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Original Research

Analysis of the Emergency Nursing Staff Need Using Baseline Emergency Staffing Tool (Best) In Indonesia: A Prospective Study

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ABSTRACT

Introduction: Patient density in the emergency room (ER) is a worldwide phenomenon and a major health-care issue. Because of the high degree of patient severity and the dynamic workflow, treating patients in the ER is frequently delayed. But, determining the need for nurses in the ER is difficult since patients arrive at random, including several complex situations, the quantity of patients, and the length of stay shifting greatly. This study aims to assess the emergency nursing staff need by determining the nurses' workload and patient dependency level in emergency room of the hospital using the baseline emergency staffing tool (BEST).

Methods: A prospective observational research design was used in this study. A consecutive sample of 101 nurses selected in seven-day period in emergency department. The research was carried out in two government general hospitals situated in the provinces of Central Java and East Java. The BEST was used to estimate nursing staff requirement in emergency department and patient dependency was assessed using the Jones Dependency Tool (JDT).

Results: Calculation of staff requirements in the ER of the first hospital has an average of 16 nurses, while the second hospital has an average of 30 people. The staffing challenges faced by these hospitals are significant, with a discrepancy of 3 nurses and 14 individuals in the ER. Based on the official hours, the highest number of staff needed in the evening and night while the relatively low number is in the morning.

Conclusions: This gap in staffing might have an effect on how patient's outcomes and poses potential risks. To maintain the greatest standard of service, it is critical to account for changes in patient volume and alter staffing levels accordingly.

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1. INTRODUCTION

Patient density in the emergency room (ER) is a global phenomenon and a serious health care problem (Fann et al., 2019). The high level of patient severity and dynamic workflow cause frequent delays in treating patients in the ER, coupled with the inflexibility of managing nurse resources which can reduce productivity and hamper many nurse activities (Bakhoum et al., 2021). This condition has an impact on increasing the risk of nurses experiencing burnout and dissatisfaction with their work, moreover a lot of time is spent on administrative activities thereby reducing the time spent interacting with patients (Bakhoum et al., 2021; Yudiah et al., 2018). The following are the findings of

a study on the workload of emergency room nurses in several Indonesian cities: Bandung City has a severity rate of 59.2% and a moderate severity rate of 37% (Aprilia et al., 2019), in Sampang City it is 25% in the heavy category and 75% in the moderate category (Insan et al., 2021), Tangerang City is 55% in the heavy category and 45% is in the moderate category (Purimahua et al., 2020), Kupang City is in the 12.5% heavy category and 82.5% in the moderate category (Vanchapo et al., 2019). This condition shows the high workload of emergency room nurses in Indonesia. Increased workload and burnout for nurses has an impact on decreasing the quality of service and clinical decision making (Bakhoum et al., 2021; Vanchapo et al., 2019).

All patients who visit the ER are given initial care and continuous care by nurses (Varndell et al., 2013). Nursing workload must be calculated according to the type of nursing activity and not in the same pattern and percentage. The overall amount of nursing time needed to complete both nursing and non-nursing tasks must be considered in measuring nursing workload. Nursing activities can be in the form of direct care (intensity of nursing actions) or indirect care or both (patient dependency). While all administrative tasks, including unit administration, staff meetings, attending seminars, and other non-patient activity that should not be equated with indirect nursing care are considered non-nursing activities (Alghamdi, 2016). Measuring the workload of nurses is a prerequisite for identifying adequate suitability for nurses to deliver nursing care that is both safe and excellent. Because patients arrive at random with a mix of complex cases, the quantity of patients, and length of stay are all very variable, estimating the requirement for nurses in the ER is exceedingly challenging. Multiple responsibilities are expected of emergency department nurses in a high-stress, noisy, and busy environment. Therefore, the ER needs to have the right nurses to ensure satisfaction and improve patient and nurse outcomes. Although the availability of suitable nurses affects the cost factor, inadequate nurses can cause very high patient care costs (Alghamdi, 2016; Wundavalli et al., 2019).

The method that has been widely used to determine the number of nurses and workload but is not specific to the ER is WISN (Susilawati et al., 2023). The drawback of this method is that it heavily relies on having extensive data completeness, requiring effort to collect for its analysis, and a deficiency in data can impact the accuracy of the results. According to some literature, the method used to determine the number of nurses needed in the ER is based on professional assessment, patient census, the number of hours spent with each patient, the severity or reliance of the patient, the patient classification system, nursing productivity, and a combination of nurse credentials (Wundavalli et al., 2019). Professional judgment is illogical and subjective. Patient reliance or the cross-departmental mix of cases were not indicated by patient census, hours per patient visit, or duration of stay. Although the level of severity or patient dependence can reflect the intricacy of each unique situation, it can also change during the course of a patient's stay, making it challenging to evaluate using some tools. The patient classification system does not predict how long a patient will be dependent. This might change quickly for certain individuals in response to medical care, or the degree of dependency might rise over time. There isn't a single ER-relevant tool that is complete, easy to use, valid, and capable of evaluating nursing activity both directly and indirectly and is able to translate nursing workload, according to a systematic review of 12 ER patient classification systems (Wundavalli et al., 2019).

Because clinical stability may alter from one circumstance to the next, patient dependence might fluctuate significantly from time to time. Therefore, a prospective approach to evaluating patient dependence and its connection to nurses' actual workload is necessary (O'Brien & Benger, 2007). The Jones Dependency Tool (JDT) was acknowledged as the sole prospective assessment technique with strong evidence of validity, reliability, simplicity, applicability, and generalizability in assessing patient dependency in ER care (Varndell et al., 2013). JDT consists of six domains, including: communication; airway, breathing and circulation (ABC); mobility; eating, drinking, elimination and self-care; environmental, safety, health, and social needs; and triage category (Crouch & Williams, 2006). JDT was acknowledged as the only prospective assessment tool that showed strong evidence of reliability, validity, simplicity, use, and generalizability in evaluating patient dependency in ER treatment (Varndell et al., 2013). The dependency degree of ER patients in Indonesia is currently determined without the use of a conventional system. Based on the explanation above, it is necessary to analyze the workload of nurses and the level of dependency of patients in the Hospital Emergency Room. The purpose of this study is to assess the requirement for emergency nursing personnel by determining the workload of nurses and the level of dependency of patients in the hospital emergency room using the BEST tool. The study focused on understanding the distribution of patient dependency levels, identifying the majority of high-dependency patients, and assessing the adequacy of staffing levels to meet patient needs. Additionally, the study examined the variation in staffing requirements across different hours of the day to understand the dynamic nature of patient flow.

2. METHODS

2.1 Design

This research design used a prospective observational study.

2.2 Population, Sample, and Sampling

We used a non-probability sampling technique with a consecutive sampling approach. This sampling technique is used by selecting samples that meet the research criteria for a certain period of time so that the number of samples is fulfilled. Nurses were selected in seven-day period in the emergency department. The inclusion criteria were a) Emergency Room Nurses who have worked for at least 1 year, and b) Nurses who were willing to be a respondent. The exclusion criteria were nurses who do not provide direct care to patients (in structural positions) and nurses who are on day off or sick so they cannot participate as respondents. This research was conducted in two government general hospitals located in the provinces of Central Java (Hospital A) and East Java (Hospital B), Indonesia. This hospital was chosen because it is a type A hospital which is a referral hospital for patients in both provinces. Our sampling was 101 emergency nurses, in which 46 nurses from Hospital A and 55 nurses from Hospital B.

2.3 Variable

The variable in this study is the emergency nursing staff need based on the workload of nurses and the level of dependency of patients in the hospital emergency room using BEST.

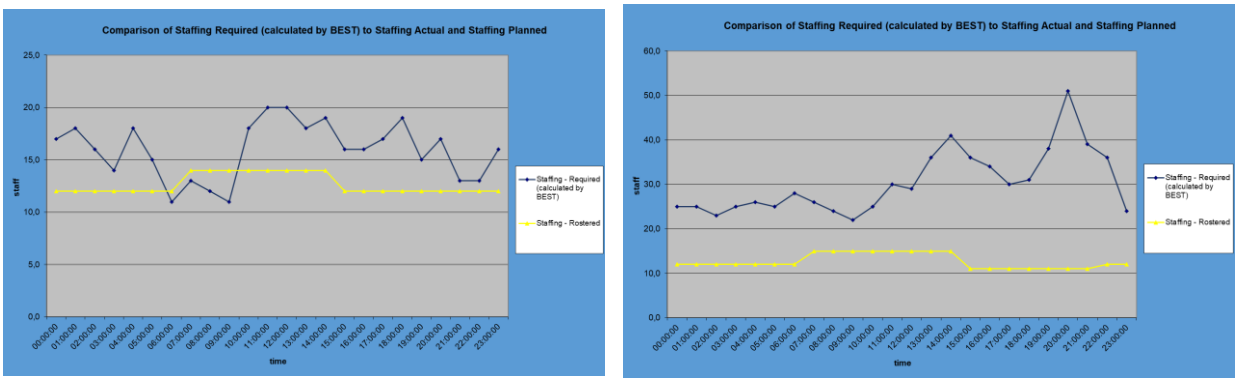
2.4 Instruments

Patient dependency was evaluated using the Jones Dependency Tool (JDT), and the Baseline Emergency Staffing Tool (BEST) was used to determine the emergency department's nursing staff needs. BEST was created by the RCN Emergency Care Association (ECA) and Faculty of Emergency Nursing (FEN) (Royal College of Nursing, 2021). BEST is a tool for workforce planning that may be used locally in your emergency department (ED) to show any discrepancy between nursing workload and staffing. The tool enables you to: 1) analyze the volume and pattern of nursing workload in your emergency department; 2) compare this to your rostered staffing level; and 3) determine the full-time proportionate workforce and skill mix that would be needed to provide nursing care within the division during the study period. The ratios of nurses to patients within the various dependency groups are used in the computations. These ratios must accurately reflect the care that is really provided in your department; otherwise, the yields from the device won't be accurate. BEST uses the following ratios: entire dependency (two nurses for every patient), high dependency (one nurse for every two patients), moderate dependency (one nurse for every two patients), and low dependency (one nurse for every 3.5 patients). Patient dependency volume measured by the JDT in the department and the total staff members scheduled for clinical shifts in the department make up the hourly data sets used by BEST. JDT consists of six domains, including: communication; airway, breathing and circulation (ABC); mobility; eating, drinking, elimination and self-care; environmental, safety, health, and social needs; and triage category. A three-point scale, ranging from 1 (no impairment) to 3 (totally impaired), is used to rate each domain. The aggregate score is then calculated by adding the highest level of dependency for each of the six areas. The rating for each domain ranges from 1 (no impairment) to 3 (totally impaired). The six domains' highest reliance levels are then summed together to provide an overall score (Table 1). One of four dependability levels—low (score range: 6-7), moderate (score range: 8–12), high (score range: 13–15), or total (scores: 16–18)—was assigned to the final score.

2.5 Procedure

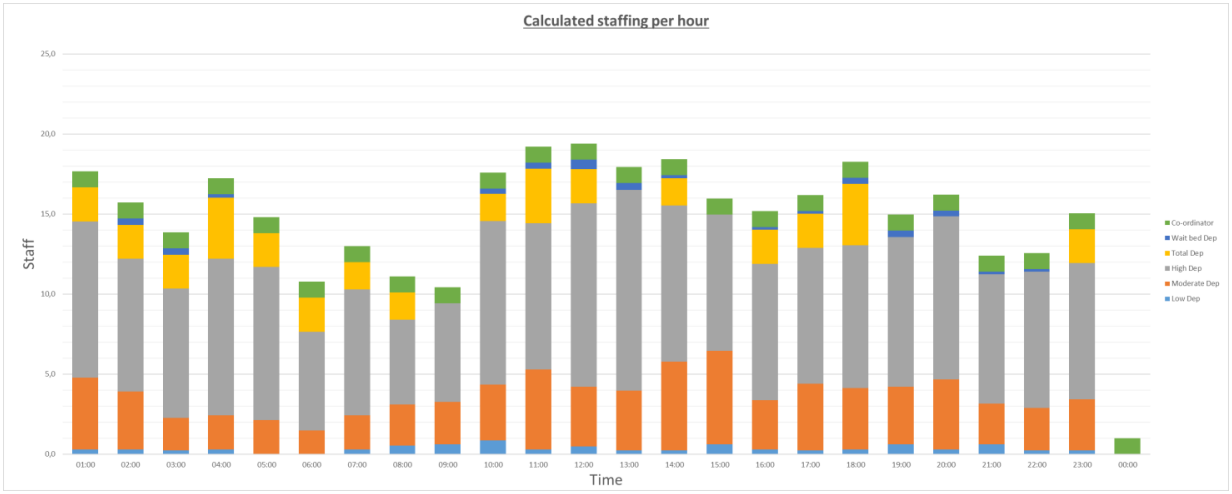
Emergency nurses who were assigned to triage patients who arrived each shift collected the data. Before utilizing JDT to assess patient dependence, patients were first ranked in order of importance and organized according to need. Before data collection began, triage nurses, P1, P2, and P3 nurses underwent three instructional sessions each to become accustomed to and receive training in using JDT. The research team is accessible to help nurse enumerators during the workweek. Data analysis is done after all the data has been gathered. Two nurses and a member of the research team worked as research assistants. Research assistants were trained by concurrently observing a nurse in order to boost dependability and to prepare them for formal observations. To enhance the precision and dependability of time-motion data collection, research assistants were instructed on identifying workload categories and watched by researchers throughout the pilot observation training session. Interrater reliability was assessed using Cohen's Kappa, and the results indicated substantial agreement ($\kappa = 0.75$) among the two trained observers. Typically, observed nurses are given 2 to 4 rooms every shift. In order to identify any potential differences in ED workload and work flow, observations were done throughout the morning (8:00am–12:00am), afternoon (12:00pm–3:00pm), and afternoon (3:00pm–6:00pm) shifts.

The survey was conducted every hour per day for 7 days (not necessarily in 1 week). the initials of all nurses in the room at that hour are written on the staff list. To measure the patient's dependency level using the JDT instrument. Every hour all new patients are counted and written in the column according to the level of dependence and added the number of patients with moderate, high and total dependence who are still in the unit from the previous hour. If there are patients who change their level of dependence (for example patients from who were initially totally dependent to moderately dependent after they were stabilized) then they are added to the new dependency level column and the number on the previous dependency is reduced. Patients with low dependency are only counted once on the hour they

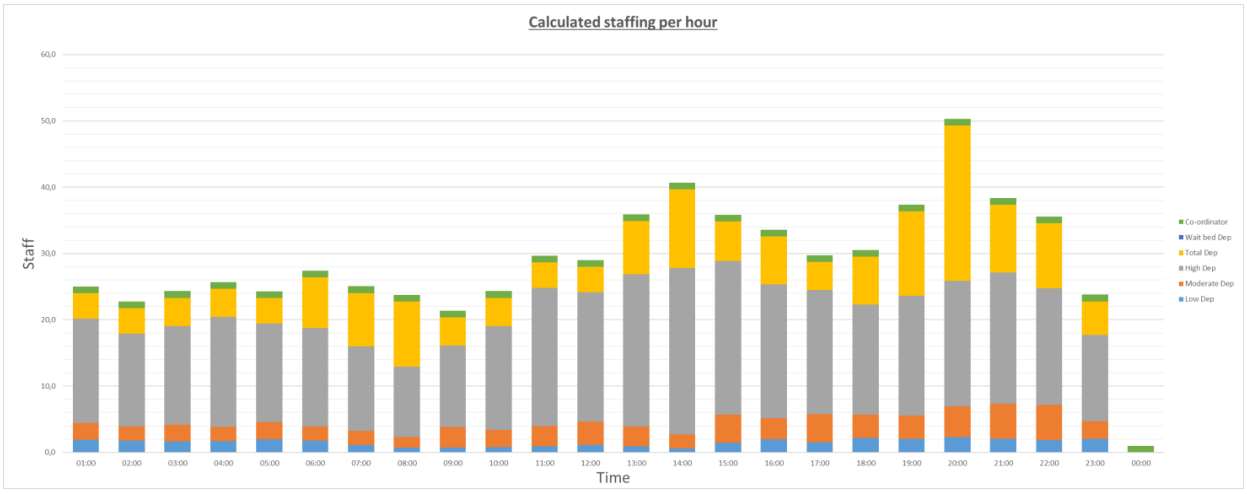


(a) (b)

Figure 1. Comparison of Required Staffing (calculated by BEST) with Actual Staff and Planned Staff in ER (a) Hospital A and (b) Hospital B



(a)



(b)

Figure 2. Comparison of Calculated Staffing per hour in ER (a) Hospital A and (b) Hospital B

arrive. Because usually these patients require very little attention in the next hour of care than when they first arrive. Patients listed in the waiting room column are patients who have been fully documented in the ER and are waiting to be transferred to the ward. If there are patients who are in the waiting period but have a total dependency level, then they are still included in the total dependency calculation.

2.6 Data Analysis

Prior to analysis, all of the data were pooled into a single dataset and anonymised. Before being uploaded to the SPSS v22 data analysis application, data collecting forms were transferred to a digital spreadsheet. In order to give descriptive statistics for variables dependent on the level of measurement, frequencies and percentages were utilized for

Tabel 1. Frequency Distribution based on Respondent Characteristics in the Emergency Room of Hospital A and B

Characteristics		Hospital A		Hospital B	
		Mean (Min-Max)	Std. Dev	Mean (Min-Max)	Std. Dev
Age		37.47 (29-51)	6.71	37.05 (24-57)	8.48
		Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Gender					
	Male	28	60.87	20	36.36
	Female	18	39.13	35	63.64
Education					
	Baccalaureate	12	26.09	18	32.73
	degree	34	73.91	37	67.27
	Diploma				
Length of work experience	1 – 3 year	20	43.48	18	32.73
	4 – 10 year	12	26.09	16	29.09
	> 10 year	14	30.43	21	38.18

Tabel 2. Frequency Distribution based on Patient Dependence Level according to JDT and Staff needed according to BEST in the ER Hospital A.

Time	Low	Moderate	High	Total	Wait bed	Staffing - Required (calc)	Staffing - Required (rounded)	Staffing - Rostered
00:00:00	0.5	4.4	8.1	2.1	0.0	16.10	17	12
01:00:00	0.3	4.5	9.8	2.1	0.0	17.67	18	12
02:00:00	0.3	3.6	8.3	2.1	0.4	15.71	16	12
03:00:00	0.2	2.0	8.1	2.1	0.4	13.84	14	12
04:00:00	0.3	2.1	9.8	3.8	0.2	17.24	18	12
05:00:00	0.0	2.1	9.6	2.1	0.0	14.81	15	12
06:00:00	0.0	1.5	6.2	2.1	0.0	10.78	11	12
07:00:00	0.3	2.1	7.9	1.7	0.0	12.99	13	14
08:00:00	0.5	2.6	5.3	1.7	0.0	11.11	12	14
09:00:00	0.6	2.7	6.2	0.0	0.0	10.43	11	14
10:00:00	0.9	3.5	10.2	1.7	0.3	17.60	18	14
11:00:00	0.3	5.0	9.1	3.4	0.4	19.22	20	14
12:00:00	0.5	3.7	11.5	2.1	0.6	19.40	20	14
13:00:00	0.2	3.7	12.5	0.0	0.4	17.92	18	14
14:00:00	0.2	5.5	9.8	1.7	0.2	18.41	19	14
15:00:00	0.6	5.8	8.5	0.0	0.0	15.95	16	12
16:00:00	0.3	3.1	8.5	2.1	0.2	15.18	16	12
17:00:00	0.2	4.1	8.5	2.1	0.2	16.18	17	12
18:00:00	0.3	3.8	8.9	3.8	0.4	18.26	19	12
19:00:00	0.6	3.6	9.4	0.0	0.4	14.95	15	12
20:00:00	0.3	4.4	10.2	0.0	0.3	16.20	17	12
21:00:00	0.6	2.6	8.1	0.0	0.2	12.40	13	12
22:00:00	0.2	2.7	8.5	0.0	0.2	12.57	13	12
23:00:00	0.2	3.2	8.5	2.1	0.0	15.06	16	12
						Mean	16	13
						Difference	3	

categorical data (such as gender, education, and length of work experience) as well as mean and standard deviation for normally distributed data (e.g., age).

2.7 Ethical Clearance

This research has been declared ethically feasible by the Ethical Commission of dr. Saiful Anwar Malang Hospital with number 1.078/VIII/HREC/2022.

3. RESULTS

The results of this study obtained data on the characteristics of nurses as research respondents in the Emergency Room of Hospital A and Hospital B based on age, gender, education, and length of work. Table 1 shows that the characteristics of the respondents in the average age range in Hospital A and Hospital B are 37 years. The gender characteristics of nurses showed that the highest distribution in Hospital A was 28 men (60.87%) while in Hospital B there were 35 women (63.64%). The highest level of education for nurses in Hospitals A and B was Diploma in Nursing, namely 34 respondents (73.91%) and 37 respondents (67.23%). If seen from the length of work of nurses in Hospital A, most of them have worked for 1-3 years, namely 20 people (43.48%), while in Hospital B most have worked more than 10 years, namely 21 people (38.18%).

Table 2 describes the level of patient dependency based on the Jones Dependency Tool (JDT) and the number of staff needed using the Baseline Emergency Staffing Tool (BEST) calculation in the ER of Hospital A. The majority of patients are at a high level of dependency with the highest number of patients in seven days reaching 12 people and a minimum of 8 people. While a small proportion of patients are in the category of low dependency level, namely an average of 1 patient. The average number of staff needed is 16 nurses and scheduled staff is 13 nurses. So, there is a difference in the number of nurses as many as 3 people. When viewed from official hours, the number of patients requiring a large number of nurses is from 10.00 to 19.00 and 01.00 and 04.00. while the relatively low number is at 06.00 to 09.00 (Figure 1a & 2a).

Furthermore, the level of patient dependency and the number of staff needed in the ER of Hospital B can be seen in Table 3, that is, most of the patients are also at a high level of dependence, with the highest number of patients reaching 25 people and a minimum of 10 people. Likewise, only a small proportion of patients with low dependency levels, namely between 1 and 2 patients per day on average. Based on BEST calculations, the number of staff needed is an average of 30 people, while the staff that has been scheduled is 16 people, so there is a difference of 14 people. In figure 1b & 2b, it can be seen that the highest number of staff needed is at 12.00 to 21.00 where the peak is at 20.00. Meanwhile, the relatively low number is between 00.00 and 10.00.

4. DISCUSSION

The study uses the Baseline Emergency Staffing Tool (BEST) calculation to determine the staffing needs of ER in hospitals. Hospital A has an average of 16 nurses, while Hospital B has an average of 30 people. The staffing challenges faced by these hospitals are significant, with a discrepancy of 3 nurses and 14 individuals in the ER. According to the previous study, the ratio of patients to registered nurses varied by shift, ranging from 0.3 to 8.8 (mean 3.2), and the number of patients to licensed practical nurses varied from 1.5 to 23.5 (mean 5.0). The average skill mix was 60% registered nurses and 40% licensed practical nurses (Amritzer et al., 2021). Calculation of staff requirements based on BEST uses the ratio between the number of nurses and the patient's dependency level so that the results are greater than the rostered nurses (Saaiman et al., 2021). The BEST does not define a minimum staffing number or compare among organisations but a recommended number based on information and skill mix requirements (Jones, 2015). The tool's outputs should not be viewed as a simple staffing calculator but rather as a method for addressing nursing shortages and addressing the nursing burden (Youd, 2015). This is good for reducing the negative impact of increased workload and emphasizing the significance of appropriate staffing levels to ensure quality of patient care.

This gap in staffing has the potential to impact patient outcomes and poses potential risks. It may lead to nurse fatigue, decreased attention to patient needs, and decreased overall quality of care (Griffiths et al., 2016). It also poses potential risks, such as nurse burnout, compromised patient safety, and diminished quality of care (Ho & Chua, 2016). The difference between the required and scheduled staff highlights the need for a more accurate estimation of staffing needs (Davis et al., 2014). The previous study reveals a 95% probability of survival to hospital discharge when workload-to-nurse ratio is <40, and a 95% chance of death when ratio is >52 which proves that patients exposed to high workload/nurse ratios had lower odds of survival to hospital discharge (Lee et al., 2017). Hospital administrators must consider the high patient dependency levels when developing staffing schedules and ensure that an adequate number of nurses are available to meet the demands of the patients (Butler et al., 2008). Prior research indicated that the allocation of staff should consider the workload rather than solely relying on patient numbers (Lee et al., 2017). Elevated workload-to-staff ratios could potentially have negative implications for patient outcomes and have been linked to higher mortality rates (Neuraz et al., 2015). It is crucial to account for fluctuations in patient volume and adjust staffing levels accordingly to maintain the highest standard of care.

Tabel 3 Frequency Distribution based on Patient Dependence Level according to JDT and Staff needed according to BEST in the ER of Hospital B

Time	Low	Moderate	High	Total	Wait bed	Staffing - Required (calc)	Staffing - Required (rounded)	Staffing - Rostered
00:00:00	1.5	24.66	25	12	24.66	25	25	15
01:00:00	1.9	24.98	25	12	24.98	25	25	15
02:00:00	1.8	22.74	23	12	22.74	23	23	15
03:00:00	1.6	24.32	25	12	24.32	25	25	15
04:00:00	1.7	25.65	26	12	25.65	26	26	15
05:00:00	2.0	24.26	25	12	24.26	25	25	15
06:00:00	1.8	27.41	28	12	27.41	28	28	15
07:00:00	1.1	25.04	26	15	25.04	26	26	18
08:00:00	0.7	23.72	24	15	23.72	24	24	18
09:00:00	0.7	21.39	22	15	21.39	22	22	18
10:00:00	0.8	24.32	25	15	24.32	25	25	18
11:00:00	0.9	29.64	30	15	29.64	30	30	18
12:00:00	1.1	28.98	29	15	28.98	29	29	18
13:00:00	0.9	35.91	36	15	35.91	36	36	18
14:00:00	0.6	40.71	41	15	40.71	41	41	18
15:00:00	1.5	35.82	36	11	35.82	36	36	15
16:00:00	1.9	33.54	34	11	33.54	34	34	15
17:00:00	1.5	29.72	30	11	29.72	30	30	15
18:00:00	2.2	30.49	31	11	30.49	31	31	15
19:00:00	2.1	37.39	38	11	37.39	38	38	15
20:00:00	2.3	50.27	51	11	50.27	51	51	15
21:00:00	2.1	38.34	39	11	38.34	39	39	15
22:00:00	1.8	35.55	36	12	35.55	36	36	15
23:00:00	2.1	23.79	24	12	23.79	24	24	15
						Mean	30	16
						Difference	14	

The study's examination of staffing requirements during official hours reveals interesting patterns. Patients requiring a larger number of nurses are most prevalent during two distinct periods, in the evening and after midnight until early morning. Conversely, the relatively lower number of patients requiring nurses in the morning, during 06:00 to 09:00. These finding supports an earlier study that reveal the emergency nurses demand in Australia based on average beds per nurse ratios was highest in the night shift (Wise et al., 2015). These hours likely correspond to periods of higher patient influx or increased acuity of medical conditions, demanding more attentive and specialized care (Anselmi et al., 2017). So, it can be suggested that potential opportunities for staff optimization during morning hours.

Our study has some limitations. Due to limited resources, it was not possible to catch every patient who visited the emergency department. However, this could also indicate that the tool needs a systematic process to improve its recording. Patients enrolled in this study were drawn from a sample of emergency department visits over a 7-day period. It is also possible that there were selection biases due to patient presentation and other factors influencing input of nursing data, which meant that potential patients were not included.

5. CONCLUSION

In conclusion, the discrepancy between required and scheduled staffing underscores the importance of precise staffing calculations and adaptability in handling patient flow fluctuations. By implementing evidence-based staffing practices and addressing the dynamic nature of patient needs, the hospital can enhance its emergency care services and improve patient outcomes. Further research and continuous evaluation are recommended to ensure ongoing improvements in patient care delivery. To address the staffing challenges and meet the demands of high-dependency patients, several recommendations can be considered. Firstly, hospital management should implement real-time monitoring and evaluation of patient flow to anticipate surges in patient volume

and adjust staffing levels accordingly. Secondly, continuous training and education for nurses should be provided to enhance their skills and ability to handle complex cases efficiently. Additionally, the use of technology and data-driven approaches can aid in making accurate staffing predictions and optimizing resource allocation.

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