



Received: [09-09-2026]

Revised: [15-09-2026]

Published: [22-09-2026]

Author's Contribution

A – Research concept and design

B – Collection and/or assembly of data

C – Data analysis and interpretation

D – Writing the article

E – Critical revision of the article

F – Final approval of article

HEALTH FOCUS JOURNAL

THE RELATIONSHIP BETWEEN OVERCROWDING CONDITIONS AND SERVICE QUALITY IN THE EMERGENCY DEPARTMENT

Sarah Noer Aidah^{1*,A,B,F}, Dyah Wiji Puspita Sari^{2,A,B,D,F}, Retno Issroviatiningrum^{1,C,D,F},

^{1,2,3}Faculty of Nursing, Universitas Islam Sultan Agung, Indonesia

* Corresponding Author Email: sarahnoera@gmail.com

ABSTRACT

Background: Overcrowding in the Emergency Department (ED) is a significant issue worldwide. ED overcrowding is associated with numerous negative consequences; it can also affect the efficiency and quality of medical care provided to patients. Patients with conditions requiring immediate attention may experience delays in receiving care, which can negatively impact treatment outcomes.

Objectives: To analyze the relationship between overcrowding conditions and service quality in the Emergency Department

Methods: This cross-sectional study was conducted in an ED in May 2026 involving 124 respondents selected through accidental sampling. Participants included stable adult patients or family caregivers aged ≥ 17 years; patients requiring immediate resuscitation were excluded. Overcrowding was evaluated using the 7-item National Emergency Department Overcrowding Scale (NEDOCS) across six categories. Service quality was assessed using an adapted 22-item SERVQUAL questionnaire ($r > 0.361$, $\alpha = 0.855$) categorized into Good, Fair, and Poor. Data were evaluated using descriptive statistics and the Spearman Rank correlation test.

Results: Most respondents were aged 46–55 years ($n = 44$, 35.5%) and female ($n = 70$, 56.5%). ED overcrowding was predominantly categorized as Crowded/Overcrowded ($n = 40$, 32.3%), followed by Severely Overcrowded ($n = 36$, 29.0%), Dangerously Overcrowded ($n = 24$, 19.4%), Very Busy ($n = 22$, 17.7%), and Busy ($n = 2$, 1.6%). Service quality was rated Good by 67 respondents (54.0%), Fair by 51 (41.1%), and Poor by 6 (4.8%). Bivariate analysis demonstrated a statistically significant inverse correlation between ED overcrowding conditions and service quality.

Conclusion: Higher ED overcrowding is inversely associated with lower service quality ratings. Future research should employ longitudinal multi-center designs and incorporate objective clinical throughput metrics.

Keywords: Overcrowding; Service Quality; Emergency Department (ED); NEDOCS.

INTRODUCTION

Emergency Departments (ED) serve as the primary gateway for acute and life-saving medical care, functioning as an indispensable reservoir of clinical resources and knowledge within modern

healthcare systems (Mostafa & El-Atawi, 2024; World Health Organization, 2021). However, acute healthcare facilities worldwide confront profound operational strain driven by escalating patient demand, severe workforce constraints, and prolonged waiting intervals (Chang et al., 2022). Among these challenges, ED overcrowding represents one of the most critical threats to clinical governance and public health delivery globally (Altun et al., 2025; Salway et al., 2020). Overcrowding manifests when the acute demand for medical attention outpaces the functional, spatial, and staffing capacity of the emergency facility. This operational imbalance precipitates clinical delays for patients requiring immediate attention, impairs diagnostic workflows, exacerbates clinician burnout, and significantly compromises patient-perceived service quality (Atohm et al., 2023; Mostafa & El-Atawi, 2024).

Substantial international empirical data underscore the magnitude of ED overcrowding (Chang et al., 2022; World Health Organization, 2021). Across healthcare networks globally, acute patient presentations have escalated dramatically, placing severe operational burdens on emergency facilities and escalating boarding times (Carter et al., 2016; Pines et al., 2017). Empirical investigations consistently demonstrate that high-density acute encounters precipitate systematic throughput saturation; for instance, international multi-center evaluations reveal substantial bottlenecks in initial triage, intervention delays, and prolonged observation intervals during peak admission surges (Morley et al., 2018; Tsai et al., 2021). Preliminary observations at the local study setting substantiated this strain: average daily patient arrivals reached 60 visits against a physical capacity of only 12 stretchers. During evening peak hours (18:00–21:00 WIB), full stretcher occupancy forced multiple patients to await triage in wheelchairs, extending initial intervention times for urgent yellow-category patients up to 35–45 minutes and inpatient boarding intervals beyond one hour.

ED overcrowding is structured around three interrelated domains: input, throughput, and output bottlenecks (Salway et al., 2020). Input factors involve unscheduled arrival surges, inappropriate non-urgent presentations, and demographic aging marked by complex multimorbidity's (Aalam, 2024; Altun et al., 2025). Throughput delays stem from internal diagnostic intervals, laboratory turnaround lags, and clinical staffing shortages (Mostafa & El-Atawi, 2024). When structural capacity fails to absorb patient demand, care processes deteriorate, leading to delays that directly erode perceived reliability, assurance, and empathy (Al-Neyadi et al., 2018). Although prior investigations have examined ED crowding, empirical findings regarding its relationship with service quality and patient perceptions remain divergent (Chang et al., 2022; Salway et al., 2020). Several studies demonstrate that severe overcrowding significantly degrades service quality, responsiveness, and patient satisfaction due to prolonged waiting times (Afonso et al., 2021; Tsai et al., 2021). Conversely, other empirical evidence suggests that resilient clinical triage, effective

interpersonal communication, and clinical reassurance can serve as protective buffers, maintaining favorable patient perceptions even under heavy operational congestion (Al-Neyadi et al., 2018; Mostafa & El-Atawi, 2024).

METHODS

Study Design and Participants

This study employed a quantitative approach with an observational analytic cross-sectional design to analyze the relationship between overcrowding as the independent variable and service quality as the dependent variable, with concurrent assessment during the same study timeframe. The study was conducted in the Emergency Department (ED) of Bogor Islamic Hospital in May 2026.

Ethical approval statement

The study adhered to ethical principles of informed consent, anonymity, confidentiality, beneficence, non-maleficence, and justice. Before participating, respondents were informed about the study's purpose, benefits, and procedures, and willingly provided written consent without coercion. Respondents retained the right to decline or withdraw from participation at any time.

Research Instruments

The study consisted of two variables: overcrowding condition as the independent variable and service quality in the ED as the dependent variable. Overcrowding condition was measured using the National Emergency Department Overcrowding Scale (NEDOCS) observation sheet, comprising seven components: number of ED beds, total hospital bed count, total number of patients in the ED, number of critical care/emergency patients, longest waiting time for patients in the waiting room, number of patients awaiting inpatient admission, and longest waiting time for inpatient admission. These data were entered into the NEDOCS Calculator to determine the ED overcrowding score. NEDOCS scores were categorized into: Not Busy (0–20), Busy (21–60), Very Busy but Not Crowded (61–100), Crowded/Overcrowded (101–140), Severely Overcrowded (141–180), and Dangerously Overcrowded (>181).

Service quality was measured using a questionnaire consisting of 22 statements adapted from research by Pane (2020). The instrument covered dimensions of Responsiveness, Assurance, Tangibles, Empathy, and Reliability. The questionnaire used a Guttman scale with response options Yes = 1 and No = 0. Total scores ranged from 0–22 and were categorized into Good (15–22), Fair (8–14), and Poor (0–7). The service quality instrument underwent validity testing, where all 22 items yielded calculated *r*-values greater than the *r*-table value of 0.361, and reliability testing with a Cronbach's alpha coefficient of 0.855.

Data Analysis

Univariate analysis was applied to summarize respondent demographic profiles (age, gender), ED overcrowding levels, and service quality ratings using absolute frequencies (n) and percentages (%). Bivariate analysis was conducted using the Spearman Rank correlation test to examine the relationship between overcrowding conditions and service quality, as both variables were measured on ordinal scales and did not meet the assumptions of normality. The threshold for statistical significance was set at $p \leq 0.05$.

RESULTS

Table 1. Respondent Characteristics

Characteristics	Frequency	Percentage (%)
Age years		
17-25	7	5,6
26 - 35	17	17,7
36 – 45	36	29,0
46 – 55	44	35.5
>56	20	16.1
Gender		
Male	54	43,5
Female	70	56.5

Based on the table above, respondent categories by age showed the highest proportion in the age group of 46 to 55 years, with 44 respondents (35.5%). The lowest was in the 17 to 25 years group, with 7 respondents (5.6%), female respondents accounted for 70 respondents (56.5%), while male respondents numbered 54 (43.5%).

Table 2. Frequency Distribution Based on Overcrowding Level in ED of Bogor Islamic Hospital

Overcrowding	Frequency	Percentage (%)
Dangerously Overcrowded	24	19.4
Crowded/Overcrowded	40	32,3
Severely Overcrowded	36	28,2
Very Busy but Not Overcrowded	23	18,5
Busy	2	1,6

Based on Table 2, among 124 respondents, the majority were in the Crowded/Overcrowded category (40 respondents, 32.3%). The lowest category was Busy, with 2 respondents (1.6%).

Table 3. Frequency Distribution Based on Service Quality in ED of Bogor Islamic Hospital

Service Quality	Frequency	Percentage (%)
Good	67	54,0
Fair	51	41,1

Service Quality	Frequency	Percentage (%)
Poor	6	4,8

Based on Table 3, among 124 respondents, the majority rated service quality as Good (67 respondents, 54.0%), while the lowest category was Poor (6 respondents, 4.8%).

Table 4. Spearman Rank Test for the Relationship Between Overcrowding Conditions and Service Quality in the ED of Bogor Islamic Hospital (n=124)

Research Variables	Frequency	ρ -value	R (Coefficient Correlation)
Overcrowding & Service Quality	124	0,036	-0,188

Based on Table 4, the Spearman Rank correlation test yielded a significance value of $p = 0.036$. Since $p = 0.036 < 0.05$, H_0 is rejected and H_a is accepted. This indicates a significant relationship between overcrowding and service quality in the ED of Bogor Islamic Hospital. The correlation coefficient value of -0.188 falls within the range of 0.00–0.199, categorizing the strength of the relationship as very weak, while the negative sign indicates an inverse direction between the two variables

DISCUSSION

Based on research findings from 124 respondents in the ED of Bogor Islamic Hospital, respondent characteristics showed that the 46–55 years age group formed the largest proportion (44 respondents, 35.5%), whereas the 17–25 years age group was the smallest (7 respondents, 5.6%). The predominance of the 46–55 years age group indicates that ED services in this study were mostly utilized by late adults. This condition may be related to an increased risk of health problems with advancing age, leading to a higher demand for healthcare services. Physical changes occurring in this age range increase vulnerability to illness, prompting more frequent healthcare utilization. These findings align with literature indicating that advancing age brings physical and psychological changes that render individuals more susceptible to health disorders and frequent healthcare service utilization.

The age distribution also revealed that the 36–45 years age group comprised 36 respondents (29.0%), the >56 years group had 20 respondents (16.1%), and the 26–35 years group had 17 respondents (13.7%). This distribution demonstrates that ED users originate across various age groups, not exclusively from elderly populations. This reflects the characteristic nature of the ED as a unit receiving patients with diverse and unpredictable severity levels. Consequently, the high

proportion of the 46–55 age group does not imply that overcrowding is tied strictly to specific age demographics, as ED crowding is driven by total visit volume, case complexity, service processes, and hospital capacity to transfer patients to downstream units. Thus, age characteristics are best understood as general sample profiles rather than primary determinants of overcrowding.

Regarding gender, female respondents comprised the majority (70 respondents, 56.5%), compared to male respondents (54 respondents, 43.5%). This demonstrates a slightly higher proportion of female patients or accompanying family members participating in the study. This finding may reflect differences in healthcare utilization patterns by gender. In previous research, Aalam (2024) similarly observed a higher proportion of female emergency department visits compared to males. Thus, female predominance in this study remains consistent with previous emergency service utilization findings.

The higher proportion of female respondents may be influenced by various factors, including specific healthcare needs and a greater tendency among women to monitor health conditions for themselves and family members. Women may also manage dual roles as homemakers and workers, exposing them to diverse health demands. Furthermore, biological factors and reproductive health needs often lead to increased healthcare facility interactions. However, this study did not test relationships between gender and overcrowding or service quality. Therefore, gender distribution should be interpreted solely as sample descriptive data rather than an indicator of direct influence on primary study variables.

For the overcrowding variable, results revealed that the Crowded/Overcrowded category was most frequent (40 respondents, 32.3%), followed by Severely Overcrowded (36 respondents, 29.0%) and Dangerously Overcrowded (24 respondents, 19.4%). Meanwhile, Very Busy but Not Crowded accounted for 22 respondents (17.7%) and Busy comprised only 2 respondents (1.6%). These findings demonstrate that ED conditions at Bogor Islamic Hospital during the study period trended toward high density. NEDOCS measurements evaluate bed availability, patient count, critical care volume, wait times, and boarding times; thus, overcrowding reflects not just patient numbers, but systemic imbalances between demand and ED capacity.

The dominance of overcrowded categories highlights capacity management and patient throughput as critical operational aspects. Theoretically, overcrowding stems from three main components: input, throughput, and output. Input relates to high patient volume arriving; throughput involves internal processing including staff availability and diagnostic testing; output involves inpatient bed availability and discharge/transfer bottlenecks. These findings reinforce that overcrowding is a complex issue extending beyond mere patient arrival volume. High overcrowding proportions warrant targeted management, as crowding elevates wait times, hinders clinical workflow, and potentially impacts patient safety.

An inverse relationship indicates that higher ED crowding correlates with lower perceived service quality. However, a correlation coefficient of -0.188 highlights that service quality is not determined solely by overcrowding. Service quality represents a multi-dimensional construct influenced by responsiveness, assurance, reliability, empathy, and tangibles. Therefore, while ED density creates operational pressure, competent healthcare staff, effective triage, team coordination, and adherence to practice standards help preserve service quality standards.

These findings can be understood through Donabedian's Healthcare Quality Model (Structure, Process, Outcome). Overcrowding directly affects structural dimensions (physical space, bed counts, resource constraints relative to volume). However, structural limitations do not automatically dictate poor outcomes if process quality is maintained. Swift triage, clinical competence, interprofessional communication, and standard compliance act as protective buffers mitigating crowding impacts on care quality. This explains why the majority of respondents (67 respondents, 54.0%) evaluated service quality as Good despite prevailing overcrowded conditions.

Similarly, under the SERVQUAL framework (Tangibles, Reliability, Responsiveness, Assurance, Empathy), overcrowding exerts primary stress on Tangibles and Responsiveness due to spatial limits and prolonged wait times. Conversely, Reliability and Assurance remain intact when clinicians demonstrate professional skill and reliable care delivery. These mechanisms align with observations by Fatma (2021), who reported a negative correlation between overcrowding and ED patient satisfaction ($p=0.021$, $r=-0.216$). In contrast, Saraswati (2025) observed $p=0.014$ with $r=0.288$ at PKU Muhammadiyah Grabag Magelang. Variations across studies stem from institutional differences in ED capacity, staffing ratios, workflow systems, and surge adaptation capabilities.

Overcrowding remains a vital factor significantly associated with service quality, even if the strength of association is low. High quality ratings indicate healthcare staff resilience and adaptive strategies during surge periods. Mitigating overcrowding requires structural and operational optimization in capacity management, patient flow, triage protocols, and inpatient bed coordination to consistently maintain service quality and patient safety.

CONCLUSION

Emergency Department overcrowding demonstrated a statistically significant inverse relationship with patient-perceived service quality, indicating that higher levels of ED crowding correspond to lower ratings of care quality. Despite persistent crowding conditions, the majority of patients and family caregivers rated overall service quality favorably, highlighting the protective role of clinical competence, staff empathy, and triage adherence. To advance clinical practice and policy, future research should employ multi-center longitudinal designs and incorporate objective

clinical performance metrics—such as door-to-doctor time, length of stay, and boarding duration to establish targeted interventions for emergency surge management.

ACKNOWLEDGMENTS

The authors express their gratitude to Sultan Agung Islamic University Semarang, particularly the Faculty of Nursing, for academic and institutional support throughout this study. Sincere appreciation is extended to the hospital administration, emergency department leadership, clinical staff, and participating patients and families for their cooperation during data collection.

FUNDING

This research received no external grant or financial funding from any public, commercial, or non-profit sector.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest associated with this study and publication.

DECLARATION ON THE USE OF ARTIFICIAL INTELLIGENCE (AI)

The authors declare that no Generative AI or AI-assisted technologies were used in the writing of this manuscript.

REFERENCES

- Aalam, A. A. (2024). Patient demographics and emergency department utilization trends in acute healthcare settings. *Journal of Emergency Nursing*, 50(2), 145–154. <https://doi.org/10.1016/j.jen.2023.11.004>
- Afonso, R., Mestre, M., & Ribeiro, C. (2021). Impact of emergency department overcrowding on delay in clinical interventions and patient satisfaction: A prospective study. *International Journal of Emergency Medicine*, 14(1), Article 58. <https://doi.org/10.1186/s12245-021-00382-7>
- Al-Neyadi, H. S., Abdallah, S., & Malik, M. (2018). Measuring patient's satisfaction of healthcare services in the UAE hospitals: Using SERVQUAL quantification. *International Journal of Healthcare Management*, 11(4), 275–281. <https://doi.org/10.1080/20479700.2016.1266804>
- Altun, M., Kaya, E., & Yilmaz, A. (2025). Overcrowding in emergency departments: A scoping literature review. *Anatolian Journal of Emergency Medicine*, 8(2), 94–100. <https://doi.org/10.54996/anatolianjem.1684632>
- Atohm, M., Al-Ghamdi, S., & Al-Zahrani, B. (2023). The association between emergency department overcrowding and delay in treatment: A systematic review. *International Journal of Environmental Research and Public Health*, 20(3), Article 1887. <https://doi.org/10.3390/ijerph20031887>
- Carter, E. J., Pouch, S. M., & Larson, E. L. (2016). The relationship between emergency department crowding and patient outcomes: A systematic review. *Journal of Nursing Scholarship*, 46(2), 106–115. <https://doi.org/10.1111/jnu.12055>

- Chang, A. M., Lin, A., Fu, R., & Lowe, R. A. (2022). Emergency department crowding and quality of care: A systematic review of operational and clinical outcomes. *Academic Emergency Medicine*, 29(5), 614–625. <https://doi.org/10.1111/acem.14442>
- Hitti, E., Hadid, D., Melki, J., & Tamim, H. (2020). Validation of the National Emergency Department Overcrowding Score (NEDOCS) in an international setting: Measuring crowding in a tertiary care center. *BMC Emergency Medicine*, 20(1), Article 45. <https://doi.org/10.1186/s12873-020-00340-9>
- Morley, C., Unwin, M., Peterson, G. M., Stankovich, J., & Kinsman, L. (2018). Emergency department crowding: A systematic review of causes, consequences and solutions. *PLOS ONE*, 13(8), Article e0203316. <https://doi.org/10.1371/journal.pone.0203316>
- Mostafa, R., & El-Atawi, K. (2024). Strategies to measure and improve emergency department performance: A review. *Cureus*, 16(1), Article e52341. <https://doi.org/10.7759/cureus.52341>
- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12–40.
- Pines, J. M., Griffey, R. T., & Uscher-Pines, L. (2017). Emergency department crowding and the quality of emergency care. *Emergency Medicine Clinics of North America*, 35(3), 517–528. <https://doi.org/10.1016/j.emc.2017.03.003>
- Rasouli, H. R., Esfahani, M., Vahdati, S. S., & Farahmand, S. (2019). Patients' satisfaction in emergency departments: A systematic review. *Emergency*, 7(1), Article e36. <https://doi.org/10.22037/emergency.v7i1.24647>
- Salway, R. J., Valenzuela, R., Shoenberger, J. M., Mallon, W. K., & Vicellio, A. (2020). Emergency department crowding: Causes, consequences, and solutions. *Emergency Medicine Clinics of North America*, 38(2), 277–292. <https://doi.org/10.1016/j.emc.2020.01.002>
- Savioli, F., Alfieri, A., Zanza, C., Longhitano, Y., Racca, F., Desideri, G., & Piccioni, A. (2022). Quality of care and patient satisfaction in the emergency department: A review of the Donabedian model application. *Emergency Care Journal*, 18(2), Article 10562. <https://doi.org/10.4081/ecj.2022.10562>
- Szekendi, M. K., Williams, M. V., Carrier, D., & Cerese, J. (2015). The input-throughput-output model of emergency department crowding: A multi-center evaluation of throughput strategies. *Journal of Healthcare Management*, 60(1), 27–41. <https://doi.org/10.1097/00115514-201501000-00007>
- Tekwani, K. L., Watts, H. F., Sweis, R. T., & Rzechula, K. H. (2015). A comparison of the NEDOCS score to clinician and nurse perception of emergency department crowding. *International Journal of Emergency Medicine*, 8(1), Article 20. <https://doi.org/10.1186/s12245-015-0068-1>
- Tsai, C. L., Liang, C. C., & Teng, C. C. (2021). The relationship between hospital overcrowding, wait times, and emergency service quality: An empirical study. *Healthcare*, 9(11), Article 1422. <https://doi.org/10.3390/healthcare9111422>
- World Health Organization. (2021). Emergency care systems for universal health coverage: Ensuring timely care and service quality. World Health Organization. <https://www.who.int/publications/i/item/9789240028784>
- Yarmohammadian, M. H., Rezaei, F., Haghshenas, A., & Tavakoli, N. (2017). Overcrowding in emergency departments: A review of strategies to decrease response time and patient waiting time. *Journal of Research in Medical Sciences*, 22(1), Article 23. <https://doi.org/10.4103/1735-1995.200277>
- Zeinali, N., Bastani, P., & Delavari, S. (2020). Factors affecting the quality of emergency department services: A qualitative study using the SERVQUAL model. *Journal of Health Management and Informatics*, 7(3), 173–181. <https://doi.org/10.30476/jhmi.2020.87114.1068>