total satisfaction with web-based application for calculating nursing staff is still in the medium range (70%-75%). The highest average percentage score was observed in the content and accuracy components (75%). However, nurses perceived that one area requiring improvement was the time-consuming nature of completing the application.

**Table 2** Nurses' satisfaction with web-based application for calculating staffing needs (N=25)

Category	Possible Score	Median (Range)	MPS (%)
Content	20 (5 items)	15 (15–20)	75
Format	28 (7 items)	20 (19–25)	71.4
Accuracy	24 (6 items)	18 (16–21)	75
Timeless	20 (5 items)	14 (14–18)	70
Ease of Use	24 (6 items)	17 (16–21)	70.8
All	116 (29 items)	84 (82–103)	72.4

MPS: (Average-minimum score)/Range

#### 3.2.3. Description of Nurses' Satisfaction with the Staffing Application

Table 3 shows the result of nurses' satisfaction across the five dimensions measured. In the content dimension, the entire nurses agreed that this application provided the necessary information. In the format dimension, 56% respondents reported difficulty understanding how to complete the application. In terms of accuracy, nearly all (98.7%) stated that the application was accurate in calculating the workload and staffing requirements. A total of 96.8% described the application as fast and reliable in calculating the workforce and

workload of nurses. Even though 92% stated that the application was easy to use, 8% reported difficulty with the operation.

**Table 3** Detailed description of nurses' satisfaction with the staffing application

No	Statement	Strongly disagree	Disagree	Agree	Strongly Agree
<b>Content</b>					
1	Electronic-based application provides information based on user needs.	0 (0)	0 (0)	22 (88)	3 (12)
2	Electronic-based application provides accurate information on manpower and workload.	0 (0)	0 (0)	20 (80)	5 (20)
3	Electronic-based application provides useful reports for individual work.	0 (0)	0 (0)	22 (88)	3 (12)
4	The application facilitates the provision of accurate manpower and workload information.	0 (0)	0 (0)	23 (92)	2 (8)
5	The reports provided by the application support the needs of room management.	0 (0)	0 (0)	20 (80)	5 (20)
Total		0 %	0 %	85,6 %	14.4 %
<b>Format</b>					
6	The information presented by the application system is very clear.	0 (0)	1 (4)	23 (92)	1 (4)
7	The design of the application is very attractive.	0 (0)	0 (0)	23 (92)	2 (8)
8	The colour composition of the application system minimizes eye strain during use.	0 (0)	0 (0)	22 (88)	3 (12)
9	The colour composition of the electronic-based documentation system is not boring when used.	0 (0)	0 (0)	23 (92)	2 (8)
10	The format and form of reports generated by electronic-based application systems are difficult to understand.	0 (0)	9 (36)	14 (56)	2 (8)
11	The application system display is easy, thereby enabling a faster filling process	0 (0)	1 (4)	22 (88)	2 (8)
12	The application system displays information in a clear and well-organized manner.	0 (0)	0 (0)	22 (88)	3 (12)
Total		0 %	6.2 %	85.1 %	8.7 %
<b>Accuracy</b>					
13	The information generated by the application system is very accurate.	0 (0)	1 (4)	20 (80)	4 (16)
14	The output displayed on the screen reflects the data entered.	0 (0)	0 (0)	22 (88)	3 (12)
15	The application system frequently encounters errors.	0 (0)	12 (48)	13(52)	0 (0)
16	The application system can minimize the occurrence of errors in calculating the staffing and workload of nurses.	0 (0)	0 (0)	24 (96)	1 (4)
17	The application system produces reliable and trustworthy information.	0 (0)	0 (0)	25 (100)	0 (0)
18	The reports generated by the application system support accurate decision-making.	0 (0)	0 (0)	23 (92)	2 (8)
Total		0 %	0.66%	84%	15,33%
<b>Timeless</b>					
19	The application system provides the information needed on time.	0 (0)	0 (0)	25 (100)	0 (0)
20	The application system provides up-to-date data.	0 (0)	0 (0)	22 (88)	3 (12)
21	The application system provides appropriate alerts/reminders to users through notifications.	0 (0)	0 (0)	24 (96)	1 (4)
22	The application system provides manpower shortage information when needed.	0 (0)	1 (4)	19 (76)	5 (20)
23	The application system supports rapid decision-making.	0 (0)	3 (12)	22 (88)	0 (0)
Total		0 %	3.2%	89.6%	7.2%
<b>Ease of Use</b>					
24	An electronic-based application system is very user-friendly	0 (0)	0 (0)	22 (88)	3 (12)
25	A long time is required to learn the operation of electronic-based application systems.	0 (0)	8 (32)	18 (68)	0 (0)

Table 3 Continued

No	Statement	Strongly disagree	Disagree	Agree	Strongly Agree
<i>Ease of Use</i>					
26	An electronic-based application system is easy to use.	0 (0)	0 (0)	23 (92)	2 (8)
27	There is a help menu in the e-application system.	0 (0)	0 (0)	23 (92)	2 (8)
28	The electronic-based application systems provide clear instructions for use.	0 (0)	0 (0)	23 (92)	2 (8)
29	There are no obstacles in teaching electronic-based application systems to new individuals.	0 (0)	4 (16)	21 (84)	0 (0)
Total		0 %	8 %	86 %	6%

#### 4. Discussion

Objectives of this study were twofold, namely, the first was to develop a nursing staff application accessible through mobile and web platforms. The second was to identify nurses' satisfaction with the application, which calculated staffing needs based on patient dependency level and unit workload.

##### 4.1 Application development based on unit workload and patient dependency level

The method of calculating nursing staff based on workload has been used widely. The workload includes the assessment of all nursing activities conducted in providing patient care. The activities are quantified into activity time, which is categorized according to the level of care required by the patient. WISN is commonly used for measuring workload (WHO, 2016) (Nguyen et al., 2022), but has limitations in reliability due to using retrospective data. The challenge of this method is the inability to capture the multitasking nature of health workers, which may lead to biased staffing calculations (Asres & Gessesse, 2024).

Investigations on workload generally focused on measuring nurses' activity or nursing time. The total amount of executed activity provides an indicator of nurses' workload. An investigation that assesses nurses' activity using NAS is considered the best measurement, although many existing workload measurement tools do not provide sufficient evidence of accuracy (Hoogendoorn et al., 2020). The reciprocal relationship between workload and staffing shortage is the basis for calculating nurses' manpower. Workload is measured by the activity time of nurses providing patient care daily, commonly referred to as NHPPD. A study examining the effectiveness of nursing staff calculation method found that NHPPD was the most frequently used and considered the most effective method (Min & Scott, 2016).

Analysis is conducted on nurses' workload in a hospital, calculated from the use of productive time, direct nursing activities, indirect activities, and non-nursing activities (Ko & Park, 2023). Some actions cannot be calculated for an individual nurse from these activities, leading to this study adding UAS variable that changes daily. UAS consists of counting the number of patients on each day, admissions, discharges, internal and external patients transferred, as well as the number of patients escorted by nurses to the operating room and for supporting examinations. All of the components are included in the calculation of nurses' workload through UAS. According to a study, patient transfers represent a workload factor that should be included in the measurement of nurses' workload (Blay et al., 2017).

During this study, the total number of ideal nurses in a unit was calculated by examining UW value. The calculation of nursing staff based on unit workload and patient acuity level, when performed using the application, generates workload results specific to each unit/ward. Furthermore, unit workload is calculated through UAS, summed with the number of patient care hour scores per day based on patient dependency, referred to as NHPPD. Hoi et al. (2010) suggested that NHPPD values varied by dependency category, including Category A (1.1 hours for low acuity), B (1.3 hours), C (2.75 hours), D (4.7 hours), and E (highest acuity/dependency of 8.4 hours). UW value (in hours) obtained is divided by the effective working hours of nurses in one shift to determine the ideal number of staff required. This shows that nurses are fully (100%) satisfied with the content, namely the electronic-based application provides accurate workforce and workload information, as well as facilitates the provision of the data (Table 3).

Excessive workload of nurses is determined by comparing the estimated staffing requirements derived from the analysis with the currently available resources. According to Müller et al. (2021), the workload is assessed by comparing the currently available nursing resources with the calculated staffing requirements based on workload analysis. When the ratio exceeds 1, the workload is considered high, suggesting a need for additional nursing staff. Another method to assess the workload is by calculating the productive time estimated at 80% for direct patient care, while the remaining (20%) is used for personal and non-productive activities (Ilyas, 2017). This parameter is used to assess workload intensity, where nurses working above the amount of productivity time show that managers need to consider assigning additional staff to the unit.

#### 4.2 Nurses' satisfaction with the application

EUCS is commonly used to assess user satisfaction with a particular application. This is defined as the affective attitude of an individual toward a computer application being interacted with directly (Doll & Torkzadeh, 1988). This study found that nurses' satisfaction with the application remained at a moderate satisfaction. The highest satisfaction reported in the areas of content and accuracy. A previous investigation showed that perceived usefulness and ease of use had a direct and significant influence on the level of mobile application usage by nurses (Nezamdoust et al., 2022). Another study reported that relative advantage, compatibility, trial-ability, and observer ability had a direct and significant influence on nurses' use of mobile application, while complexity showed no significant influence (Nezamdoust et al., 2022). The discussion section connects and compares the obtained results with the theory and the reports from previous studies.

#### 4.3 Limitation

Several limitations were observed, firstly, this study was conducted in only the inpatient unit due to serving as an initial trial for the calculation application of nursing staff. A small sample size was used, and there was a lack of a representative sample size, while both training and assistance were conducted in the application. Secondly, technical issues were encountered during the training sessions, including signal constraints and some application errors due to simultaneous access by multiple trainees. Therefore, data collection was conducted post-guided assistance period compared to immediately after the training was completed.

### 5. Conclusion

In conclusion, this study found that the application was developed based on unit workload and patient dependency levels. Nurses' satisfaction with the application was at a moderate level (72.4%), with the highest satisfaction reported in the categories of content and accuracy (both at 75%). Other satisfaction scores included 71.4%, 70%, and 70.8% for format, timelessness, and ease of use, respectively. Nurses' satisfaction should be considered in designing and developing the application program to facilitate the usage through mobile and web platforms. In addition, nurses should be trained in using the application to improve the effectiveness of calculating the number of staff and workload. Structured training could help nurses understand the features of the application better, promoting the usage to improve work efficiency and reduce errors. Regular evaluation of satisfaction is necessary for continuous improvement, while feedback from nurses needs to serve as a basis for refining existing features and developing new features that are more relevant to daily needs. Strengthening communication between nurses and hospital management is essential to ensure that expectations and challenges related to the application are openly discussed.

### Acknowledgment

The authors are grateful to the Faculty of Nursing, University of Indonesia, for the invaluable support provided and to all respondents who participated in this study.

### References

- Afriani, T., Hariyati, T. S., Yetti, K., & Besral, B. (2022). Exploring Nurses' Perceptions of their Workload at Coronavirus Disease 2019 Isolation Ward in Jakarta, Indonesia: A Qualitative Study. *Open Access Macedonian Journal of Medical Sciences*, 10(G), 195–201. <https://doi.org/10.3889/oamjms.2022.7282>
- Asres, G. D., & Gessesse, Y. K. (2024). Workload Indicators of Staffing Need (WISN) method for health workforce planning at health facility: A scoping review. *Human Factors in Healthcare*, 6(April 2023), 100078. <https://doi.org/10.1016/j.hfh.2024.100078>
- Banda, Z., Simbota, M., & Mula, C. (2022). Nurses' perceptions on the effects of high nursing workload on patient care in an intensive care unit of a referral hospital in Malawi: a qualitative study. *BMC Nursing*, 21(1), 1–7. <https://doi.org/10.1186/s12912-022-00918-x>
- Blay, N., Roche, M. A., Duffield, C., & Gallagher, R. (2017). Intrahospital transfers and the impact on nursing workload. *Journal of Clinical Nursing*, 26(23–24), 4822–4829. <https://doi.org/10.1111/jocn.13838>
- Doll, W. J., & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. *MIS Quarterly: Management Information Systems*, 12(2), 259–273. <https://doi.org/10.2307/248851>
- Greaves, J., Goodall, D., Berry, A., Shrestha, S., Richardson, A., & Pearson, P. (2018). Nursing workloads and activity in critical care: A review of the evidence. *Intensive and Critical Care Nursing*, 48, 10–20. <https://doi.org/10.1016/j.iccn.2018.06.002>
- Gupta, A., Mittal, P., Kalita, B. J., & Patnaik, S. K. (2023). An Economic Approach to Human Resource Planning: Application of WISN for a Dialysis Centre Staffing. *Journal of Health Management*.



- <https://doi.org/10.1177/09720634231216072>
- Havaei, F., & MacPhee, M. (2020). The impact of heavy nurse workload and patient/family complaints on workplace violence: An application of human factors framework. *Nursing Open*, 7(3), 731–741. <https://doi.org/10.1002/nop2.444>
- Hoi, S. Y., Ismail, N., Ong, L. C., & Kang, J. (2010). Determining nurse staffing needs: The workload intensity measurement system. *Journal of Nursing Management*, 18(1), 44–53. <https://doi.org/10.1111/j.1365-2834.2009.01045.x>
- Hoogendoorn, M. E., Margadant, C. C., Brinkman, S., Haringman, J. J., Spijkstra, J. J., & de Keizer, N. F. (2020). Workload scoring systems in the Intensive Care and their ability to quantify the need for nursing time: A systematic literature review. *International Journal of Nursing Studies*, 101(1). <https://doi.org/10.1016/j.ijnurstu.2019.103408>
- Ilyas, Y. (2017). *Perencanaan SDM Rumah Sakit* (5th ed.). Fakultas Kesehatan Masyarakat Universitas Indonesia.
- Kementrian Kesehatan. (2023). *Profil Kesehatan Indonesia 2023*. Kementerian Kesehatan Republik Indonesia.
- Kim, J., Kim, S., Park, J., Park, E., Jeong, S., & Lee, E. (2018). Adequacy of nurse staffing level in integrated nursing care. *Journal of Korean Academy of Nursing Administration*, 24(4), 288–297. <https://doi.org/10.1111/jkana.2018.24.4.288>
- Ko, Y., & Park, B. (2023). Calculating the optimal number of nurses based on nursing intensity by patient classification groups in general units in South Korea: A cross-sectional study. *Nursing Open*, 10(6), 3982–3991. <https://doi.org/10.1002/nop2.1657>
- MacPhee, M., Dahinten, V., & Havaei, F. (2017). The Impact of Heavy Perceived Nurse Workloads on Patient and Nurse Outcomes. *Administrative Sciences*, 7(1), 7. <https://doi.org/10.3390/admsci7010007>
- Min, A., & Scott, L. D. (2016). Evaluating nursing hours per patient day as a nurse staffing measure. *Journal of Nursing Management*, 24(4), 439–448. <https://doi.org/10.1111/jonm.12347>
- Müller, R., Cohen, C., Delmas, P., Pasquier, J., Baillif, M., & Ortoleva Bucher, C. (2021). Scope of nursing practice on a surgery ward: A time-motion study. *Journal of Nursing Management*, August 2020, 1–16. <https://doi.org/10.1111/jonm.13318>
- Nantsupawat, A., Nantsupawat, R., Kulnaviktikul, W., & Mchugh, M. D. (2015). Relationship between nurse staffing levels and nurse outcomes in community hospitals, Thailand. *Nursing and Health Sciences*, 17(1), 112–118. <https://doi.org/10.1111/nhs.12140>
- Nezamdoust, S., Abdekhoda, M., & Rahmani, A. (2022). Determinant factors in adopting mobile health application in healthcare by nurses. *BMC Medical Informatics and Decision Making*, 22(1), 1–10. <https://doi.org/10.1186/s12911-022-01784-y>
- Nguyen, T. T. H., Phung, H. T., & Bui, A. T. M. (2022). Applying the workload indicators of staffing needs method in nursing health workforce planning: evidences from four hospitals in Vietnam. *Human Resources for Health*, 19(1), 1–9. <https://doi.org/10.1186/s12960-021-00668-y>
- Niaraces Zavare, A. S., Akbari, F., Zahmatkesh, M., Alizadeh Bazgir, M., & Shaarbafchizadeh, N. (2023). Is the Workload Indicators of Staffing Needs (WISN) method rigorous enough to tell us how many nurses we need in a general hospital? *International Journal of Healthcare Management*. <https://doi.org/10.1080/20479700.2023.2269670>
- WHO. (2016). *Workload Indicators Staffing Need (WISN)* (Issue 15). [https://apps.who.int/iris/bitstream/handle/10665/205943/9789241510059\\_eng.pdf;jsessionid=E6D08BAD9068C3F3BCC77218DFCF7357?sequence=1](https://apps.who.int/iris/bitstream/handle/10665/205943/9789241510059_eng.pdf;jsessionid=E6D08BAD9068C3F3BCC77218DFCF7357?sequence=1)