

The relationship between patient overcrowding and accuracy of triage in the emergency room at PKU Muhammadiyah Gamping Hospital

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Abstract

Introduction: Patient overcrowding in the Emergency Department (ED) may influence the accuracy of triage, which is crucial in determining the priority of emergency care. Errors in triage can delay treatment, increase complications, and even cause death. Objective: To examine the relationship between patient density and triage accuracy in the ED of PKU Muhammadiyah Gamping Hospital. Methods: This quantitative correlational study used a cross-sectional design involving 32 ED nurses selected through total sampling. Instruments included triage accuracy observation sheets and the National Emergency Department Overcrowding Scale (NEDOCS). Data were analyzed using Spearman's rank correlation test with $\alpha = 0.05$. Results and Discussion: A significant relationship was found between patient density and triage accuracy ($p = 0.012$; $r = 0.437$). In busy conditions, 17 respondents (53.1%) performed triage and all were accurate (0% errors). In very busy but not overcrowded conditions, 15 respondents (46.9%) were involved, with 9 (28.1%) accurate and 6 (18.8%) inaccurate. Overall, 26 nurses (81.3%) performed triage correctly, while 6 (18.8%) made errors. Conclusion and Recommendations: Patient density is significantly related to triage accuracy in the ED. Nurses are expected to maintain quick and accurate decision-making even under busy or overcrowded conditions to ensure patient safety.

Keywords: Patient overcrowding, Triage accuracy, Emergency Department

1. Introduction

Emergency services are medical services aimed at saving lives and preventing disability (Kundiman et al., 2019). Hospitals are the first point of entry for patients. Nurses in the ED often interact directly with patients. A nurse must master the knowledge, skills, and clinical nursing actions required to provide appropriate care and nursing practices to ensure patient recovery and prevent fatal errors or complications (Khalilati et al., 2022).

The results of a study conducted by Ohaiba et al. (2024), show that overall adult ED visits increased steadily from $17.2 \pm 0.3\%$ in 1999 to $21.7 \pm 0.3\%$ in 2019. There are differences in ED use between demographic and socioeconomic groups. Indonesia is one of the countries in ASEAN with the highest number of patient visits to emergency departments. In 2017, the number of patients visiting emergency departments reached 4,402,205, which was an accumulation of 12% of emergency department visits, originating from 1,033 general hospitals and 1,319 other hospitals. Furthermore, in 2018, there was an increase in patient visits to emergency rooms in Central Java (Kemenkes, 2022)

Every patient admitted to the emergency department undergoes triage to determine the priority of treatment. Triage is conducted by categorizing patients based on specific criteria. Triage assessment is currently conducted in various ways, but all follow the principles of assessing the airway, breathing, and circulation. The purpose of triage is to provide first aid in the ER (Sensi et al., 2023).

Triage is crucial for expediting life-saving measures for patients in need. However, research findings still indicate a high rate of inaccuracy in triage labeling. Based on previous research, 75.2% of triage procedures at GMIM Pancaran Kasih Manado General Hospital were performed inaccurately (Kundiman et al., 2019). Other research also shows that 41.7% of triage procedures at Ulin Banjarmasin Regional General Hospital were inaccurate in triage labeling (Khalilati et al., 2022).

One factor that affects the accuracy of triage is overcrowding. This is evidenced by previous research results showing that there is a significant relationship between overcrowding and triage accuracy (Kundiman et al., 2019). Increased public access to emergency room facilities is directly proportional to the increase in the number of patient visits, which causes emergency rooms to often experience congestion or overcrowding. This condition has various consequences and has become a crisis issue at both the national and international levels (Suroso et al., 2023).

A survey of 49 nurses in the ED showed that 64% of nurses stated that the average time required for patients to obtain an inpatient room was more than 24 hours, while 56.1% of nurses stated that patient density in the ED was activated more than once per shift and 63.2% of nurses stated that the team's response time to patient density activation in the ED took more than 4 hours (Gide, 2021). Based on the results of a preliminary study conducted on February 27, 2025, at the PKU Muhammadiyah Gamping Hospital Emergency Room, field observations showed that when there was a surge in patients, there were errors in triage labeling, such as non-emergency patients who should have been in the false room being placed in the true room. There were no special triage officers, as all nurses on duty had the authority to perform triage. Patients enter the triage room and are examined based on the severity of their condition. Triage labeling is done by referring to the colors on the triage accuracy observation sheet used.

After the triage process is complete, patients are placed according to their triage category. In practice, errors have occurred, especially when the number of patient visits is high, such as errors in labeling. Of the 10 patients who came to the emergency room, 6 were not correctly triaged. Patients who should have been given a special green label for the false room were instead placed in the true room, which is actually intended for emergency patients. The triage errors in the ED were due to the large number of patients arriving at the same time. The number of patient visits was not proportional to the number of nurses on duty. The purpose of this study was to determine the relationship between patient density and the accuracy of triage implementation in the Emergency Department of PKU Muhammadiyah Gamping Hospital.

2. Method

This study is a quantitative study with an analytical observational approach (Sucipto, 2020). The research design used is cross-sectional, where data collection is carried out through observation at a specific point in time (Setiawan & Prasetyo, 2015). The data analysis used includes univariate and bivariate analysis with the Spearman's rank test. The study was conducted in July 2025 at the Emergency Room (ER) of PKU Muhammadiyah Gamping Hospital.

The population in this study was all nurses working in the ED of PKU Muhammadiyah Gamping Hospital. The sample was determined using a saturated sampling technique (census), so that the entire population was used as the research sample with a total of 32 respondents (Sugiyono, 2024). The research instruments used were the National Emergency Department Overcrowding Scale (NEDOCS) to measure the level of ED crowding and a triage observation sheet to assess the accuracy of triage implementation. The NEDOCS questionnaire has been validated by Weiss et al. (2004) with a calculated r^2 value of 0.49 ($p < 0.001$) and is reliable with a Cronbach's Alpha value of more than 0.60. Furthermore, this instrument has also been proven to be reliable based on the reliability test results with a Cronbach's Alpha value of 0.83 (95% CI = 0.75–0.90), indicating high internal consistency. Data collection was conducted using primary data obtained through direct observation of respondents in accordance with the research instrument.

3. Results

3.1. Frequency Distribution of Respondent Characteristics

Table 1
 Frequency Distribution of Respondent Characteristics

Characteristics	Frequency (f)	Percentage (%)
Age		
20-30 years	21	65.6%
> 30 years old	11	34.4
Total (N)	32	100%
Education		
DIII Nursing	9	28.1

DIV Nursing	1	3.1
Nursing Profession	22	68.8
Number (N)	32	100
Gender		
Male	14	43.8
Female	18	56.3%
Total (N)	32	100%
Length of Service		
1-5 years	19	59.4%
> 5 Years	13	40.6%
Total (N)	32	100

Based on the data in Table 1, most respondents were aged 20-30 years, with 21 respondents (65.6%). Respondents aged over 30 numbered 11 (34.4%). Based on the data in the table, most respondents had a professional nursing education, totaling 22 respondents (68.8%). Respondents with a DIII education totaled 9 respondents (28.1%). The fewest respondents had a DIV education, totaling 1 respondent (3.1%). Based on the data in the table, most respondents were female, with 18 respondents (56.3%), and male respondents numbered 14 (43.8%). Based on the data in the table, most respondents had worked for 1-5 years, with 19 respondents (59.4%), and 13 respondents (40.6%) had worked for more than 5 years.

3.2. Frequency Distribution of Patient Density According to NEDOCS in the Emergency Room of PKU Muhammadiyah Gamping Hospital

Table 2
Frequency Distribution of Patient Density According to NEDOCS in the Emergency Room of PKU Muhammadiyah Gamping Hospital

Patient Density	Frequency (f)	Percentage (%)
Level 1 Not busy (0-20)	0	0
Level 2 Busy (21-60)	17	53.1
Level 3 Very busy but not crowded (61-100)	15	46.9
Level 4 Crowded (101-140)	0	0
Level 5 Very crowded (141-181)	0	0
Level 6 Dangerous (>180)	0	0
Total	32	100

Based on the data in Table 2, it can be seen that most of the patient density conditions in the busy emergency room (21-60) were 17 (53.1%). Meanwhile, the patient density condition in the very busy but not crowded emergency room was 15 (46.9%).

3.3. Frequency Distribution of Respondents According to the Accuracy of Triage Implementation in the Emergency Room of PKU Muhammadiyah Gamping Hospital

Table 3
Frequency Distribution of Respondents According to the Accuracy of Triage Implementation in the Emergency Room of PKU Muhammadiyah Gamping Hospital

Accuracy of Triage Implementation	Frequency (f)	Percentage (%)
Inaccurate	6	18.8
Correct	26	81.8%
Total	32	100

Based on the data in Table 3, it can be seen that most of the triage implementation was accurate, totaling 26 (81.8%). Meanwhile, 6 (18.8%) were inaccurate.

3.4. Frequency Distribution of Triage Implementation According to the Observation Sheet Questionnaire

Table 4

No.	Kegiatan	Ya		Tidak	
		f	%	f	%
1.	Patient arrives and is received by emergency room staff/paramedics	32	100%	0	0%
2.	In the <i>triage</i> room, medical history and examination are conducted	29	90,63%	3	9,37%
3.	Determination of the degree of urgency by the nurse or midwife on duty	18	56,38%	14	43,75%
4.	Time taken to classify patients within 30 seconds or less	19	59,38%	13	40,62%
5.	Patients are classified according to their severity by assigning color codes	19	59,38%	13	40,62%
6.	Patient management according to priority	21	65,63%	11	34,37%

Based on Table 4, the results show that all patients (100%) were received by emergency department staff in accordance with applicable procedures. Anamnesis and examination in the triage room were performed on most patients, namely 90.63%, while 9.37% were not. The determination of the degree of urgency was only carried out on 56.38% of patients, while 43.75% were not. Patient grouping according to the standard time (≤ 30 seconds) was recorded at 59.38%, while 40.62% exceeded the specified time. Patient differentiation based on color codes was performed in 59.38% of patients and not performed in 40.62% of patients. Meanwhile, patient management according to triage priority was carried out in 65.63% of patients, while 34.37% were not in accordance with priority.

3.5. Frequency Distribution of Respondents According to Patient Density Conditions and Accuracy of Triage Implementation in the Emergency Room of PKU Muhammadiyah Gamping Hospital

Table 5

Frequency Distribution of Respondents According to Patient Density Conditions and Accuracy of Triage Implementation in the Emergency Room of PKU Muhammadiyah Gamping Hospital

Patient Density	Accuracy of Triage Implementation				Total	<i>P-value</i>	<i>Correlation Coefficient</i>
	Accurate		Inaccurate				
	f	%	f	%			
Busy	17	53,1%	0	0%	17	53,1%	
Very busy but not crowded	9	28,1%	6	18,8%	15	46,9%	0,012
Total	26	81,3%	6	18,8%	32	100%	0,437

Based on the cross-tabulation results in Table 5, the results of the test of the relationship between patient density and the accuracy of triage implementation show that in busy conditions, all Accuracy of Triage Implementation Frequency (f) Percentage (%) Inaccurate 6 18.8 Correct 26 81.8% Total 32 100 Based on the data in Table 3, it can be seen that most of the triage implementation was accurate, totaling 26 (81.8%). Meanwhile, 6 (18.8%) were inaccurate. Table 4. Frequency Distribution of Triage Implementation According to the Observation Sheet Questionnaire No Activity Yes No

respondents who performed triage numbered 17 respondents (53.1%) and all of them performed triage correctly (0% incorrectly). In very busy but not crowded conditions, there were 9 respondents (28.1%) who performed triage correctly and 6 respondents (18.8%) who performed triage incorrectly, with a total of 15 respondents (46.9%). Overall, out of a total of 32 respondents, 26 respondents (81.3%) performed triage correctly and 6 respondents (18.8%) performed it incorrectly. The results of the Spearman's rank correlation test showed a p-value of 0.012 ($p < 0.05$), indicating a significant relationship between patient density and the accuracy of triage implementation. The correlation coefficient value of 0.437 indicates a moderate strength of the relationship.

3.6. Discussion

Based on the data in Table 2, it is known that patient density in the emergency room of PKU Muhammadiyah Gamping Hospital mostly shows busy conditions with 17 (53.1%), while 15 (46.9%) show busy but not crowded conditions. This finding is consistent with research by Haas et al. (2023), which found that high patient density in the ED is one of the main factors contributing to nurse fatigue (compassion fatigue) and potential medical errors. This crowded situation requires nurses to remain focused and efficient in performing their duties, especially in the triage process, despite being faced with the pressure of high patient numbers.

These findings are also in line with the opinion Cooper et al. (2019), which explains that handling complex emergencies can cause the ED to be crowded every day. Overcrowding in the ED can lead to prolonged excessive workloads, which can ultimately cause nurses to experience burnout and errors in decision-making.

The results of the study Firdaus et al. (2018) show that overcrowding in the ED is caused by an imbalance between the number of patients and the number of nurses. Managing staff in the ED is not an easy task, due to the uncertainty of the number and condition of patients arriving at the ED. Ensuring an adequate nurse-to-patient ratio is a very important factor in providing optimal care for patients' needs.

This finding supports the theory Puspitasari et al. (2024), which states that overcrowding in the ER occurs because of a surge in demand for services that is not balanced with the available capacity and resources. Factors such as limited medical personnel, high patient numbers, and delays in treatment are the main causes of this condition. The results of this study also support the theory of Sahrudi & Anam (2021), which emphasizes that the increase in patient visits to the ED requires the implementation of a triage system to group patients based on urgency levels. This aims to ensure that critically ill patients receive immediate treatment.

The findings of Suranata (2023) further reinforce this, with a p-value of 0.001 indicating a significant relationship between overcrowding and triage accuracy. The study by Puspitasari et al. (2024) in Boyolali also supports these results, with a p-value of 0.000 related to the accuracy of initial assessment in the ED.

Based on the data in Table 3, it shows that most respondents performed triage accurately, with 26 respondents. These research results align with Ulpa & Wiryansyah (2025), where most respondents performed triage accurately, with 30 respondents (88.2%). According to Sahrudi & Anam (2021), triage plays an important role in the emergency system as a method for determining the priority of patients who require immediate treatment in the ER. Triage is a complex decision-making process to identify patients who are at risk of death, disability, or deterioration if they do not receive immediate treatment. After assessing the severity and urgency, the triage system generally determines the estimated safe waiting time before medical intervention is performed (Ulpa & Wiryansyah, 2025).

This study is also in line with Prahmawati et al. (2024), where the results obtained from 84 respondents showed that most of them (50 respondents or 59.5%) performed triage appropriately. Suranata (2023) stated that triage errors in the emergency room can occur due to the large number of patients arriving at the same time, while the number of visits is not proportional to the number of nurses on duty.

The scope of emergency care practice encompasses several stages, ranging from relatively long observation periods, complex diagnostic examinations, to increased critical and intensive care in the emergency department. This situation can cause the ED to become crowded and congested every day,

as in some cases patients spend more time in the ED to receive definitive care and other diagnostic support examinations as procedures before being transferred to the care room (Cooper et al., 2019).

Faidah Noor (2013), states that one of the tasks of emergency nurses is to perform triage, assess, and prioritize patients' clinical conditions quickly, ranging from life-threatening cases to chronic conditions. These results are consistent with the research Annisa et al. (2023), which reported that all nurses (100%) had good knowledge of triage, and 59.5% of them had adequate skills in performing triage in the emergency room of Banda Aceh City.

This research is also supported by the findings Nonutu et al. (2015) in a study titled *The Relationship Between the Number of Patient Visits and the Accuracy of Triage Implementation in the Emergency Room of Prof. Dr. R.D. Kandou Manado General Hospital*. Through observation of triage services, it was found that triage was performed correctly for 77 respondents (75.49%) in the low-volume patient category, while triage was performed incorrectly for 28 respondents (82.35%) in the high-volume patient category. Additionally, accurate triage implementation was recorded in 6 respondents (17.64%) of the high-volume patient category, and inaccurate triage implementation was recorded in 25 respondents (24.50%) of the low-volume patient category.

The study Gustia & Manurung (2018) on the relationship between the accuracy of triage assessment and the success rate of treating head injury patients at the emergency room of HKBP Balige General Hospital, Toba Samosir Regency—a type C hospital in Sumatra—showed that the success rate of triage assessment was recorded in 14 people (82.36%). Meanwhile, the study by Sumarno et al. (2017) entitled *The Relationship between the Accuracy of Triage Implementation and the Level of Patient Family Satisfaction in the Emergency Room of Prof. Dr. R.D. Kandou Manado General Hospital* reported that of the 120 respondents, 114 respondents (95%) were in the accurate triage implementation category, while 6 respondents (5%) were in the inaccurate category. Based on these findings, it can be concluded that triage is an important component in the ED, where its accuracy is greatly influenced by patient density.

Based on the research data in Table 5 above, there were 17 respondents (53.1%) with busy patient density and accurate triage implementation, while there were 0 respondents (0%) with busy patient density and inaccurate triage implementation. Meanwhile, there were 9 respondents (28.1%) with very busy but not crowded patient density and accurate triage implementation, while there were 6 respondents (18.8%) with busy but not crowded patient density and inaccurate triage implementation.

Most of the research results showed that patient density using the NEDOCS measurement tool was at level 2 (busy) with accurate triage implementation in 17 respondents (53.1%). There was a relationship between patient density and the accuracy of triage implementation in the Emergency Room of PKU Muhammadiyah Gamping Hospital with a p-value of 0.012 ($P=0.012<0.5$). The strength of the relationship was 0.437, indicating a moderate correlation.

The results of this study are in line with the research Puspitasari et al. (2024), which states that overcrowding in the ER occurs due to a surge in demand for services that is not balanced with the available capacity and resources. Factors such as limited medical personnel, high patient numbers, and delays in treatment are the main causes of this condition. This study is also consistent with the theory Sahrudi & Anam (2021) which emphasizes that the increasing number of visits to the ED requires the implementation of a triage system to group patients based on urgency. The purpose of this implementation is to ensure that patients in critical condition receive immediate treatment.

This is also supported by the findings of Suranata (2023) which shows a p-value of 0.001 as an indication of a significant relationship between overcrowding and triage accuracy. Puspitasari et al. (2024)'s research in Boyolali, further strengthens these results with a p-value of 0.000 related to the accuracy of initial assessment in the emergency room. Triage plays an important role in the emergency room, especially when patients arrive simultaneously. The implementation of triage is not only aimed at acting quickly and in a timely manner, but also at providing the best treatment for patient safety. Based on the ABCDE classification method, priority is determined by considering the severity of the injury, the number of patient visits, the availability of medical facilities, and the patient's chances of survival, so that patients receive care according to their clinical urgency, especially in critical conditions (Pusponegoro et al., 2016)

There were 6 respondents with busy but non-urgent conditions and improper triage implementation. This occurred because some nurses were new, had not received triage training, and the number of nurses was not proportional to the increasing number of patient visits. Additionally, patient demands for priority care that did not align with the level of urgency based on Standard Operating Procedures (SOP) also contributed to this situation.

Research by Sensi et al. (2023) reaffirms that triage is key to ensuring optimal patient care and effective utilization of hospital resources. Triage nurses must be able to perform clinical assessments and make appropriate triage decisions, even under busy working conditions and heavy workloads. Nurses responsible for triage are required to follow standard procedures in performing triage in the emergency department. Therefore, nurses need to have competencies that include basic knowledge, skills, and attitudes to perform triage correctly (Lairin Djala et al., 2024)

Research by Kundiman et al. (2019) found a correlation between overcrowding and the accuracy of triage implementation in the ER of GMIM Pancaran Kasih Manado General Hospital. The study results revealed that out of 105 respondents, only 26 people (41.9%) performed triage accurately, while 79 people (58.1%) did so inaccurately. This indicated a mismatch between the number of nurses and the increasing number of patient visits, as well as patients' demands for priority care that did not align with standard operating procedures (SOPs). These findings align with the study by Nonutu et al. (2015), which states there is a significant relationship between the number of patient visits and the accuracy of triage implementation.

The study by Firdaus et al. (2018) reveals that the factors causing overcrowding include long waiting times, triage implementation, and an imbalance in the ratio of doctors and nurses in the emergency room. These findings are in line with the study by Kenny et al. 2020), which mentions three main components that influence this condition, namely input, throughput, and output. The input component includes urgent and non-urgent patient visits, while throughput includes triage, number of beds, and work experience. Meanwhile, output is related to the ratio of personnel, rehabilitation facility capacity, and inefficient processes in transferring care between teams. These results are also supported by research Moskop et al. (2019), which states that overcrowding is caused by input, throughput, and output factors. The study by Di Somma et al. (2015) also suggests that crowding in the ED occurs due to a simultaneous surge in demand for services accompanied by a limited number of beds and a shortage of nurses and doctors. Furthermore, by Haas et al. (2023) adds that significant causes of overcrowding include prevailing health policies, socio-cultural beliefs, and unnecessary duplicate diagnostic tests.

Based on the overall research, the researchers assume that high patient density in the ED affects the accuracy of triage implementation. If patient density occurs repeatedly, it can cause an excessive burden on the ED and adversely affect service quality. Therefore, healthcare workers need to have adequate competence to deal with crisis situations and make clinical decisions quickly and accurately

4. Conclusion

Based on the study entitled "The Relationship between Patient Density and the Accuracy of Triage Implementation in the Emergency Room of PKU Muhammadiyah Gamping Hospital," it can be concluded that patient density in the ER of PKU Muhammadiyah Gamping Hospital is mostly in the busy category (level 2) based on measurements using the NEDOCS tool. In this category, the accuracy of triage implementation was appropriate for 17 respondents (53.1%).

5. Acknowledgements

The researchers would like to express their deepest gratitude to all parties who contributed to this study, especially the staff of the PKU Muhammadiyah Gamping Hospital Emergency Room who gave permission to conduct this study, as well as the research assistants and all respondents who voluntarily participated in this study.

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