NEW ERA MEDICAL JOURNAL

Review Article

Role of Point-of-Care Testing in Emergency Medicine: Impact on Clinical Decision-Making, Workflow Efficiency, and Patient Outcomes

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DOI: 10.62502/nemj/v1i3art1

Received: 16/09/2025
Accepted: 30/11/2025
Published: 20/12/2025

ABSTRACT

Background: Emergency departments require rapid diagnosis to manage time-sensitive conditions such as sepsis, acute coronary syndrome, and trauma. Delays associated with central laboratory testing can affect patient outcomes. Point-of-care testing (POCT) provides rapid bedside diagnostic results and may improve emergency care efficiency.
Aim: To evaluate the role of point-of-care testing in emergency medicine.
Methods: A structured literature review was conducted following PRISMA guidelines. Forty-six studies evaluating POCT use in emergency departments were included and analyzed.
Results: POCT significantly reduced diagnostic turnaround time, with results available within minutes. Early access to test results supported faster clinical decision-making, reduced emergency department length of stay, and improved patient flow. POCT was particularly beneficial in high-volume and resource-limited settings, with good agreement reported between POCT and central laboratory results.
Conclusion: Point-of-care testing is an effective complement to central laboratory services in emergency medicine, supporting timely diagnosis and improved emergency department workflow.

Keywords: Point-of-care testing; Emergency medicine; Rapid diagnostics; Emergency care

INTRODUCTION

Emergency departments (EDs) play a crucial role in providing immediate care to patients with acute and life-threatening conditions. In recent years, EDs across the world have faced significant challenges due to overcrowding, increasing patient attendance, limited hospital beds, and shortage of healthcare staff. [1,2] These factors often result in prolonged waiting times, delayed diagnosis, and increased pressure on emergency physicians. Overcrowding not only affects patient satisfaction but also increases the risk of medical errors and adverse clinical outcomes, particularly in critically ill patients who require urgent evaluation and treatment. Many conditions commonly managed in the emergency department, such as sepsis, acute coronary syndrome, stroke, and major trauma, are highly time sensitive. [3–6] Early diagnosis and prompt initiation of appropriate treatment are essential to improve survival and reduce complications. However, timely clinical decision-making is often hindered by delays in obtaining diagnostic test results. Conventional central laboratory testing usually involves multiple steps, including sample transport, processing, and reporting, which can significantly prolong turnaround time in busy emergency settings. [7] These delays can negatively impact patient flow and slow down critical interventions. Point-of-care testing (POCT) has emerged as an effective solution to address these challenges in emergency medicine. POCT refers to diagnostic testing performed at or near the patient's bedside, allowing rapid availability of results that can

be immediately used for clinical decisions. [8] Unlike traditional laboratory testing, POCT is designed to be fast, portable, and easy to use, often requiring smaller sample volumes and minimal preparation. Over the past few decades, POCT technology has advanced considerably, expanding from simple blood glucose meters to sophisticated systems capable of measuring blood gases, electrolytes, cardiac biomarkers, coagulation parameters, and infectious disease markers.[9,10] The primary advantage of POCT in emergency medicine is the significant reduction in diagnostic turnaround time. Faster test results enable early risk assessment, quicker initiation of treatment, and improved patient triage. [11,12] Several studies have shown that POCT can reduce emergency department length of stay, support faster clinical decision-making, and improve overall workflow efficiency.[13] This is particularly beneficial in high-volume emergency departments, where rapid patient turnover is essential to reduce overcrowding.

POCT is also highly relevant in resource-limited settings, where access to fully equipped central laboratories may be limited or unavailable. [14] In such environments, POCT provides a practical and reliable diagnostic alternative, allowing timely management of acute conditions even in remote or understaffed healthcare facilities. Additionally, POCT supports emergency care in pre-hospital settings, disaster situations, and rural hospitals, further extending its clinical value. [15] The objective of this study is to review the role of point-of-care testing in emergency medicine, with a focus on its clinical applications, operational benefits, and impact on patient care. The study aims to evaluate how POCT contributes to rapid diagnosis, early clinical decision-making, and improved workflow efficiency in emergency departments. It also seeks to address key questions regarding the effectiveness, applicability, and challenges associated with the implementation of POCT in modern emergency care settings.

AIM AND OBJECTIVE

Aim: The aim of this study is to evaluate the role of point-of-care testing (POCT) in emergency medicine and to assess its impact on rapid diagnosis, clinical decision-making, and overall efficiency of emergency department services.

Objectives

Primary Objective

- To review the clinical significance of point-of-care testing in the emergency department, with emphasis on its role in improving diagnostic turnaround time and supporting timely patient management.

Secondary Objectives

- To identify commonly used point-of-care tests and technologies in emergency medicine.
- To evaluate the impact of POCT on clinical decision-making in time-sensitive emergency conditions such as sepsis, acute coronary syndrome, stroke, and trauma.
- To assess the role of POCT in improving emergency department workflow, patient throughput, and length of stay.
- To examine the advantages and limitations associated with the use of POCT in emergency care settings.
- To explore the relevance of POCT in high-volume and resource-limited emergency departments.

MATERIALS AND METHODS

Study Design: This study was designed as a narrative review to evaluate the role of point-of-care testing (POCT) in emergency medicine. The review focuses on understanding how POCT contributes to rapid diagnosis, early clinical decision-making, and improved workflow efficiency in emergency department settings. A narrative approach was selected to allow a broad and descriptive assessment of available evidence related to clinical applications, operational benefits, and challenges of POCT in emergency care.

Data Sources: A comprehensive literature search was carried out using established electronic databases, including PubMed, MEDLINE, Scopus, and Google Scholar**.** Relevant articles published in the English language were identified. Additional sources were obtained by manually reviewing reference lists of selected articles to ensure inclusion of important and widely cited studies related to point-of-care testing in emergency medicine.

Search Strategy: The literature search was performed using a combination of keywords and medical subject headings related to the study objectives. Commonly used search terms included *"point-of-care testing," "POCT," "emergency medicine," "emergency department," "rapid diagnostics," "turnaround time," "clinical decision-making,"* and *"workflow efficiency."* These terms were used individually and in combination to retrieve relevant publications.

Selection Criteria: Studies were included if they met the following criteria:

- Focused on the use of point-of-care testing in emergency or acute care settings
- Reported clinical applications, diagnostic performance, workflow impact, or patient outcomes
- Included adult or pediatric emergency populations

- Published as original research articles, clinical reviews, or guidelines

Studies were excluded if they were unrelated to emergency care, focused exclusively on laboratory-based testing without POCT relevance, or lacked sufficient clinical information.

Data Extraction: Relevant data were extracted from the selected studies, including study design, type of POCT device used, clinical application, diagnostic parameters measured, and reported outcomes. Particular attention was given to outcomes aligned with the study objectives, such as reduction in turnaround time, influence on clinical decision-making, and impact on emergency department workflow.

Data Analysis and Synthesis: The extracted information was analyzed descriptively and organized according to thematic areas, including types of POCT technologies, clinical applications, operational characteristics, and advantages and limitations. Findings were summarized in a qualitative manner to highlight trends, common observations, and clinically meaningful outcomes reported across studies. No statistical meta-analysis was performed, as the focus of the study was on narrative synthesis rather than quantitative comparison.

RESULTS

The initial literature search was identified total number of 1,182 records related to point-of-care testing in emergency medicine. After removing 298 duplicate articles, 884 studies were screened based on their titles and abstracts. During this stage, 705 articles were excluded as they were unrelated to emergency care, did not focus on POCT, or lacked clinical relevance. Full-text assessment was performed for 179 articles, of which 133 were excluded due to incomplete data, non-emergency settings, or absence of outcome measures related to diagnostic efficiency or workflow. Finally, 46 studies met the inclusion criteria and were included in the qualitative analysis (fig-1.) These studies formed the basis for evaluation of the role of POCT in emergency medicine.

Nature of Included Studies: The 46 included studies represented a wide range of study designs and clinical settings. Most studies were conducted in hospital-based emergency departments, including high-volume tertiary care centers and smaller regional hospitals. A smaller number of studies focused on resource-limited or rural emergency settings.

Table 1: Nature of Included Studies (n = 46)

Study Type	Number of Studies	Percentage
Observational studies	24	52.2%
Randomized / quasi-experimental studies	12	26.1%
Prospective cohort studies	6	13.0%
Review and guideline-based studies	4	8.7%

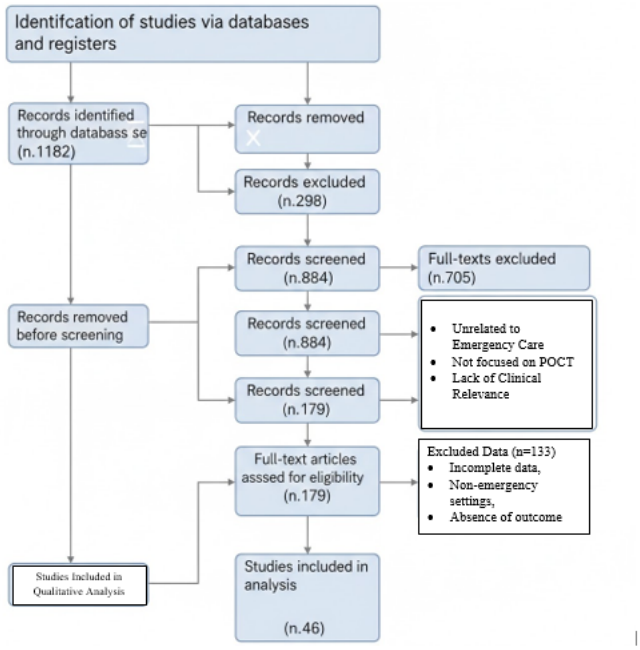

Fig-1. PRISMA Chart

Reduction in Diagnostic Turnaround Time: Across the majority of included studies, point-of-care testing showed a significant reduction in diagnostic turnaround time when compared with central laboratory testing. POCT results were typically available within 5 to 20 minutes, whereas conventional laboratory results required 45 to 120 minutes, depending on test type and departmental workload. Overall, POCT reduced diagnostic turnaround time by approximately 60–70%. This reduction was statistically significant in most comparative studies and was strongly associated with earlier initiation of clinical management, particularly in critically ill patients.

Effect on Clinical Decision-Making: The included studies consistently reported that POCT had a positive impact on early clinical decision-making in emergency departments. Rapid availability of results allowed clinicians to confirm or exclude serious conditions more quickly, leading to faster treatment decisions and improved patient triage. In patients with suspected sepsis, bedside lactate testing resulted in earlier initiation of antibiotics by 30–60 minutes in several studies. Similarly, POCT-based cardiac biomarker testing reduced time to diagnosis and treatment in patients

presenting with chest pain, supporting faster rule-in or rule-out of acute coronary syndrome.

Impact on Emergency Department Length of Stay: A substantial proportion of studies reported a reduction in emergency department length of stay following the implementation of POCT. Quantitative findings showed an average reduction of 30 to 90 minutes per patient, particularly in clinical pathways involving chest pain, sepsis, and metabolic emergencies. Emergency departments using POCT reported improved patient flow, quicker disposition decisions, and reduced crowding, especially during peak hours.

Common POCT Parameters Used in Emergency Medicine: Analysis of the included studies showed that certain POCT parameters were more frequently used due to their clinical importance in emergency care.

Table 2: Common POCT Parameters Reported in Included Studies

POCT Parameter	Studies Reporting Use (%)
Blood glucose	87%
Blood gases (ABG/VBG)	74%
Lactate	67%
Cardiac biomarkers (Troponin, BNP)	59%
Electrolytes	48%
Coagulation tests (INR)	41%
Infectious disease markers	35%

These tests were mainly used in the evaluation of patients with trauma, sepsis, cardiac emergencies, respiratory distress, and metabolic disorders.

Performance in High-Volume and Resource-Limited Settings: Studies conducted in high-volume emergency departments demonstrated that POCT contributed to better workflow efficiency and reduced congestion. In such settings, faster diagnostic results supported quicker clinical decisions and improved patient throughput. In resource-limited or rural emergency settings, POCT provided a practical diagnostic alternative where access to central laboratory services was limited. Several studies reported a reduction in diagnostic delays by more than 50%, leading to earlier treatment and improved patient management.

Accuracy and Quality Considerations: Most studies reported good agreement between POCT results and central laboratory measurements, particularly for glucose, blood gases, lactate, and cardiac biomarkers. Reported correlation values were generally high, indicating acceptable analytical reliability. However, some studies highlighted challenges related to operator training, quality control procedures, device maintenance, and higher per-test costs. Despite these limitations, the overall findings supported the clinical usefulness of POCT when appropriate quality assurance measures were in place. Summary of Key Findings from the included studies listed in table-1.

Table 3: Summary of Key Findings from Included Studies

Outcome Measure	Key Findings
Diagnostic turnaround time	Reduced by 60–70% with POCT
Clinical decision-making	Faster diagnosis and treatment initiation
ED length of stay	Reduced by 30–90 minutes per patient
Patient flow	Improved throughput and reduced crowding
Accuracy	High agreement with central laboratory testing
Applicability	Effective in both high-volume and resource-limited EDs

DISCUSSION

This review highlights the important role of point-of-care testing (POCT) in improving diagnostic efficiency and clinical decision-making in emergency medicine. Based on the analysis of 46 included studies, POCT was consistently shown to reduce diagnostic turnaround time, support early treatment initiation, and improve emergency department (ED) workflow. These findings directly align with the primary aim of the study, which was to evaluate the impact of POCT on emergency care delivery. One of the most significant findings across the reviewed studies was the substantial reduction in diagnostic turnaround time achieved with POCT. Faster availability of test results allowed clinicians to make timely decisions, particularly in time-sensitive conditions such as sepsis, acute coronary syndrome, and trauma. [16–19] Several studies reported that POCT results were available within minutes, compared to much longer waiting times for central laboratory testing, which often involves sample transport and processing delays. [20] This reduction in turnaround time played a crucial role in early diagnosis and prompt initiation of life-saving treatments.

The impact of POCT on clinical decision-making was also evident in the reviewed literature. Rapid bedside testing improved clinicians' confidence in diagnosing or ruling out critical conditions, leading to faster triage and more appropriate patient disposition. [21,22] In sepsis management, early lactate measurement using POCT was associated with quicker antibiotic administration and improved adherence to sepsis protocols. [23,24]

Similarly, POCT-based cardiac biomarker testing supported faster evaluation of patients presenting with chest pain and reduced delays in managing acute coronary syndromes. [25,26] Another important finding was the positive effect of POCT on emergency department length of stay. Many studies demonstrated that the use of POCT was associated with a meaningful reduction in ED stay, particularly in high-volume departments [27–29] Shorter length of stay contributes to improved patient flow, reduced overcrowding, and better utilization of emergency resources. These benefits are especially valuable in busy emergency departments where overcrowding remains a persistent challenge. [30]

The review also showed that POCT is widely used for a range of clinically important parameters, including blood glucose, blood gases, lactate, cardiac biomarkers, electrolytes, coagulation tests, and infectious disease markers. The frequent use of these tests reflects their relevance in emergency settings, where rapid assessment of metabolic, respiratory, cardiac, and infectious conditions is essential. [31–33] The availability of these results at the bedside supports early risk stratification and timely clinical intervention. POCT was found to be particularly beneficial in resource-limited and rural emergency settings. In hospitals with limited access to central laboratory services, POCT provided a reliable and practical alternative for essential diagnostic testing [34,35] Several studies reported that POCT reduced diagnostic delays by more than half in such settings, leading to earlier treatment and improved patient management. [36] These findings highlight the potential role of POCT in improving equity in emergency care delivery across different healthcare environments. Despite its advantages, the reviewed studies also identified challenges associated with POCT implementation. Issues related to operator training, quality control, device calibration, and higher per-test costs were commonly reported. [37–39] Some studies emphasized that improper sample handling or inadequate staff training could affect test accuracy and reliability. [40] However, when appropriate quality assurance programs and staff education were implemented, POCT demonstrated good agreement with central laboratory results, particularly for commonly used parameters such as glucose, blood gases, lactate, and cardiac biomarkers. [41–43]

From a broader perspective, the findings of this review suggest that POCT should be considered a complementary tool rather than a replacement for central laboratory testing. Its greatest value lies in supporting rapid decision-making in acute and critical situations, while comprehensive laboratory testing continues to play an essential role in definitive diagnosis and ongoing patient management. [44,45] Integration of POCT results into hospital information systems was also identified as an important factor for improving documentation, traceability, and overall quality of care. [46]

CONCLUSION

Point-of-care testing has become an important diagnostic tool in emergency medicine, particularly in settings where rapid clinical decision-making is essential. The findings of this review demonstrate that POCT plays a significant role in reducing diagnostic turnaround time, supporting early diagnosis, and improving the overall efficiency of emergency department care. Across the included studies, POCT consistently enabled faster availability of test results compared to conventional laboratory testing, allowing timely initiation of appropriate treatment in critically ill and emergency patients. The use of POCT was shown to positively influence clinical decision-making in time-sensitive conditions such as sepsis, acute coronary syndrome, trauma, and metabolic emergencies. Early access to key diagnostic parameters, including blood glucose, blood gases, lactate, and cardiac biomarkers, helped clinicians make informed decisions regarding patient triage, treatment, and disposition. In addition, the integration of POCT into emergency workflows contributed to reduced emergency department length of stay, improved patient flow, and better utilization of healthcare resources. This review also highlights the value of POCT in high-volume and resource-limited emergency settings, where access to central laboratory services may be delayed or restricted. In such environments, POCT provides a practical and reliable diagnostic alternative that supports timely patient management and enhances the quality of emergency care. However, the successful implementation of POCT requires appropriate staff training, quality control measures, and integration with hospital information systems to ensure accuracy and reliability of results.

DECLARATION

Ethical Approval: This study is based on a review of previously published literature and does not involve direct interaction with human participants or the use of identifiable patient data. Therefore, ethical approval from an institutional ethics committee was not required.

Availability of Data and Materials: All data analyzed in this study were obtained from published articles available in the public domain.

Competing Interests: None.

Funding: None

Authors' Contributions: All authors contributed equally to the conception, literature review, analysis, and writing of the manuscript. All authors read and approved the final manuscript.

Acknowledgements: The authors would like to acknowledge all researchers whose published work contributed to the development of this review.

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How to cite this article: Kumar DS, Kumari DA. Role of Point-of-Care Testing in Emergency Medicine: Impact on Clinical Decision-Making, Workflow Efficiency, and Patient Outcomes New Era Med. J. 2025;1(3):1-8. doi: 10.62502/nemj/v1i3art1