OPEN ACCESS

Saudi Journal of Nursing and Health Care
Abbreviated Key Title: Saudi J Nurs Health Care
ISSN 2616-7921 (Print) |ISSN 2616-6186 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Emergency Department Nurses' Self-Reported Awareness of Clinical Quality Indicators: Implications for Healthcare Logistics and Patient Flow - A Cross-Sectional Study

Alaa Mujallad[1], Hala Mohammed Yasin[1], Fatma Ahmed Elsobky[1,2], Faten Shawky Kandil[1], Intisar Alsheikh Mohamed[1], Ishraga Abdelgadir Mohamed[1], Jumana Aljohani[1], Abrar Rabea[1], Fatoon Mahjoub[1], Manal Alsaktawi[1], Renada Al-Beiruty[1], Hend Maarof Tag[1,3]*

[1]Department of Nursing, College of Applied Medical Science, University of Jeddah, Jeddah, Saudi Arabia
[2]Department of Pediatric Nursing, Faculty of Nursing. Benha University, Benha, Egypt
[3]Department of Zoology, Faculty of Science, Suez Canal University, Ismailia, Egypt

DOI: https://doi.org/10.36348/sjnhc.2026.v09i09.006 | **Received:** 08.07.2026 | **Accepted:** 03.09.2026 | **Published:** 12.09.2026

***Corresponding author:** Hend Maarof Tag
Department of Nursing, College of Applied Medical Science, University of Jeddah, Jeddah, Saudi Arabia

Abstract

Background: Emergency department (ED) quality indicators monitor timeliness, safety, effectiveness, patient flow, and patient-centered care. Several indicators also signal the performance of patient-flow logistics, including queueing, throughput, handoffs, and coordination of time-critical resources. Nurses influence these processes, yet their familiarity with formal measurement frameworks may vary. ***Aim:*** To assess ED nurses' self-reported awareness of selected clinical quality indicators, examine its association with ED experience, and interpret the measured flow- and timeliness-related indicators from a healthcare-logistics perspective. ***Methods:*** A cross-sectional survey was completed by 45 ED nurses. Ten indicators were rated on a five-point self-reported awareness scale and grouped into four domains. Internal consistency was assessed using Cronbach's alpha. Descriptive statistics, exploratory contingency-table analyses, and Spearman correlation were reported. Healthcare logistics was an interpretive framework rather than a directly measured construct; the instrument did not assess procurement, inventory, replenishment, internal transport, or supply-chain performance. Sparse cells and multiple item-level tests required cautious inference. ***Results:*** The awareness scale showed good internal consistency (Cronbach's alpha = .89). Longer ED experience was positively correlated with the overall awareness score (Spearman's rho = .374, p = .011; N = 45). The reported omnibus association between experience group and categorized overall awareness was significant (chi-square (6) = 23.104, p = .001), although sparse expected counts limit conventional chi-square inference. Of the flow- and timeliness-related item tests, only door-to-doctor/ECG time met a conservative Bonferroni benchmark of .005. Clinical experience was the most frequently reported information source. ***Conclusion:*** Longer ED experience was associated with greater self-reported awareness. The findings support integrating patient-flow logistics into nursing orientation and quality-improvement training, but they do not provide evidence about supply-chain performance. The small sample, self-report measure, sparse cells, and cross-sectional design restrict causal and generalizable conclusions.

Keywords: Emergency nursing; quality indicators; healthcare logistics; patient flow; self-reported awareness; cross-sectional study.

1. INTRODUCTION

Emergency care is intrinsically time sensitive. Delays in recognition, assessment, treatment, and disposition can affect patient outcomes, while crowding and access block can compromise safety and patient experience. The World Health Organization describes emergency care as an integrated platform for delivering accessible, quality, and time-sensitive services for acute illness and injury [1].

Clinical quality indicators translate broad quality goals into measurable elements of structure, process, or outcome. Contemporary emergency-care frameworks emphasize that indicators should be clinically meaningful, measurable, feasible, and responsive to improvement [2,3]. Common ED indicators include time to triage, waiting time, length of stay (LOS), left-without-being-seen (LWBS) rate, time-critical interventions, medication safety, infection-

prevention compliance, unplanned return visits, and patient experience.

Nurses have a central role in triage, initial assessment, surveillance, medication administration, infection prevention, communication, documentation, and coordination of flow. Several of the indicators examined in the present study overlap with nurse-sensitive priorities identified internationally and in Saudi Arabia, including medication errors, pain assessment, hand-hygiene compliance, and patient satisfaction [4–6]. Awareness of how these activities are measured may support staff engagement with audit, feedback, and quality-improvement work.

Healthcare logistics encompasses the coordinated movement of patients, information, staff, medications, equipment, diagnostic services, and supporting resources to the point of care. In EDs, patient-flow logistics includes demand-capacity matching, queueing, triage, internal handoffs, diagnostic turnaround, disposition, transfer, and bed flow. Research on ED crowding commonly distinguishes input, throughput, and output constraints, while more recent patient-flow research emphasizes that solutions must extend across the wider hospital rather than remain confined to the ED [7–10]. Emergency nurses are active patient-flow managers whose work is shaped by staffing, information systems, physical layout, interprofessional coordination, and escalation processes [11].

However, familiarity acquired informally through clinical exposure may be uneven. Newly employed nurses may have less opportunity to participate in audit cycles, incident review, accreditation activities, or performance meetings. Evidence from Saudi ED settings also emphasizes the importance of patient-flow and LOS indicators and the system-level factors that influence them [7]. Direct assessment of nurses' objective knowledge remains distinct from asking nurses to rate their own awareness; therefore, the present study is framed explicitly as an assessment of self-reported awareness.

Study Aim and Objectives

The study aimed to assess ED nurses' self-reported awareness of selected clinical quality indicators and its association with ED experience. The objectives were to:

- describe self-reported awareness across four indicator domains;
- estimate the internal consistency of the awareness scale;
- examine the association between ED experience and item-level and overall awareness; and
- identify the main reported sources of information about quality indicators.
- interpret the measured flow- and timeliness-related indicators through a patient-flow logistics lens, without treating logistics as a directly measured study variable; and
- derive practice and research implications for integrating patient-flow and resource-coordination concepts into ED nursing education and quality improvement.

2. METHODS

2.1 Study design and reporting

A descriptive analytic cross-sectional survey design was used. Reporting was reorganized with reference to the STROBE recommendations for cross-sectional studies [12].

2.2 Setting and study period

The study was conducted among emergency department nursing staff working in selected hospitals in Jeddah, Saudi Arabia. The setting was chosen because emergency departments are critical areas where clinical quality indicators are directly applied and monitored in daily practice. Data collection and study-related activities were carried out over a five-month period, from January to May 2026. This period included preparation of the questionnaire, participant recruitment, distribution of the survey, data collection, data entry, and statistical analysis.

2.3 Participants and sampling

The study participants were emergency department nursing staff working in selected hospitals in Jeddah, Saudi Arabia. A convenience sampling technique was used to recruit eligible participants during the study period. Nurses were included if they were currently working in the emergency department and agreed to participate in the study. Nurses who were not assigned to the emergency department, nursing students, interns, or those who declined participation were excluded. A total of 45 emergency department nurses completed the questionnaire and were included in the final analysis. This sample size was considered appropriate for the exploratory nature of the study and for describing nurses' self-reported awareness of emergency department clinical quality indicators.

2.4 Instrument

Data were collected using a structured self-administered questionnaire. The first section collected participant characteristics. The second section asked respondents to rate their current awareness of ten ED quality indicators on a five-point scale: 1 = not aware, 2 = slightly aware, 3 = moderately aware, 4 = well aware, and 5 = fully aware. Because these are self-ratings rather than scored factual questions, the construct is described as self-reported awareness throughout this manuscript.

Table 1: Domains and indicators included in the awareness scale

Domain	Indicators
Operational efficiency and patient flow	Waiting time; time to triage; ED LOS; LWBS rate
Clinical quality and time-critical care	Time to pain management; door-to-doctor/ECG time for critical patients
Patient safety and infection control	Medication error rate; hand hygiene and infection-control compliance; readmission/return within 72 hours
Patient-centered care	Patient satisfaction measurement

Participants also selected their main source of information about quality indicators: hospital policies/protocols, workshops or training, online courses, clinical experience, or uncertainty about the source.

Healthcare logistics was not measured as a separate questionnaire domain. The logistics interpretation was restricted to concepts represented by existing indicators, particularly waiting, triage, LOS, LWBS, time- critical coordination, and patient flow. No item assessed procurement, inventory control, stockouts, replenishment lead time, equipment readiness, specimen transport, internal distribution, bed-transfer delay, or supplier performance.

2.5 Instrument development and validity

The study instrument was developed as a structured self-administered questionnaire to assess emergency department nursing staff's self-reported awareness of clinical quality indicators. The questionnaire was designed based on commonly used emergency department quality indicators related to patient flow, time-critical care, patient safety, infection control, and patient-centered care. The knowledge and awareness section included ten indicators grouped into four domains: operational efficiency and patient flow, clinical quality and time-critical care, patient safety and infection control, and patient-centered care.

Participants rated their level of awareness for each indicator using a five-point Likert scale ranging from 1 = Not aware to 5 = Fully aware. Higher scores indicated greater self-reported awareness of emergency department quality indicators. The questionnaire also included demographic questions and an item asking about the main source of information regarding quality indicators.

To ensure content validity, the questionnaire was reviewed for clarity, relevance, and appropriateness to the study objectives and emergency department nursing context. The items were organized into domains to ensure that the instrument covered the main dimensions of emergency department clinical quality indicators. Feedback from the review process was used to refine the wording of items and improve the overall structure of the questionnaire before data collection. The internal consistency of the awareness section was later assessed using Cronbach's alpha, which showed good reliability, **$\alpha = 0.89$**.

2.6 Ethical considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Before participation, an informed consent statement was included at the beginning of the questionnaire. The statement explained the purpose of the study, the voluntary nature of participation, and the participants' right to refuse or withdraw without any penalty or consequences. Participants were informed that completing the questionnaire indicated their agreement to participate in the study. There was no coercion or pressure to participate. Confidentiality and anonymity were maintained throughout the study. No personal identifying information, such as names, identification numbers, phone numbers, or email addresses, was collected. All responses were kept confidential and were used only for research purposes. Data were reported in aggregate form to ensure that individual participants could not be identified.

2.7 Statistical analysis

Data were analyzed using IBM SPSS Statistics [insert version]. Frequencies and percentages summarized categorical variables and item responses. An overall awareness score was calculated as the mean of the ten items when the required item-completion rule was met. Internal consistency was evaluated using Cronbach's alpha. Years of ED experience were analyzed using the three categories reported in the dataset (≤2 years, 3–10 years, and >10 years); the coding of participants at exactly two years must be verified against the raw dataset before submission.

The original analysis used Pearson chi-square tests to explore item-by-experience associations and the association between experience group and categorized overall awareness. Because multiple expected cell counts were below five, these tests are presented as exploratory and require confirmation using exact or Monte Carlo procedures. Spearman's rank correlation was prioritized for the relationship between ordered experience and overall awareness. Item-level p values were unadjusted; a Bonferroni benchmark of .005 (0.05/10) is noted to limit false-positive interpretation across ten item-level tests. Statistical significance was two-sided at $p < .05$ for the prespecified overall analysis.

3. RESULTS

3.1 Participant distribution

The analytic sample comprised 45 ED nurses. Six participants (13.3%) were in the least-experienced

group, 21 (46.7%) had 3–10 years of ED experience, and 18 (40.0%) had more than 10 years (Table 2).

Table 2: Distribution of participants by ED experience (N = 45)

ED experience	n	%
≤2 years*	6	13.3
3–10 years	21	46.7
>10 years	18	40.0

Item-level awareness and exploratory associations

Descriptively, higher proportions of fully aware responses were generally observed among nurses with longer ED experience. Table 3 summarizes the originally reported Pearson chi-square tests. Sparse expected counts make the conventional asymptotic p values unreliable; exact or Monte Carlo confirmation is required. Four item-level tests were nominally significant at $p < .05$, but only door-to-doctor/ECG time met the conservative Bonferroni benchmark of $p < .01$.

Table 3: Exploratory item-level associations between ED experience and self-reported awareness

Domain / indicator	χ^2	df	Unadjusted p	Interpretation
Operational: Waiting time	16.321	8	.038	Statistically significant association
Operational: Time to triage	14.074	8	.080	No statistically significant association
Operational: ED LOS	14.451	8	.071	No statistically significant association
Operational: LWBS rate	19.318	8	.013	Statistically significant association
Clinical: Time to pain management	14.433	8	.071	No statistically significant association
Clinical: Door-to-doctor/ECG time	28.327	8	<.001	Statistically significant association
Safety: Medication error rate	14.550	8	.068	No statistically significant association
Safety: Hand hygiene/infection control	13.973	8	.082	No statistically significant association
Safety: Return/readmission within 72 h	10.775	8	.215	No statistically significant association
Patient-centered: Satisfaction measurement	17.786	8	.023	Statistically significant association

Pearson's chi-square test was used for exploratory item-level analysis. Statistical significance was set at $p < .05$. Because multiple item-level comparisons were performed and several tables included expected cell counts below five, significant findings should be interpreted cautiously

3.2 Overall awareness

As shown in Table 4 and Figure 1, the categorized overall awareness of emergency department quality indicators varied across ED experience groups. Most nurses with ≤2 years of ED experience were classified as having low awareness 5 (83.3%), while only 1 (16.7%) was classified as having high awareness. In contrast, nurses with 3–10 years of ED experience were more frequently categorized as having high awareness 7 (33.3%) or very high awareness 8 (38.1%). Similarly, among nurses with >10 years of ED experience, the largest proportion had very high awareness 8 (44.4%), followed by moderate and high awareness 5 (27.8%) each. The association between ED experience and categorized overall awareness was statistically significant, $\chi^2(6) = 23.104$, $p = .001$, indicating that nurses with longer ED experience tended to report higher levels of awareness of ED quality indicators. However, this finding should be interpreted with caution because some expected cell counts were small.

Table 4: Categorized overall awareness by ED experience

ED experience	Low n (%)	Moderate n (%)	High n (%)	Very high n (%)
≤2 years*	5 (83.3)	0 (0.0)	1 (16.7)	0 (0.0)
3–10 years	3 (14.3)	3 (14.3)	7 (33.3)	8 (38.1)
>10 years	0 (0.0)	5 (27.8)	5 (27.8)	8 (44.4)
Total	8 (17.8)	8 (17.8)	13 (28.9)	16 (35.6)

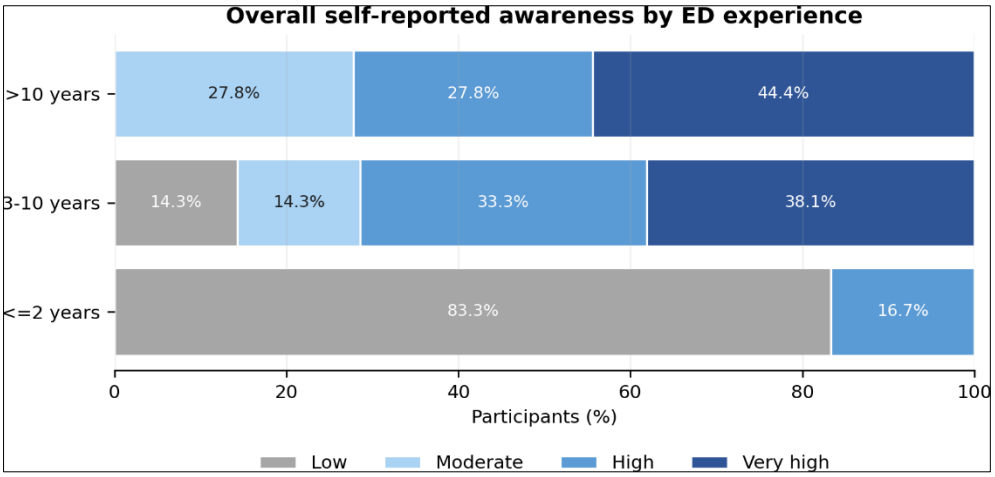

Figure 1: Distribution of categorized overall self-reported awareness by ED experience. Percentages are calculated within each experience group. Category cut points require confirmation from the raw analysis file

Spearman correlation showed a positive association between ordered ED experience and the overall awareness score ($\rho = .374$, $p = .011$; $N = 45$), representing a weak-to-moderate relationship. This association should not be interpreted causally.

3.3 Sources of information

As shown in Figure 2, clinical experience was the most frequently reported primary source of information about ED quality indicators, accounting for 35.6% of responses. This was followed by hospital policies and protocols, reported by 28.9% of participants. Formal educational sources were less commonly reported, including workshops or training sessions 15.6% and online courses 11.1%. A smaller proportion of participants reported that they were not sure about their main source of information 8.9%. These findings suggest that ED nursing staff mainly acquire knowledge of quality indicators through practical clinical exposure and institutional policies, while structured educational activities such as workshops and online courses appear to contribute less frequently.

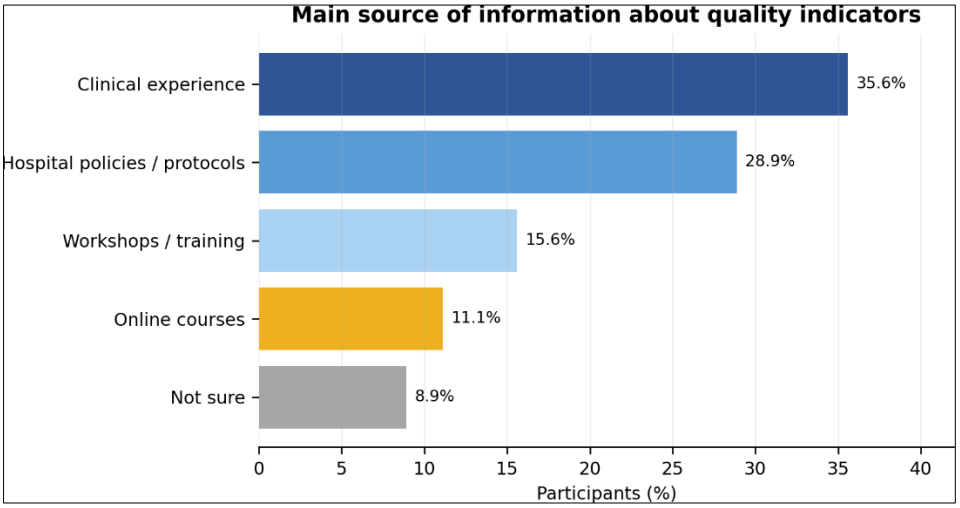

Figure 2: Main reported source of information about ED quality indicators (N = 45)

3.4 Logistics-relevant interpretation of measured indicators

Several questionnaire items were directly related to emergency department logistics and patient-flow processes, including waiting time, time to triage, emergency department length of stay, Left Without Being Seen rate, and door-to-doctor/ECG time for critical patients. These indicators reflect key operational issues such as patient movement through the emergency department, triage efficiency, access to timely clinical assessment, diagnostic readiness, staff availability, and coordination of time-critical care. As shown in **Figure 3**, the proportion of participants reporting being "fully aware" of patient-flow and time-critical indicators was generally higher among nurses with longer emergency department experience. For example, full awareness of waiting time was highest among nurses with more than 10 years of experience, while full awareness of door-to-doctor/ECG time for critical patients was also greater in the most experienced group. This pattern suggests that clinical exposure and longer experience in the emergency department may contribute to better familiarity with

logistics-related quality indicators. Item-level analysis showed that waiting time and Left Without Being Seen rate were significantly associated with ED experience at the unadjusted level. However, door-to-doctor/ECG time for critical patients was the strongest finding and remained statistically significant after applying a conservative multiple-comparison threshold. In contrast, time to triage and ED length of stay did not show statistically significant associations with ED experience. Therefore, these findings should be interpreted as exploratory and descriptive, particularly because several contingency tables included small expected cell counts. As shown in **Figure 4**, full awareness varied across the ten measured ED quality indicators. The highest proportions of "fully aware" responses were reported for medication error rate and hand hygiene/infection control compliance, followed by waiting time and time to pain management. This indicates that nurses may be more familiar with patient safety and infection-control indicators than with some patient-flow and return-visit indicators. Overall, the results describe nurses' self-reported awareness of logistics-related and clinical quality indicators; they do not directly measure actual emergency department performance, waiting time, throughput, resource availability, or patient outcomes.

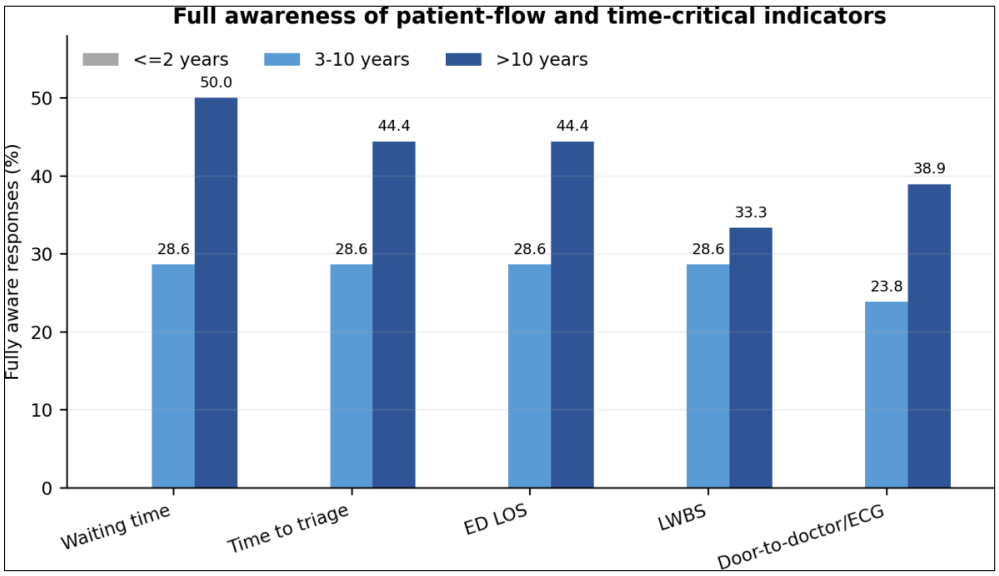

Figure 3: Percentage reporting "fully aware" for patient-flow and time-critical indicators by ED experience. The figure is descriptive and does not replace exact or Monte Carlo inference for sparse tables

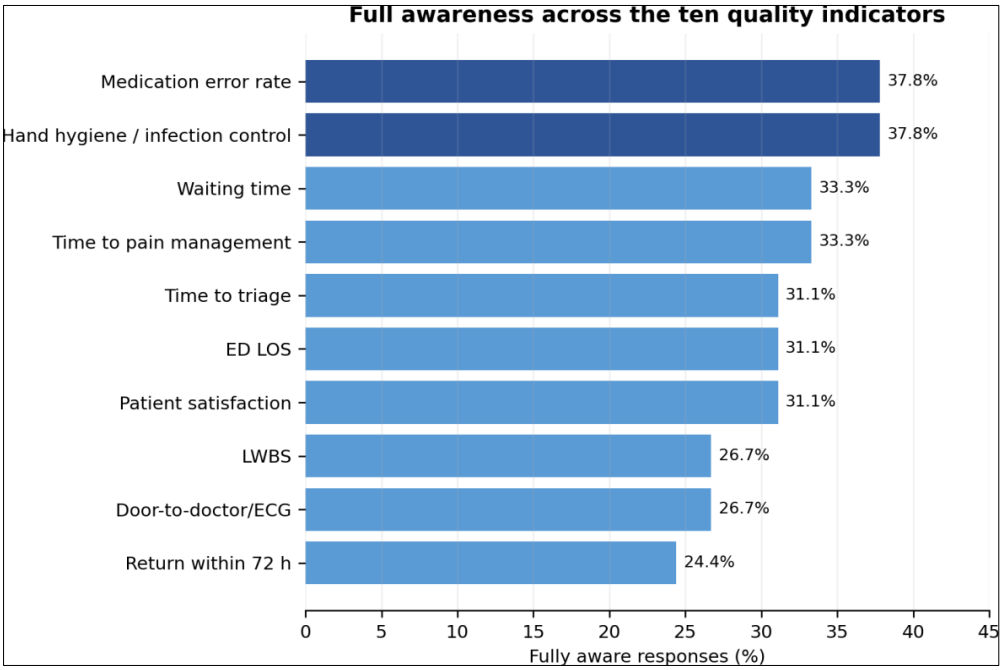

Figure 4: Percentage of the total sample reporting "fully aware" across the ten measured ED quality indicators (N= 45)

4. DISCUSSION

This study examined emergency department nurses' self-reported awareness of selected clinical quality indicators and explored its association with years of experience in the emergency department. Overall, the findings indicate that longer ED experience was associated with higher awareness of ED quality indicators. This was supported by the significant association between ED experience and categorized overall awareness, as well as the positive Spearman correlation between ordered experience and the overall awareness score. This finding is clinically plausible, as repeated exposure to triage, time-critical protocols, incident review, accreditation requirements, performance feedback, and quality-improvement activities may increase nurses' familiarity with formal ED quality indicators.

The association between experience and awareness is consistent with previous evidence showing that nurses contribute directly to patient-flow management through clinical prioritization, coordination, communication, discharge planning, and escalation across acute-care pathways [11,13]. These activities provide practical exposure to quality indicators that may not be fully acquired through classroom teaching alone. However, experience should be understood as one pathway to awareness rather than a substitute for standardized education. Nurses' exposure to quality indicators may vary according to shift patterns, role allocation, mentorship, local protocols, and opportunities to participate in audits, accreditation, or quality-improvement activities.

Operational indicators such as waiting time, time to triage, ED length of stay, and Left Without Being Seen rate are closely embedded in the daily management of emergency department flow. International frameworks emphasize that ED performance reflects interactions across the wider emergency-care system rather than the emergency department alone [2,3]. This agrees with the current findings, where awareness of several patient-flow indicators appeared higher among more experienced nurses. Recent Saudi evidence also identified boarding, bed occupancy, disposition delays, workflow barriers, staffing, peak demand, and interdepartmental coordination as important factors affecting ED quality indicators [7,14]. Therefore, the observed relationship between ED experience and awareness may reflect greater operational exposure among senior nurses to patient movement, crowding, escalation procedures, and flow-related performance monitoring.

Crowding and patient-flow literature further supports interpreting these indicators together rather than separately. Waiting time, triage delay, prolonged length of stay, and LWBS may represent different stages of a common demand-capacity imbalance. Systematic reviews have shown that ED flow problems are often linked to input, throughput, and output constraints, including arrival patterns, diagnostic turnaround, consultation delays, bed availability, discharge processes, and access block [8,9,15–17]. In this context, the present study reinforces the importance of nurses' awareness of patient-flow indicators because nurses are positioned at multiple points in the ED journey, from initial assessment and prioritization to monitoring, communication, escalation, and patient transfer.

The strongest item-level association was observed for door-to-doctor/ECG time for critical patients. This finding is consistent with previous literature emphasizing that time-sensitive assessment and early intervention are central components of emergency care quality and patient safety [1]. Nurses with longer ED experience may have greater exposure to critical cases, escalation pathways, rapid assessment protocols, ECG procedures, and audit standards, which may explain their higher reported awareness of this indicator. From a logistics perspective, door-to-doctor/ECG time is not only a clinical indicator but also a coordination measure. It depends on early recognition, rapid communication, staff availability, equipment readiness, timely patient routing, documentation, and escalation when the pathway is delayed. However, this result should be interpreted as evidence of self-reported familiarity rather than confirmed technical knowledge of the indicator. Although experienced nurses appeared more aware of door-to-doctor/ECG time, the study did not assess their ability to define the indicator, identify its measurement components, or apply it in practice.

Medication safety, pain management, hand hygiene, infection-control compliance, and readmission within 72 hours represent important patient safety and clinical quality indicators. These indicators overlap with nursing-sensitive priorities reported in international and Saudi-focused literature, including medication errors, pain assessment, hand-hygiene compliance, and patient satisfaction [4–6]. In the current study, descriptive awareness of patient safety and infection-control indicators tended to be higher among more experienced participants. Although the item-level associations in this domain were not statistically robust after considering multiple comparisons and sparse contingency cells, the pattern remains important from a quality-improvement perspective. It suggests that patient safety awareness may develop through clinical exposure, repeated participation in routine safety practices, and familiarity with hospital policies and reporting systems.

Patient satisfaction should not be interpreted as a purely interpersonal outcome. The current findings are consistent with previous studies indicating that emergency department experience is influenced by multiple operational and clinical factors, including perceived waiting time, information provided about delays, staff communication, pain management, privacy, and the physical environment [18,19]. Therefore,

interventions that improve patient flow, shorten waiting, or enhance communication about delays may contribute not only to operational efficiency but also to patient experience [20]. However, speed alone should not be treated as the only marker of quality. A narrow focus on timeliness may create safety trade-offs if not balanced with medication safety, reassessment, pain management, hand hygiene, infection control, and unplanned return indicators. Quality dashboards should therefore integrate timeliness, safety, clinical care, and patient-experience measures.

The finding that clinical experience was the most commonly reported source of information about ED quality indicators is important. This agrees with the practical nature of emergency nursing, where much knowledge is acquired through repeated exposure to patient care, local routines, escalation processes, and informal learning [21]. However, reliance on clinical experience alone may lead to inconsistent understanding of indicator definitions, targets, calculation rules, and reporting responsibilities. Formal policies and protocols were the second most commonly reported source, while workshops, training sessions, and online courses were less frequently reported. This finding supports the need for a blended educational strategy that preserves case-based learning and senior mentorship while anchoring practice in standardized indicator definitions, transparent calculation rules, current targets, audit feedback, and locally validated data.

The methodological context of the study should also be considered when interpreting the results. The sample size reflected the practical challenges of recruiting nursing staff from emergency departments, which are specialized, high-demand clinical settings with shift duties, continuous patient flow, urgent workload demands, and limited staff availability during working hours. Therefore, the sample should be understood in relation to the realities of conducting research among ED nurses rather than as a simple numerical limitation. In addition, the study used self-reported awareness, which is appropriate for assessing perceived familiarity with quality indicators but differs from objective knowledge testing. The item-level findings should therefore be viewed as exploratory, particularly because multiple comparisons were performed and some contingency-table cells had small expected counts.

Taken together, the findings highlight emergency department experience as an important factor associated with nurses' awareness of clinical quality indicators, particularly those related to patient flow, time-critical coordination, patient safety, and patient-centered care. The significant association between ED experience and overall awareness, together with the positive Spearman correlation, indicates that nurses with longer ED exposure were more likely to report higher awareness of quality indicators. This pattern was especially clear for logistics-relevant indicators such as waiting time, Left Without Being Seen rate, and door-to-doctor/ECG time for critical patients, as well as patient satisfaction measurement. These indicators connect daily nursing practice with core ED functions, including timely assessment, patient movement, escalation of critical cases, safety monitoring, and communication with patients.

Overall, the study strengthens the view that nurses' awareness of ED quality indicators is not only a theoretical quality concept but also a practical component of emergency care delivery. Enhancing this awareness, particularly among less experienced nurses, may support better participation in quality-improvement activities, improve patient-flow monitoring, and contribute to safer, more responsive, and more patient-centered emergency department services. The findings support integrating ED quality indicators into nursing orientation, continuing education, audit-and-feedback activities, and interdisciplinary quality-improvement programs.

4.1 limitations

One methodological challenge in this study was the limited sample size, which was related to the nature of the targeted population. The study focused specifically on nursing staff working in emergency departments, a specialized clinical group that is smaller in number compared with nurses in general inpatient or outpatient departments. In addition, emergency departments are high-pressure settings with continuous patient flow, shift duties, urgent workload demands, and limited availability of staff during working hours. These factors may have affected nurses' ability to participate in the survey and contributed to the final sample size. Therefore, the sample size should be understood in relation to the practical challenges of conducting research in an emergency department setting rather than as a weakness of the study. Despite this challenge, the study provides useful exploratory evidence about emergency department nurses' awareness of clinical quality indicators and highlights important areas for quality improvement and staff education.

4.2 Implications for healthcare logistics and nursing practice

The findings support a clinically grounded patient-flow logistics component within ED nursing education. This component should connect frontline actions to the ED journey from arrival to departure and clarify how queueing, handoffs, diagnostics, bed availability, and escalation affect quality indicators. It should not be presented as evidence that nurses require full procurement or supply-chain management training; those domains were outside the instrument and require separate needs assessment.

- Include formal definitions, calculation rules, targets, and staff responsibilities for ED quality indicators in nursing orientation.
- Use periodic audit-and-feedback sessions and case-

based learning rather than relying on experience alone.

- Teach demand-capacity mismatch, bottleneck recognition, internal handoffs, diagnostic turnaround, escalation of delays, and bed-flow coordination through interdisciplinary simulation.
- Use an integrated dashboard combining waiting, triage, LOS, LWBS, time-critical care, safety, and patient-experience indicators; add direct logistics measures only when validated operational data are available.
- Standardize escalation routes for crowding, delayed investigations, critical-item shortages, equipment unavailability, and delayed transfers, with clear ownership across nursing, medicine, diagnostics, bed management, pharmacy, and support services.
- Develop and validate an instrument that separates perceived awareness from objective knowledge.
- In future multicenter studies, recruit a larger sample; prespecify primary outcomes; use exact, ordinal, or multivariable models; and directly measure patient-flow and supply-chain variables.

5. CONCLUSION

Longer ED experience was associated with greater self-reported awareness of selected ED clinical quality indicators in this sample. The association was most defensible for the overall score; individual indicator findings should be treated as exploratory because of sparse cells and multiple comparisons. Viewed through a healthcare-logistics lens, waiting, triage, LOS, LWBS, and door-to-doctor/ECG time connect nursing practice with patient-flow coordination. The study supports integrating these concepts into orientation and quality improvement, but it neither establishes causation nor evaluates procurement, inventory, transport, equipment readiness, or supply-chain performance.

Declarations

Consent for Publication: Not applicable, provided no identifiable participant information is reported.

Availability of Data and Materials: The datasets generated and analyzed during the current study are not publicly available to protect participant confidentiality but may be available from the corresponding author upon reasonable request and subject to institutional approval.

Competing Interests: The author declares no competing interests.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. World Health Organization. Emergency care. Geneva: WHO; 2023. Available from: https://www.who.int/health-topics/emergency-care
2. Hansen K, Boyle A, Holroyd B, *et al.,*Updated framework on quality and safety in emergency medicine. Emergency Medicine Journal. 2020;37:437–442. doi:10.1136/emermed-2019-209290.
3. Broccoli MC, Moresky R, Dixon J, *et al.,* Defining quality indicators for emergency care delivery: findings of an expert consensus process by emergency care practitioners in Africa. BMJ Global Health. 2018;3:e000479. doi:10.1136/bmjgh-2017-000479.
4. Oner B, Zengul FD, Oner N, Ivankova NV, Karadag A, Patrician PA. Nursing-sensitive indicators for nursing care: a systematic review (1997–2017). Nursing Open. 2021;8(3):1005–1022. doi:10.1002/nop2.654.
5. Koch D, Kutz A, Conca A, Wenke J, Schuetz P, Mueller B. The relevance, feasibility and benchmarking of nursing quality indicators: a Delphi study. Journal of Advanced Nursing. 2020;76(12):3483–3494. doi:10.1111/jan.14560.
6. Hakami A, *et al.,* Nursing research priorities based on the nurse-sensitive indicators: a scoping review and Delphi consultation. The Open Nursing Journal. 2023;17:e187443462304190.
7. Aljohani L, Alqasimi NA, Alharbi W, *et al.,*Key indicators contributing to prolonged emergency department stays in Saudi Arabia: a modified Delphi study. BMC Emergency Medicine. 2026;26:20. doi:10.1186/s12873-025-01438-y.
8. Morley C, Unwin M, Peterson GM, Stankovich J, Kinsman L. Emergency department crowding: a systematic review of causes, consequences and solutions. PLoS One. 2018;13(8):e0203316. doi:10.1371/journal.pone.0203316.
9. Samadbeik M, Staib A, Boyle J, *et al.,*Patient flow in emergency departments: a comprehensive umbrella review of solutions and challenges across the health system. BMC Health Services Research. 2024; 24:274. doi:10.1186/s12913-024-10725-6.
10. Zamani H, Parvaresh F, Nasr Isfahani M. Optimizing patient flow logistics: strategic challenges, tactical solutions, and future directions. BMC Health Services Research. 2025; 25:1382. doi:10.1186/s12913-025-13516-9.
11. Benjamin E, Giuliano KK. Work systems analysis of emergency nurse patient flow management using the Systems Engineering Initiative for Patient Safety model: applying findings from a grounded theory study. JMIR Human Factors. 2024;11:e60176. doi:10.2196/60176.
12. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. PLoS Medicine. 2007;4(10):e296. doi:10.1371/journal.pmed.0040296.
13. Sharma S, Rafferty AM, Boiko O. The role and contribution of nurses to patient flow management

in acute hospitals: a systematic review of mixed methods studies. International Journal of Nursing Studies. 2020;110:103709. doi:10.1016/j.ijnurstu.2020.103709.
14. Jaber MJ, Bindahmsh AA, Abu Dawwas MA, *et al.,* Obstacles and challenges affecting quality indicators in a complex tertiary emergency center. Global Journal on Quality and Safety in Healthcare. 2024;7(4):162–174. doi:10.36401/JQSH-24-10.
15. Jones PG, Mountain D, Forero R. Emergency department crowding measures associations with quality of care: a systematic review. Emergency Medicine Australasia. 2021;33(4):592–600. doi:10.1111/1742-6723.13743.
16. Pearce S, Marr E, Shannon T, Marchand T, Lang E. Overcrowding in emergency departments: an overview of reviews describing global solutions and their outcomes. Internal and Emergency Medicine. 2024;19(2):483–491. doi:10.1007/s11739-023-03477-4.
17. de Freitas L, Goodacre S, O'Hara R, Thokala P, Hariharan S. Interventions to improve patient flow in emergency departments: an umbrella review. Emergency Medicine Journal. 2018;35(10):626–637. doi:10.1136/emermed-2017-207263.
18. Sonis JD, Aaronson EL, Lee RY, Philpotts LL, White BA. Emergency department patient experience: a systematic review of the literature. Journal of Patient Experience. 2018;5(2):101–106.
19. Asiri M, AlMohimeed AS, Almoneef M. Factors affecting patient satisfaction in the emergency department: a systematic review. Cureus. 2025;17(12):e99509. doi:10.7759/cureus.99509.
20. Shafik W. Operational Research, Transport, and Logistics in the Healthcare Sector. In Optimizing Research Project Management in Education 2026 (pp. 143-182). IGI Global Scientific Publishing.
21. Zhang H, Wang Q, Zhao J, Wang M, Wang J. Exploring the Double - Edged Sword Effect of Responsible Leadership on Nurses' Proactive Behavior: The Mediating Roles of Affective Commitment and Emotional Exhaustion. Journal of Nursing Management. 2026;2026(1):6642530