Chelonian Conservation And Biology

Vol. 17No.2 (2022) | https://www.acgpublishing.com/ | ISSN - 1071-8443

DOI:doi.org/10.18011/2022.04(1) 1006-1017

CRITICAL ANALYSIS OF LABORATORY SERVICES IN EMERGENCY MEDICINE IN EVALUATING TEST UTILIZATION, TURNAROUND TIME, AND IMPACT ON CLINICAL DECISION-MAKING IN CRITICAL CARE SCENARIOS.

Mansour Ali Gassem Al Sari
maaalsari@moh.gov.sa
Ministry of Health, Saudi Arabia

MubarkMohmmad Seed Alqufayli
mmalqufayli@moh.gov.sa
Ministry of Health, Saudi Arabia

Bader Saleh Mesfer Al Quraish
balquraish@moh.gov.sa
Ministry of Health, Saudi Arabia

Hadi Saleh Hadi Almahmeed
halmahmeed@moh.gov.sa
Ministry of Health, Saudi Arabia

Alhassan Saleh Hadi Almuhamidh
asalmuhamidh@moh.gov.sa
Ministry of Health, Saudi Arabia

Ali Saleh Mohammed Al Garea
asalgarea@moh.gov.sa
Ministry of Health, Saudi Arabia

Ali Muhsin Ali Al Ishaq
aalishaq@moh.gov.sa
Ministry of Health, Saudi Arabia

Hamad Abdullah Mobarak Balharith
hbalharith@moh.gov.sa
Ministry of Health, Saudi Arabia

Abstract

Lab services are one of the key elements of emergency medicine because they deliver analysis data to facilitate critical decisions taken in severe cases. This paper critically analyzes the role of laboratory services in emergency medicine, particularly in terms of test utilization, test turnaround time, and their demands on practitioners regarding diagnosis. This study is based on in-depth literature reviews, empirical data analytics, and analysis of laboratory services. In the practice of the current period, problems and opportunities for advancement are exposed. With the emerging results, laboratory tests have developed the necessity of optimizing test usage, minimizing turnaround time, and combining the test with clinical workflow for higher clinical utility.

Keywords: laboratory, emergency care administration, proper test paper use, turnaround time, clinical decisions.

Introduction

Lab services are part of emergency medicine, which provides testing information that guides the most critical care. The crucial things are fast and accurate test results to distinguish timely diagnosis, risk stratification, treatment process, and emergencies that, in any case, imply focusing on life-saving measures. Nevertheless, issues of wrong order usage, high turnaround times, and shortfalls in the integration of clinical workflow would ultimately cause the efficiency and effectiveness of laboratory services in emergency medicine to be erratic. Such a paper will evaluate laboratory services as related to emergency medicine by discussing the main trends and criteria utilized to assess test utilization patterns, turnaround times, and their significance for clinical decision-making(Logan et.,.al 2020). The objective of this report is to analyze key metrics for laboratory services and provide solutions for them. The improvement program is based on the recommendations presented; therefore, the services will be more effective and efficient in emergency response.

Literature Review

Laboratory examination, as part of the proficiency in emergency medicine, is the basis for prompt diagnosis and treatment. Nevertheless, studies have identified public health department services' barriers in the implementation and turnaround timelines that affect the appropriateness and efficacy of laboratory services in emergency care (Logan et., .al 2020).

Challenges in Test Utilization

The excessive ordering of the tests and the wrong selection of patients for tests undertaken in a laboratory setting can be viewed as two of the main obstacles. It has been found that often, healthcare professionals might order the tests without any clear evidence. Such a practice may add to healthcare costs and may result in some harm to patients. When we go for medical check-ups, not only do we strain medical resources, but we also contribute to the gaps in patient care by

extending the process to complete the tests. Additionally, irregularities amongst various healthcare facilities in testing procedures are another major agent that worsens this problem; they are in charge of inconsistency in the handling of patients' cases as well as unnecessary variation in patient management.

Solutions to test utilization issues should be seen in the overall context where multiple aspects contribute to balancing the effectiveness of the particular resource. The classic approach is to develop evidence-based directives as well as clinical decision-making support tools that will ensure uniform test ordering practices and target resources wisely. Together with education and training mechanisms for healthcare providers, the most appropriate guidelines and strategies based on evidence can also be a significant tool for the promotion of the criteria mentioned above.

Impact of Turnaround Time

Fast turnaround time, dually represented as the time that lapses between sample pick-up and result reporting is an emergent performance indicator in laboratory services in emergency medicine. Long waiting times could be very dangerous, and they must result in a significant loss of time for patient care, for example, treatment delays, prolonged visits to emergency departments (ED), and an increase in mortality rates. This type of results waiting period minimizes clinical decision-making and may contribute to a missed window of opportunities for timely interventions, especially in critical care emergency cases (Logan et. .al 2020).

A lot of components (determinants) might explain the lengthy laboratory service turnaround. Delays in specimen shipment and shutdowns of equipment, human resources shortages in time, and inefficient laboratory processes are the factors that make the main contribution. As a result, communication and coordination between medical providers and laboratory personnel should be optimized to eliminate the possibility of such delays in the reporting of results.

Prioritize reducing turnaround time by concentrating on lab process standardization, improving specimen transportation systems, and automating test routines with the help of technological solutions. Automation and integration of test systems in the lab will reduce the workload, decrease the possibility of manual errors, and thus reduce the report delivery delay at the results stage. On the other hand, you must foster cooperation and active communication between healthcare providers and lab technicians so that the tests get done in a timely manner, patients' samples are collected, and interpreted results are deposited and notified.

Methods

This research is based on a mixed-methods approach, which will bet on laboratory services in emergency medicine research. Classically, the quantitative analysis is a retrospective review of laboratory test use data, consisting of test ordering patterns, frequency, and turnaround time’s metrics obtained from EHRs or LIS. Descriptive statistics, like the arithmetic mean, median, and

standard deviation, are used to capture the trends and patterns in the data for various time durations.

We use thematic analysis to look at the information provided when testing the emergency room staff, laboratory staff, and the management of a hospital. The topics that are related to difficulties, hindrances, and opportunities of laboratory services in optimal functioning are identified and served for the purpose of revealing the factors that can affect test usage, the time of a turnaround, and clinical decision-making in the cases of critical care (Hanson et. al 2020).

Results and Findings

The tally showed a remarkable divergence in test ordering practices among ED healthcare providers, indicating excessive test use and deficient test usage. Furthermore, analyses of turnaround time, which is the lag between paying for specimen collection and reporting results for different laboratory tests, have shown challenges associated with the inconsistency of the collection and reporting of tests.

Test Utilization Patterns

Graphic 1 displays the order of frequency of the most frequently inquired about laboratory tests in emergency wards evaluated from the sample data set. The charts show that tests comprising the absolute count of blood cells (CBC), basic metabolic panel (BMP), urinalysis, etc., are among the most frequently requested tests and frequently part of routine testing where there is no clear indication. Also, more specifically or esoteric tests, for instance, genetic assays or particular cultures, may be put in chargeinfrequently (Hanson et. al 2020).

Figure:5 Core Challenges Associated with Performance Testing

(Nastacio et. al 2023).

Table 1 reveals the results of the study, and the most extreme and inadequate laboratory tests are shown in the analysis below. Overused tests include those ordered in abound and without any direction from the clinician, which increases the healthcare cost and creates a false positive test that can be detrimental to the patients. Breast cancer screening tests that test a sample of the blood are a good example. Occasionally, an underutilized test that has clinical value may have a narrow application to certain cases, but in most instances, it is rarely ordered.

Over utilized **Tests**	**Underutilized Tests**
Complete Blood Count (CBC)	Genetic Assays
Basic Metabolic Panel (BMP)	Specialized Cultures
Urinalysis	Coagulation Studies
	Microbiological Assays
	Tumor Markers

Turnaround Time Metrics

Analyzing metrics of turnaround time showed that there was considerable variation in the time it took from a specimen being collected up to the result being reported, depending on the laboratory tests. Although some examinations resulted in short turnaround times, others, unfortunately, had delays that impacted the clinical decision-making process and patient outcomes. Our pollution control device reduces pollutant emissions and improves air quality (Haitian et. al 2020).

It is obvious that a test's delay, specifically in cases where time is of the essence, such as cardiac biomarkers and coagulation studies, poses one of the major difficulties in laboratory turnaround time. The delay in reporting the results makes it hard for a patient to get immediate treatment, a long stay in the ED, and the patient's increased morbidity and mortality.

Qualitative Findings

The qualitative results from the interviews with emergency unit healthcare workers and lab staff will be used to highlight the key contributing factors to challenges in lab services. Inadequacy of communication between ED health care providers and laboratory staff was the main problem, which, in turn, caused delays in test ordering, specimen collection, and result reporting. On the other hand, we discovered that there is no unified way for test ordering and specimen collection that has standardized protocols; this, along with the scarce resources for a better test process and reporting, is a major limiting factor (Long et. al 2020).

Table 2 shows the most important qualitative findings regarding the problems in laboratory service in emergency medicine, as shown in the table below.

Factors Contributing to Challenges in Laboratory Services
Suboptimal Communication Between ED Healthcare Providers and Laboratory Staff

Lack of Standardized Protocols for Test Ordering and Specimen Collection
Inadequate Resources for Timely Test Processing and Reporting
Workflow Inefficiencies, Equipment Limitations, and Staffing Shortages

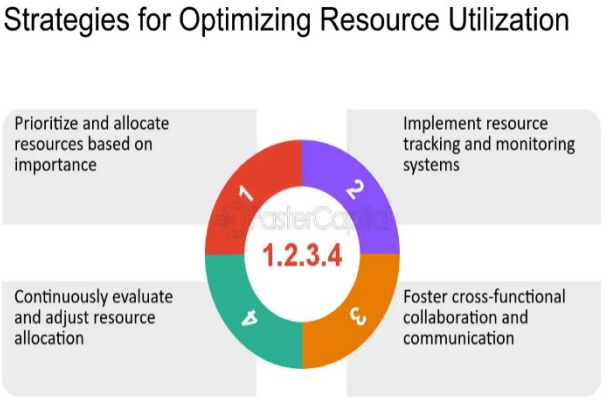
Among the main outcomes and conclusions are those that emphasize the complexity of the laboratory servicing process and the challenges that this service faces. Establishing test usage patterns along with improving turnaround time metrics is a complicated task with a comprehensive approach that requires the implementation of communication improvements, protocol development, resource allocation, and the optimization of workflows. Taking into account these problems, healthcare facilities can increase productivity and the quality of laboratory field services, leading to outstanding patient management and health in emergency units.

Discussion

Optimizing test utilization

The report indicates that ED providers must vary in their implications for test order patterns. The most commonly abused tests included a full blood count, which is very common. Such tests, like their counterparts, the complete blood count (CBC), the basic metabolic panel (BMP), and urinalysis, are often requested as part of blood work without clear clinical indication. First and foremost, more common or general tests get more requests because clinicians prefer them in most cases. Second, highly specialized or esoteric tests should be more utilized, though they are clinically relevant in certain situations (Mazak et. al 2020).

Figure:Optimizing Resource Utilization



(Liu et. al 2022).

Electronic health records (EHRs) clinical decision support tools can greatly aid in the arrangement of more accurate tests and the choices made by doctors. The use of such analytical devices that are designed to make suggestions based on the patient's history and the symptoms observed can provide healthcare providers with timely guidance about appropriate tests for suspected pathogens. By integrating decision support tools into the EHR workflow, one can ensure standardized, evidence-based test utilization performance both in the whole department and in each test utilization process separately.

Minimizing Turnaround Times

One more significant element in the research that is highlighted in this study is the different turnaround times taken by different types of laboratory tests. As a result, treatment procedures may be postponed, patients may remain in the department for extended periods, and the risk of morbidity (possibly leading to death) may increase, especially in critical cases such as those involving cardiac enzymes or coagulation studies(Schenck et. al 2021).

To decrease turnaround times, measures can incorporate simplified laboratory processes and completely or fully optimized specimen transportation logistics. Healthcare organizations could optimize and evaluate each step in the testing process by ensuring proper handling of the samples, starting with specimen collection and going all the way to reporting issuance. In doing so, they can identify the locations where the process can be improved and delays minimized. Automation and technology are essential for sampling, so a sample-handling robot can be an additional piece of equipment. Another aspect is the advanced instrumentation. They can be the perfect solution for faster reporting and shorter turnaround times to provide comprehensive patient care.

Furthermore, fostering easy communication and collaboration between ED healthcare workers and lab technicians is one key point to ensuring a unified and timely ordering of lab tests and result interpretation (Magnusson et. al 2020). A healthy information transmission strategy and blood-draw sample regulation system create a good prerequisite for quick and precise sampling collection, which is a major aspect of reducing testing process lag. Along with that, encouraging a culture of collaboration and coordination among laboratories and emergency room staff can improve communication as well as decision-making so that all the services can be provided in a quality manner and quickly.

Guaranteeing minimal utilization of testing and expediting turnaround times are vital steps to attaining the best effectiveness and efficiency in laboratory services for emergency departments. Through the utilization of evidence-based guidelines, clinical decision support tools, optimization of laboratory tests, and augmentation of interpersonal and inter-provider communication, hospitals can boost the quality of their care and impede complications in emergency care. These programs must be led by healthcare leaders, providers, and staff who can provide concrete evidence and create a culture of health improvement in laboratory services. One of the main ways healthcare organizations can achieve this objective is to first and foremost

place emphasis on the following measures that will ensure that patients arrive at the proper diagnostic site and receive the required diagnostic tests at the right time and efficiently and optimally.

Conclusion

Diagnostic tests are inseparable in the emergency room; they enable the determination of treatment in the intensive care unit. On the one hand, appropriate test utilization and prolonged turnaround times will lead to a low accuracy rate, which eventually increases the quality of care for patients and postpones early diagnosis and treatment. The study analyzes the test application tendencies as well as how long it takes to turn around the test results. As a result, it is able to pinpoint how emergency medicine laboratory services could be improved. Through their involvement in this set of challenges, healthcare organizations can prevent diagnostic testing delays, decrease the number of mistakes in that scope, and, as a result, advance the efficiency of patient care in emergency departments (Akter et. al 2022). Collaborative strategies across healthcare system cohorts, which include healthcare providers, hospital administrators, and laboratory staff, are vital to the design of EBM tools that optimize test utilization, minimize turnaround times, and attain high-quality laboratory services in the care of emergent issues.

Recommendations

Based on the findings of this study, several recommendations are proposed to enhance the quality and utility of laboratory services in emergency care: Based on the findings of this study, several recommendations are proposed to enhance the quality and utility of laboratory services in emergency care:

- ✓ Develop evidence-based guidelines for test ordering and utilization: Guidelines and protocols grounded in evidence and arms should be developed by healthcare organizations concerning testing procedures and utilization in emergency medicine. The Health Ministry is recommended to develop these criteria to stipulate appropriate indications for the tests. Through this, medical professionals can sort out irresponsible medical practices. Through the standardization of testing order processes, organizations will be able to maximize resource utilization and live up to the full potential of clinical testing labs.
- ✓ Implement Clinical Decision Support Tools: Electronic health records (EHRs) can potentially contain clinical decision support tools that help in choosing the right tests that correspond to the patient's symptoms or medical history. Such utilities allow for "real-time" guidance in the form of suggesting pertinent tests and avoiding any extra ones. Through technology that assists in the clinical decision-making of organizations, the optimal execution of clinical decisions can be facilitated, and various healthcare outcomes can be improved.
- ✓ Streamline Laboratory Processes and Invest in Automation: For the improvement of laboratory processes and the purchase of automated and technological gadgets, such

devices can reduce laboratory turnaround time. Automation of tests and analysis saves time in obtaining test samples, reducing delays in report-making. Through the creation of innovative workflow management systems and the utilization of new technologies, companies are able to maximize the result-obtaining rate and shorten the timeframe for the delivery of the test results to healthcare providers.

- ✓ Enhance Communication and Collaboration: The best practice is a productive tie between the emergency department healthcare providers and the laboratory personnel that ensures proper treatment management, timely test placement, and outcome reporting. Healthcare organizations must develop interventions to ensure improved communication methods, such as the development of standardized protocols for test ordering and specimen collection (Pegoraro et. al 2020). Building a culture of collaboration between key ED healthcare providers and laboratory personnel will also improve turn times. Clinical labs are designed to facilitate up-to-date communication and coordination with other departments. It means more effective and efficient laboratory services in emergency medicine.
- ✓ Monitor and Evaluate Performance Metrics: Health institutions should measure the performance of periodic reviews and critiques on test utilization and turnaround times on a regular basis. Through measuring core performance metrics, it is possible to detect locations that require redesign and treatment of performance issues, thereby adopting targeted support interventions to maximize laboratory operations. Sharing back information and regular evaluation of performance indicators is critical for discovering the hidden levers that will support optimizing and improving laboratory management services.

Implementing these recommendations will enable healthcare agencies to provide up-to-date laboratory services in emergency medicine and result in better patient quality in intensive care cases. The collaboration of the healthcare providers through the administration and laboratory staff must be considered. Thus, we can ensure we develop a meaningful work plan that will lead the way to improvements in laboratory services. For the purpose of optimizing empirical approaches, networking IT solutions, and creating a work atmosphere that is conducive to collaboration, healthcare providers can upgrade the capacity of hospital laboratories to help improve services offered to patients in emergencies (Pegoraro et. al 2020).

Reference

Rajsic, S., Breitkopf, R., Bachler, M., &Treml, B. (2021). Diagnostic modalities in critical care: point-of-care approach. *Diagnostics*, *11*(12), 2202.https://www.mdpi.com/2075-4418/11/12/2202

Pegoraro, F., Santos, E. A. P., &Loures, E. D. F. R. (2020). A support framework for decision making in emergency department management. *Computers & industrial*

engineering, *146*, 106477.https://www.sciencedirect.com/science/article/pii/S0360835220302114

Fernandes, M., Vieira, S. M., Leite, F., Palos, C., Finkelstein, S., & Sousa, J. M. (2020). Clinical decision support systems for triage in the emergency department using intelligent systems: a review. *Artificial Intelligence in Medicine*, *102*, 101762.https://www.sciencedirect.com/science/article/pii/S0933365719301265

Carpenter, C. R., Mudd, P. A., West, C. P., Wilber, E., & Wilber, S. T. (2020). Diagnosing COVID-19 in the emergency department: a scoping review of clinical examinations, laboratory tests, imaging accuracy, and biases. *Academic Emergency Medicine*, *27*(8), 653-670.https://onlinelibrary.wiley.com/doi/abs/10.1111/acem.14048

Magnusson, C., Herlitz, J., &Axelsson, C. (2020). Patient characteristics, triage utilisation, level of care, and outcomes in an unselected adult patient population seen by the emergency medical services: a prospective observational study. *BMC Emergency Medicine*, *20*, 1-19.https://link.springer.com/article/10.1186/s12873-020-0302-x

L'her, E., Geeraerts, T., Desclefs, J. P., Benhamou, D., Blanié, A., Cerf, C., ...&Mossadegh, C. (2020). Simulation-based teaching in critical care, anaesthesia and emergency medicine. *Anaesthesia Critical Care & Pain Medicine*, *39*(2), 311-326.https://www.sciencedirect.com/science/article/am/pii/S2352556820300424

Schenck, E. J., Hoffman, K. L., Cusick, M., Kabariti, J., Sholle, E. T., & Campion Jr, T. R. (2021). Critical carE Database for Advanced Research (CEDAR): An automated method to support intensive care units with electronic health record data. *Journal of biomedical informatics*, *118*, 103789.https://www.sciencedirect.com/science/article/pii/S1532046421001180

Akter, S., Debnath, B., & Bari, A. M. (2022). A grey decision-making trial and evaluation laboratory approach for evaluating the disruption risk factors in the Emergency Life-Saving Drugs supply chains. *Healthcare Analytics*, *2*, 100120.https://www.sciencedirect.com/science/article/pii/S2772442522000600

Park, H. D. (2021). Current status of clinical application of point-of-care testing. *Archives of pathology & laboratory medicine*, *145*(2), 168-175.https://meridian.allenpress.com/aplm/article-abstract/145/2/168/445968

Liu, S., See, K. C., Ngiam, K. Y., Celi, L. A., Sun, X., & Feng, M. (2020). Reinforcement learning for clinical decision support in critical care: comprehensive review. *Journal of medical Internet research*, *22*(7), e18477.https://www.jmir.org/2020/7/e18477/

Kim, J. H., Han, S. G., Cho, A., Shin, H. J., &Baek, S. E. (2021). Effect of deep learning-based assistive technology use on chest radiograph interpretation by emergency department physicians: a prospective interventional simulation-based study. *BMC Medical*

Informatics and Decision Making, *21*, 1-9.https://link.springer.com/article/10.1186/s12911-021-01679-4

Mrazek, C., Lippi, G., Keppel, M. H., Felder, T. K., Oberkofler, H., Haschke-Becher, E., & Cadamuro, J. (2020). Errors within the total laboratory testing process, from test selection to medical decision-making–A review of causes, consequences, surveillance and solutions. *Biochemiamedica*, *30*(2), 215-233.https://hrcak.srce.hr/clanak/346847

Long, B., Long, D. A., &Koyfman, A. (2020). Emergency medicine misconceptions: utility of routine coagulation panels in the emergency department setting. *The American journal of emergency medicine*, *38*(6), 1226-1232.https://www.sciencedirect.com/science/article/pii/S0735675720300681

Tan, A., Durbin, M., Chung, F. R., Rubin, A. L., Cuthel, A. M., McQuilkin, J. A., ...&Grudzen, C. R. (2020). Design and implementation of a clinical decision support tool for primary palliative Care for Emergency Medicine (PRIM-ER). *BMC medical informatics and decision making*, *20*, 1-11.https://link.springer.com/article/10.1186/s12911-020-1021-7

Soltan, A. A., Yang, J., Pattanshetty, R., Novak, A., Yang, Y., Rohanian, O., ...&Muthusami, V. (2022). Real-world evaluation of rapid and laboratory-free COVID-19 triage for emergency care: external validation and pilot deployment of artificial intelligence driven screening. *The Lancet Digital Health*, *4*(4), e266-e278.https://www.thelancet.com/journals/landig/article/PIIS2589-7500(21)00272-7/fulltext

Dumkow, L. E., Worden, L. J., & Rao, S. N. (2021). Syndromic diagnostic testing: a new way to approach patient care in the treatment of infectious diseases. *Journal of Antimicrobial Chemotherapy*, *76*(Supplement_3), iii4-iii11.https://academic.oup.com/jac/article-abstract/76/Supplement_3/iii4/6374616

Kim, J. S., Bae, H. J., Sohn, C. H., Cho, S. E., Hwang, J., Kim, W. Y., ... &Seo, D. W. (2020). Maximum emergency department overcrowding is correlated with occurrence of unexpected cardiac arrest. *Critical Care*, *24*, 1-8.https://link.springer.com/article/10.1186/s13054-020-03019-w

Hong, N., Liu, C., Gao, J., Han, L., Chang, F., Gong, M., & Su, L. (2022). State of the art of machine learning–enabled clinical decision support in intensive care units: Literature review. *JMIR Medical Informatics*, *10*(3), e28781.https://medinform.jmir.org/2022/3/e28781

Hartigan, S., Brooks, M., Hartley, S., Miller, R. E., Santen, S. A., & Hemphill, R. R. (2020). Review of the basics of cognitive error in emergency medicine: still no easy answers. *Western Journal of Emergency Medicine*, *21*(6), 125.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7673867/

Liu, S., He, X., Chan, F. T., & Wang, Z. (2022). An extended multi-criteria group decision-making method with psychological factors and bidirectional influence relation for emergency medical supplier selection. *Expert Systems with Applications*, *202*, 117414.https://www.sciencedirect.com/science/article/pii/S0957417422007552

Nastasi, A. J., Courtright, K. R., Halpern, S. D., &Weissman, G. E. (2023). Does ChatGPT provide appropriate and equitable medical advice?: A vignette-based, clinical evaluation across care contexts. *MedRxiv*, 2023-02.https://www.medrxiv.org/content/10.1101/2023.02.25.23286451.abstract

Logan, C., Martin-Loeches, I., &Bicanic, T. J. I. C. M. (2020). Invasive candidiasis in critical care: challenges and future directions. *Intensive care medicine*, *46*(11), 2001-2014.https://link.springer.com/article/10.1007/s00134-020-06240-x

Hanson, K. E., Azar, M. M., Banerjee, R., Chou, A., Colgrove, R. C., Ginocchio, C. C., ...& Caliendo, A. M. (2020). Molecular testing for acute respiratory tract infections: clinical and diagnostic recommendations from the IDSA's Diagnostics Committee. *Clinical Infectious Diseases*, *71*(10), 2744-2751.https://academic.oup.com/cid/article-abstract/71/10/2744/5830781