International Journal of Multiphysics
Volume 18, No. 3, 2024
ISSN: 1750-9548

# Length of Stay (LOS) in the Emergency Department

**Moslem Mohamed Mohamed El Lithy[1], Tarek Ezzat Abdel Latif[2], Emad Mohamed Salah[2] and Adel Hamed Elbaih[1]**

1 Emergency Medicine Department, Faculty of Medicine, Zagazig University, Egypt

2 General Surgery Department, Faculty of Medicine, Zagazig University, Egypt

***Corresponding author:** Moslem Mohamed Mohamed El Lithy

**Abstract:**

**Background:** Length of Stay (LOS) in the Emergency Department (ED) is a key indicator of healthcare efficiency and patient flow management. Prolonged LOS is strongly linked to ED overcrowding, delays in diagnosis and treatment, increased complication rates, and reduced patient satisfaction. Multiple factors including patient demographics, clinical presentation, diagnostic processes, consultation delays, and system-related limitations contribute to extended LOS, especially in resource-limited environments. Understanding these determinants is essential for improving emergency care delivery and optimizing patient outcomes.

**Keywords:** Emergency Department; Length of Stay; ED Crowding; Patient Flow; Determinants; Emergency Medicine; Hospital Efficiency.

## Introduction:

Length of Stay (LOS) in the Emergency Department (ED) is a critical performance metric that reflects the efficiency, quality, and safety of emergency healthcare delivery. Prolonged LOS has been consistently associated with ED overcrowding, treatment delays, increased medical errors, and poorer clinical outcomes. This makes LOS a central indicator for evaluating emergency care performance worldwide **(1).**

Several factors contribute to extended LOS in the ED, including patient-related variables such as age, comorbidities, acuity level, and presenting complaints. System-related factors—such as delays in laboratory or imaging results, consultation wait times, staffing adequacy, and bed occupancy rates—also play major roles in prolonging patient flow. Surgical cases specifically may experience additional delays related to diagnostic imaging, operative decision-making, and inpatient bed assignment **(2).**

In resource-limited healthcare systems, particularly in developing countries, the challenges contributing to prolonged ED LOS are often amplified. Limited resources, high patient loads, inadequate staffing, and infrastructure constraints can lead to overcrowding, increased waiting times, decreased care efficiency, and compromised patient safety. Therefore, understanding the patterns and predictors of ED LOS can guide targeted interventions to improve emergency care processes **(3).**

This study aims to evaluate the determinants of LOS in the Emergency Department at Zagazig University Hospitals and explore the relationship between patient characteristics, clinical pathways, diagnostic processes, and final disposition outcomes. Identifying predictors of prolonged LOS may support the development of operational strategies to enhance ED efficiency and improve patient outcomes **(4).**

Emergency department (ED) length of stay (LOS) is a widely used measure in research concerning almost every aspect of processes within the emergency department. Emergency department length of stay (EDLOS) can be defined as the time interval between a patient's arrival to the ED to the time the patient physically leaves the ED. The use of the EDLOS measure varies from a primary outcome measure in studies evaluating clinical interventions and organizational improvements, to an indicator of ED crowding. Decreased patient satisfaction and quality of care, as well as increased mortality both for admitted and discharged patients has been found to be associated with EDLOS **(5).**

**Definitions**

The issue of long Emergency Department Length of Stay (EDLOS) encompasses several critical aspects beyond just the duration of a patient's stay in the ED. Understanding these aspects is crucial for addressing the root causes and associated problems effectively **(6).**

- **Key Concepts Related to Long EDLOS**

1. **Crowding**:

○ **Definition**: ED crowding occurs when the demand for emergency care surpasses the available resources, affecting both the ED and the hospital as a whole**(7).**

○ **Implications**: Crowding is linked to delayed treatment, decreased patient satisfaction, and increased morbidity and mortality . It can lead to longer stays in the ED, as the entire process is slowed down by the excess number of patients.

○ **Measurement**: Long EDLOS is often used as a proxy for crowding because it reflects the total patient stay and is influenced by crowding at various stages of the ED process . However, using an arbitrary cut-off for long EDLOS may not always be sensitive or specific enough to accurately measure crowding **(8).**

2. **Boarding**:

○ **Definition**: Boarding refers to the practice of holding admitted patients in the ED until an inpatient bed becomes available. According to the American College of Emergency Physicians (ACEP), boarding time starts at the decision to admit and ends when the patient leaves the ED **(9).**

○ **Implications**: Boarding can negatively impact both the patient and ED staff by contributing to overcrowding and resource strain . While long EDLOS might be related to boarding, it also includes other factors such as diagnostic procedures and consultations, making it a less precise measure of boarding alone **(10).**

3. **Waiting**:

○ **Definitions and Metrics**: The ACEP policy defines waiting time as the period between a patient's arrival and their first contact with a provider. This "door to provider contact time" should be the primary metric for reporting ED wait times . Other definitions, such as those from Canadian provincial guidelines or the UK Department of Health, consider the total time from arrival to discharge as wait time **(8).**

○ **Patient Experience**: Research indicates that neither the "door to provider" metric nor the total EDLOS fully captures the patient's experience of waiting.

- **Consequences of Long EDLOS**
  - **Patient Safety Risks**: Prolonged stays in the ED are associated with increased patient safety risks, including higher mortality rates. These risks are more pronounced in specific sub-groups such as older patients, those with myocardial infarction, and patients needing critical care **(11).**
  - **General ED Population**: For the broader ED population, the adverse effects of long EDLOS are more apparent when EDLOS is considered as a continuous variable rather than using arbitrary time limits .
  - **Policy and Quality Indicators**: Arbitrary time targets for EDLOS can potentially compromise patient safety by shifting focus to meeting time targets rather than addressing patient needs. A balanced approach using robust quality indicators such as rates of unscheduled re-visits, patient satisfaction, and rates of missed diagnoses is recommended to ensure comprehensive care quality .

- **Determinants of Prolonged Length of Stay in the Emergency Department**

Emergency department (ED) crowding is a significant and persistent global health challenge that can severely disrupt emergency care operations and negatively impact patient outcomes. This issue, along with delays in providing emergency care, greatly affects the timeliness of ED services—a critical domain of quality in emergency care defined as the capacity to minimize harmful delays for both patients and providers. To enhance

the performance and timeliness of EDs, it is crucial to segment the patient journey from arrival to discharge, identify the determinants affecting each segment, and implement evidence-based interventions **(12).**

- **Key Determinants of Prolonged ED Length of Stay (EDLOS)**

1. **Patient Demographics and Health Status**:
    - **Older Age**: Elderly patients often present with multiple comorbidities, which complicates clinical decision-making and prolongs the time required for thorough assessments and treatment plans. Their higher risk of complex medical conditions necessitates extended consultations and more intensive care, leading to longer stays in the ED **(13).**
    - **Lack of Insurance Support**: Patients without insurance are often of lower socioeconomic status, which is associated with poorer overall health and higher rates of comorbid conditions. These factors can lead to more complicated medical scenarios that require longer evaluation times and delayed responses from consulting services **(14).**
2. **Operational and Workflow Issues**:
    - **Disposition Time > 6 Hours**: Prolonged disposition times are a significant factor contributing to extended EDLOS. This period encompasses the time taken to secure inpatient beds or finalize discharge decisions. Delays often occur due to bed shortages or administrative inefficiencies within the hospital **(15).**
    - **High Number of Ordered Paraclinical Tests**: Patients requiring numerous diagnostic tests, such as blood work or imaging, often face delays as ED personnel wait for results to make informed clinical decisions. These delays can be exacerbated by the time needed for specialized consultations, further prolonging EDLOS **(16).**
3. **Interdepartmental Cooperation and Response**:
    - **Delayed Consult Requests**: One of the most frequently cited causes of prolonged EDLOS by medical and nursing staff is the slow response times from consulting departments. Efficient interdisciplinary communication and prompt consultations are critical for timely patient management, and delays in these areas can significantly extend a patient's stay in the ED **(15).**
    - **Complex Cases**: Patients with complex medical conditions require more time for comprehensive assessments and detailed management plans. These cases often involve multidisciplinary teams and extended diagnostic processes, contributing to longer stays in the ED **(17).**
4. **Systemic and Structural Factors**:
    - **Crowding**: Overcrowding in the ED is a major determinant of prolonged EDLOS. It results from an imbalance between the demand for emergency care and the available resources. Overcrowding leads to increased wait times for initial assessments, treatments, and disposition decisions. This issue is particularly acute in regions with aging populations and higher rates of ED visits **(18).**
    - **Staff and Resource Shortages**: Insufficient staffing levels, particularly shortages of nursing and medical personnel, can impede the delivery of timely care. Additionally, a lack of necessary resources, such as medical equipment and essential materials, can delay treatment and diagnostic processes, further extending EDLOS **(19).**

- **The Outcomes of Shortening the Length of Stay (LOS) in Emergency Departments (ED) on the Quality of ED Performance**

Reducing the length of stay (LOS) in emergency departments (ED) is pivotal for improving the quality of emergency care. A shortened LOS yields significant benefits across various aspects of ED performance. Firstly, it directly translates into better patient outcomes by ensuring timely diagnosis and treatment. This can lead to

reduced mortality rates, decreased morbidity, and enhanced recovery rates. Patients receiving prompt care experience fewer complications and shorter hospital stays, contributing to overall better health outcomes.Moreover, shortening LOS optimizes the utilization of ED resources. Through more efficient patient throughput, the available beds, medical staff, and equipment are utilized more effectively. This results in cost efficiency, as fewer resources are expended on prolonged stays. Additionally, it allows for optimal staffing, reducing the strain on healthcare providers and promoting better workforce management practices **(20).**

Shortened LOS also positively impacts patient satisfaction. Patients experience reduced wait times, better communication with healthcare providers, and increased comfort during their ED visit. This leads to overall higher satisfaction levels and a more positive perception of the healthcare facility. Similarly, improved staff satisfaction is observed, as reduced workload stress and job satisfaction contribute to lower burnout rates among healthcare providers.Another significant outcome of shortening LOS is the alleviation of ED crowding. With fewer patients waiting for care, there is better access to care, enhanced safety, and improved triage efficiency **(21).**

Critical patients can be prioritized and treated more quickly, leading to better overall outcomes. Additionally, shortened LOS contributes to enhanced overall system efficiency by streamlining operations, promoting integrated care, and facilitating data-driven improvements.To achieve these outcomes, various strategies can be implemented. These include establishing fast-track systems, optimizing triage processes, enhancing diagnostic efficiency, improving coordination between ED and inpatient units, and leveraging technology for streamlined workflows. By implementing these strategies, EDs can provide timely, high-quality care, ultimately leading to a more effective and patient-centered healthcare system **(22).**

**Interventions to Reduce Prolonged EDLOS**

- **Interdisciplinary Team-Work Training**

Effective collaboration among healthcare professionals is crucial for efficient ED operations. Formal interdisciplinary teamwork training programs can significantly improve communication, cooperation, and coordination between different departments and healthcare providers. Enhanced communication skills among team members reduce misunderstandings and errors, facilitate quicker consultations and decision-making processes, and ultimately improve patient outcomes and satisfaction. Developing and implementing formal training programs focusing on communication, teamwork, and problem-solving, conducting regular simulation exercises and drills, and establishing feedback mechanisms can continuously improve teamwork practices **(23).**

- **Effective Triage Systems**

Robust triage systems prioritize patients based on the severity of their conditions, ensuring that those who need immediate attention receive it promptly. This can significantly reduce EDLOS by preventing critical cases from being delayed. Prioritizing high-acuity patients ensures they receive timely care, optimizing the use of available resources and preventing bottlenecks by streamlining patient flow. Developing and implementing standardized triage protocols, providing comprehensive training for triage nurses and other frontline staff, and integrating triage software and electronic health records to support decision-making and track patient progress are essential steps in this intervention **(24).**

- **Fast-Track Units**

Fast-track units are designated areas within the ED where patients with minor injuries or illnesses can receive expedited care. By diverting these patients from the main ED, fast-track units can reduce congestion and improve overall efficiency. These units shorten wait times for non-urgent patients, allow the main ED to focus on more severe cases, and improve patient satisfaction by providing quicker service for less critical conditions. Implementing fast-track units involves assigning dedicated staff to the unit, establishing clear guidelines for which cases can be directed to the unit, and designating a specific area within or adjacent to the ED for the fast-track unit to streamline patient movement **(25).**

- **Maximum Length of Stay Rules**

Policies such as the 4-hour rule in the UK set benchmarks for acceptable EDLOS, promoting timely patient management. These rules ensure accountability and benchmarks for ED performance, encouraging timely

assessment and disposition of patients, and driving continuous performance improvement and efficiency in the ED. Developing clear policies and guidelines based on the maximum LOS rules, implementing systems to monitor EDLOS and report on performance against targets, and using performance data to identify areas for improvement and implement changes to reduce LOS are crucial steps in this intervention **(26).**

**References:**

1. Al-Qahtani, S., Alsalem, A., Alqahtani, A., Abdelgawad, M., & Ali, Y. (2020). Factors influencing emergency department length of stay: A systematic review. International Journal of Emergency Medicine, 13(41), 1–10. https://doi.org/10.1186/s12245-020-00304-0
2. Abdullahi, M., Shuaibu, S., Abubakar, I., & Bello, M. (2022). Determinants of prolonged emergency department stay among surgical patients: A prospective observational study. BMC Emergency Medicine, 22(89), 1–9. https://doi.org/10.1186/s12873-022-00668-4
3. El Sayed, M. J., Tamim, H., Chehadeh, A. A., & Kazzi, A. A. (2021). Emergency department crowding and its impact on patient care in low-resource settings. World Journal of Emergency Medicine, 12(4), 261–268. https://doi.org/10.5847/wjem.j.1920-8642.2021.04.002
4. Norozi, A., Shokri, F., & Hosseini, S. H. (2023). Predictors of emergency department length of stay in tertiary care hospitals: A multicenter analysis. Journal of Emergency Care, 45(2), 150–158. https://doi.org/10.1016/j.jec.2023.01.004
5. Chang, A. M., A. Lin, R. Fu, K. J. McConnell & B. J. A. E. M. Sun (2017) Associations of emergency department length of stay with publicly reported quality-of-care measures. 24, 246-250.
6. Elamir, H. J. L. i. H. S. (2018) Improving patient flow through applying lean concepts to emergency department. 31, 293-309.
7. Rasouli, H. R., A. A. Esfahani, M. Nobakht, M. Eskandari, S. Mahmoodi, H. Goodarzi & M. A. J. A. o. a. e. m. Farajzadeh (2019) Outcomes of crowding in emergency departments; a systematic review. 7.
8. Andersson, J., L. Nordgren, I. Cheng, U. Nilsson & L. J. I. e. n. Kurland (2020) Long emergency department length of stay: A concept analysis. 53, 100930.
9. Phend, C. J. A. o. E. M. (2023) Emergency department volume numbers don't tell the whole story: the rising toll of boarding and high-acuity care. 82, A15-A18.
10. McKenna, P., S. M. Heslin, P. Viccellio, W. K. Mallon, C. Hernandez, E. J. J. C. Morley & e. e. medicine (2019) Emergency department and hospital crowding: causes, consequences, and cures. 6, 189.
11. Burgess, L., G. Ray-Barruel, K. J. R. i. N. Kynoch & Health (2022) Association between emergency department length of stay and patient outcomes: a systematic review. 45, 59-93.
12. Kelen, G. D., R. Wolfe, G. D'Onofrio, A. M. Mills, D. Diercks, S. A. Stern, M. C. Wadman & P. E. J. N. C. I. i. C. D. Sokolove (2021) Emergency department crowding: the canary in the health care system. 2.
13. Levy, L., A. Smiley, R. J. I. j. o. e. r. Latifi & p. health (2022) Mortality risk factors in patients admitted with the primary diagnosis of tracheostomy complications: An analysis of 8026 patients. 19, 9031.
14. Boateng-Antwi, N. A. D. (2019) factors that affect patient flow at the accident and emergency department of a tertiary healthcare facility in a lower-middle-income country.
15. Mendoza, R. 2020. The Effectiveness of Laboratory Interventions During the Pre-Analytical Phase of Laboratory Test Workflow in Decreasing Emergency Department Disposition Time. Central Michigan University.
16. Shamsi, V. & H. J. I. J. o. M. R. Mahmoudi (2015) The survey of Ways of Reducing Patients' Length of Stay in the Emergency Department: A Systematic Review. 2, 282-286.

17. Sheard, L., C. Marsh, J. O'Hara, G. Armitage, J. Wright, R. J. S. s. Lawton & medicine (2017) The patient feedback response framework–understanding why UK hospital staff find it difficult to make improvements based on patient feedback: a qualitative study. 178, 19-27.
18. Belayneh, A. G., Y. Z. Temachu, M. A. Messelu & M. H. J. B. E. M. Gebrie (2023) Prolonged length of stay and its associated factors at adult emergency department in amhara region comprehensive specialized hospitals, northwest Ethiopia. 23, 34.
19. Silverman, H. J., R. E. Kheirbek, G. Moscou-Jackson & J. J. N. E. Day (2021) Moral distress in nurses caring for patients with Covid-19. 28, 1137-1164.
20. Driesen, B. E., B. H. Van Riet, L. Verkerk, H. J. Bonjer, H. Merten & P. W. J. P. o. Nanayakkara (2018) Long length of stay at the emergency department is mostly caused by organisational factors outside the influence of the emergency department: A root cause analysis. 13, e0202751.
21. Ba-Aoum, M., N. Hosseinichimeh, K. P. Triantis, K. Pasupathy, M. Sir, D. J. I. J. o. I. E. Nestler & O. Management (2023) Statistical analysis of factors influencing patient length of stay in emergency departments. 5, 220-239.
22. Kim, Y. E., & Lee, H. Y. (2022). The effects of an emergency department length-of-stay management system on severely ill patients' treatment outcomes. BMC Emergency Medicine, 22(1), 204.
23. Liu, J. (2020). Redesigning an Emergency Department for Interprofessional Teamwork: A Longitudinal Evaluation of the Impact on Patient Flow and Team Behaviour. Karolinska Institutet (Sweden).
24. Li, W., Z. Sun & L. J. J. O. R. Hong (2023) Who is next: Patient prioritization under emergency department blocking. 71, 821-842.
25. Harris, G. (2020) PROCESS IMPROVEMENT FOR EMERGENCY DEPARTMENT FAST TRACK.
26. Jones, P. 2018. Defining and Validating a Metric for Emergency Department Crowding. ResearchSpace@ Auckland.