



Review Article

Patient Satisfaction with Laboratory Services: Current Trends and Strategies for Quality Improvement

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Abstract

Objectives patient satisfaction with the quality of laboratory services is a pivotal dimension in ensuring health care quality because it can affect the accuracy of diagnostic results, clinical decision-making, and overall trust in the health system. This review analyzes several critical factors that shape the perceptions of patients, including turnaround time, test accuracy, physician communication, easy access to services, and efficient delivery. The paper then considers trends such as automation, artificial intelligence, telemedicine and digital health integration, and how these new systems are affecting laboratory service quality and the patient experience. Additionally, this review explores mechanisms for quality improvement with a focus on accreditation and continuous quality management systems, ongoing professional education, and mechanisms to integrate patient feedback into systems level reform. Although substantial progress has been made, challenges, including workforce shortages, regulatory variability, and inequities in access to high-quality laboratory services, remain. Evidence-based interventions and patient-centered approaches are used to address these issues with the goal of improving service delivery and healthcare outcomes. This paper offers two important messages to those who influence and guide national policy, healthcare decisions, and development of clinical laboratories across the nation as we strive to change practice to meet new demand.

Keywords: patient satisfaction, laboratory services, quality improvement, diagnostic accuracy, patient-centered care, service efficiency, laboratory automation, artificial intelligence in healthcare, quality assurance, laboratory accreditation

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1. Introduction

Laboratory services are an integral part of contemporary healthcare, providing vital information for disease diagnosis, treatment planning, and patient management. Laboratory tests are performed to aid doctors in the treatment of diseases and diagnoses and are estimated to form the basis for up to 70% of clinical decisions, which have a major importance in providing appropriate and timely medical care. With growing need for good quality health care services, there is also an increasing expectation for efficient, reliable and patient-centred laboratory services.

There are various factors, such as turnaround time, diagnostic accuracy, communication with healthcare providers, accessibility, and overall service efficiency that impact the patient satisfaction from laboratory services. A positive laboratory experience may improve patient confidence in the healthcare system and encourage adherence to medical advice, leading to better clinical outcomes. On the other hand, a lack of satisfaction with laboratory services resulting from long waiting times, errors in test results, poor communication, or limited accessibility may provoke delayed diagnoses, treatment non-adherence, and reduced confidence in medical care among patients [1]. Laboratory medicine has been profoundly transformed by recent advances in automation, artificial intelligence (AI), telemedicine and digital health. These technologies increase workflow efficiency, reduce human mistakes, and broaden accessibility to diagnostic services, ultimately making a difference in patient satisfaction [2]. Moreover, quality improvement initiatives like laboratory accreditation programs, quality management systems (QMS), and patient feedback mechanisms have become essential in optimizing laboratory service delivery and maintaining high standards of care. However, the gold standard of laboratory practice continues to be threatened by problems such as workforce shortages, inequitable access to services and heterogeneity in compliance with regulations. Finally, dedicated efforts with proven solutions, patient-centered approaches, targeted innovation investments, and diversification of talent across laboratory service levels and product offerings will contribute to quality lab service and favorable patient experience.

2. Current Trends in Patient Satisfaction with Laboratory Services

There are various factors influencing the patient satisfaction with laboratory services, such as service efficiency, accessibility, accuracy as well as patient experience. One of the most important factors that influence is wait-time and turnaround time (TAT). Research shows that when point-of-care testing (POCT) and automated workflows are used, the reduction in TAT helps in improving patient satisfaction wherein TAT reduction policies lead to improved results and reduced anxiety from delayed diagnosis. Another key issue is diagnostic accuracy and reliability as both patients and healthcare providers use the laboratory results for medical decision-making. Dissatisfaction and distrusts in laboratory services may arise from misdiagnoses or delayed reporting [3]. Also, how professional the staff is and how they communicate with patients is very important. Laboratory staff that are able to explain clearly, are empathetic and show

considerable competence will rate well with patients. Patient satisfaction is also largely influenced by the accessibility of services, such as locations, hours of operation, and online appointment scheduling [4].

The role of technology and recent advancements in technology has greatly impacted patient satisfaction regarding the laboratory services. Laboratory automation has simplified workflows which has significantly reduced human errors and improved test processing time. (Diagnosis-based) AI applications in diagnostic testing have led to improvements in the accuracy and efficiency of the interpretation of results [2]. Solutions such as patient portals allow patients access to their test results in real time, which can promote transparency and engagement. This integration allows for streamlined communication between laboratory departments and healthcare providers and also minimizes redundancy while enhancing care coordination as well. Alongside this, telemedicine and remote diagnostics also stepped up to the plate, allowing patients to access laboratory services without the need to step foot into a healthcare facility, proving particularly useful for patients in rural or underserved regions. One new trend is the use of self-initiated or point-of-care testing (POCT), which can deliver an immediate result in an emergency or outpatient setting, thus minimizing the wait time and improving the overall patient experience[5] .

Analysing patient feedback through the use of data analytics and artificial intelligence has emerged as a key strategy to drive improvements in laboratory services. Laboratories use sentiment analysis of patient reviews to understand pain points and improve service delivery. Using machine learning methods, more than 100 determinants of patient satisfaction were identified, among others: ease of access, staff, and detail of explanation of the results [6]. Approaches include personalized patient engagement plans — for example, automated alerts for follow-up tests or AI-driven chatbots to answer patient questions — which also improve overall satisfaction.

The rise of PREMs has shed light to better understand patient needs. Numerous laboratories have introduced digital surveys and live feedback systems to solicit patients' perceptions on service quality [7]. Examples of how personalized lab services — for example, individual reports with visual explanations of test results — can help improve patient understanding and trust in the lab services used. Furthermore, mobile health (mHealth) apps can assist patients with preparations before a test and care afterwards, contributing to a positive patient experience with the laboratory. These trends point to an increasing focus on patient-centered laboratory services that prioritize convenience, transparency, and engagement [8].

Patient-reported experience measures (PREMs) have become an important tool in understanding those needs. There are several discursive examples of laboratories that have enabled digital surveys and real-time feedback regarding service quality to be collected directly from the patient. Genomics: Personalized laboratory services have been studied recently, in which test result reports are customized with visual explanations, enabling higher trust, and consequently, gaining trust and better comprehension among patients. Moreover, mobile health (mHealth) applications provide patients with instructions about what to do before tests and post-examination care, further improve the laboratory experience. Additional

themes include the increasing importance of patient-centric laboratory services, which are focused on convenience, transparency, and engagement [9].

Demographic data were systematically presented to provide context for findings in a study evaluating patient satisfaction with laboratory services:

Most of study participants age were 26-45 years, as shown in Figure 1, this indicates the main users of laboratory services were adults in the younger to average years. Generational expectations – with younger customers expecting more in terms of the speed of service, greater convenience and more digital access. Moreover, the female predominance in our sample reflects previously observed trends showing that female patients are more likely to access care and enroll in patient satisfaction surveys. Such insights allow for customizing quality improvement initiatives in addressing the needs and demands of the primary patient population [10].

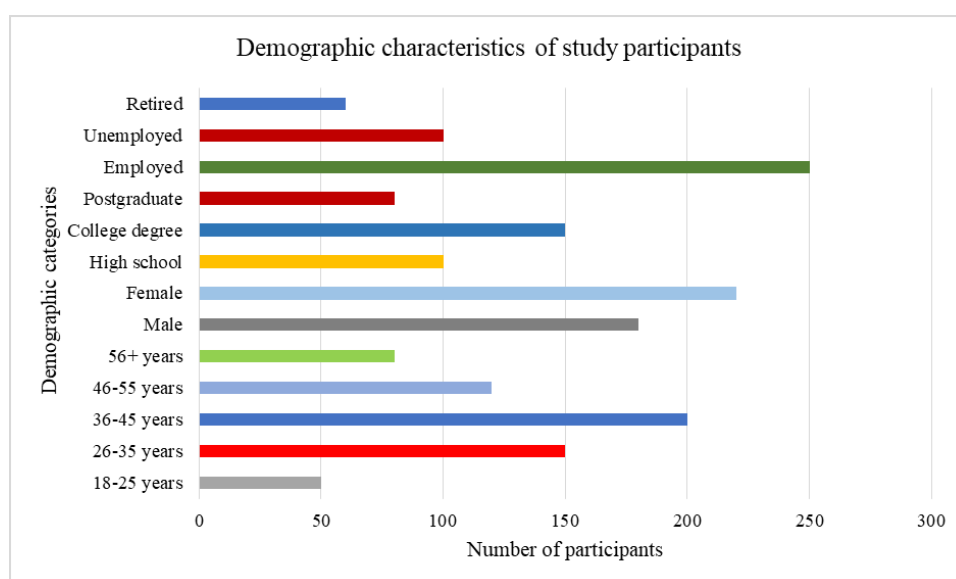


Figure 1: Demographic characteristics of study participants.

3. Strategies for Quality Improvement in Laboratory Services

This quality improvement is important for increasing patient satisfaction, the accuracy of laboratory diagnostics and the overall outcome of health care. In order to overcome inefficiencies and improve service delivery, laboratories need to adopt a combination of activities involving quality assurance measures, advancements on technology, staff training programs, and a patient-centered approach. Quality improvement strategies should have key components that may involve establishing sound quality control systems, automating & integrating AI, implementing digital health solutions, enhancing workforce competency, and addressing regulatory requirements [11].

The establishment of quality assurance programs that involves reducing errors, creating a standard protocol for laboratory procedures, and increasing test accuracy is one of the cornerstone strategies in

improving quality. These factors are part of laboratory management that needs to be assessed periodically, which includes both internal quality control (IQC) by using routine calibration of laboratory instruments and validation of testing methods; and external quality assessment (EQA), by conducting inter-laboratory performance comparisons for routine tests and thus testing one's results against the results of peer laboratories. Zeroing in on test process variability is the goal with standard operating procedures (SOP) — guiding the same way of managing, analyzing, and reporting on samples.

Automation and artificial intelligence (AI) technologies are now not only widely adopted, but have also transformed laboratory operations with regards to efficiency, precision and reliability. Machine-learning algorithms integrated to laboratory instruments are improving testing efficiencies (the speed, accuracy and reliability of tests), while AI analyzers interpret results and assist in cases of diagnosis, results interpretation, predicted disease progression and, eventually, preventative decision making. Machine learning algorithms enhance workflow efficiency by diagnosing operational bottlenecks and predicting possible delays. In pathology, AI-driven imaging techniques help to identify anomalies faster, thereby minimizing the burden on lab staff while enhancing diagnostic precision [12].

The integration of telemedicine and digital health solutions into laboratory services provides better access, convenience, and patient engagement. Electronic health record (EHR): Laboratory data can be shared directly with a patient's healthcare team integrated into their EHR, allowing health care providers to receive results faster and without administrative delays. Telepathology and remote diagnostics allow for expert consultations and second opinions, especially in areas where laboratory expertise is scarce. For the hospital, this means reduced, unnecessary visits if the results are communicated through an online patient portal, enabling direct login access, and transparency [13]. These solutions are geared towards fast tracking clinical decisions of doctors and care providers, thereby helping the ecosystem become more efficient.

It is accordingly vital that laboratory personnel are competent, a factor supported by continuing staff training and professional development programs. Laboratory personnel meet the challenges of new diagnostic modalities, quality control measures, and regulatory expectations with regular continuing education workshops, certification trackin, and competency based assessments to prepare staff. Strengthened collaboration between laboratory professionals, clinicians responsible for patient care, and healthcare administrators at the medical facility creating interdisciplinary teams with decisional authority improves communication and enhances the interpretation of the test results and the management of patients [14]. Also, leadership programs for laboratory managers will improve workflow and allocation of resources.

These measures are essential to improve satisfaction with laboratory services from a patient-centered approach. By tackling long waiting times, implementing appointment systems, and automating the sample collection, patient satisfaction will increase and services will be more effective. Communication by laboratory staff to patients about tests, expected turnaround times, and result interpretation is also

important for ensuring clarity. In addition, the implementation of services tailored to the individual patient's needs (for example, home sample collection for elderly or immobile patients) increases accessibility and patient convenience [15]. In addition, they can identify areas for improvement through feedback mechanisms like patient satisfaction surveys, keeping the service quality continuously improving.

Laboratories are also maintained, and high-quality service delivery is ensured by ensuring laboratory accreditation and compliance with regulatory standards. Laboratory competence, accuracy, and reliability remain an international priority, with standards such as ISO 15189 certification establishing benchmarks, while Clinical Laboratory Improvement Amendments (CLIA) regulations guarantee compliance with quality control specifications within the US [16]. Laboratories identify deficiencies, create follow-up corrective action plans, and promote excellence in diagnostic testing through regular auditing steps, competency assessment programs, and performance audits.

Laboratories can improve operational efficiency and eliminate costs through the implementation of lean management principles and process optimization strategies. Laboratory bottlenecks can be identified using value stream mapping and workflow analysis, and optimal solutions can be defined and implemented. Sample management is improved through real-time tracking systems that avoid errors associated with specimen misplaced, delayed, or in transit. Streamlining laboratory setups & automating non-technical tasks can lead to better resource optimization & faster turnaround [17].

In continuous quality improvement, data analytics and predictive modeling are heavily utilized. Through tracking key performance indicators (KPIs) like turnaround time, test accuracy, and patient satisfaction rates, labs are capable of spotting trends and making data-focused improvements. In addition, predictive analytics forecasts testing demands, enabling the resources to be allocated efficiently and avoiding the clogging of testing workflow. Root cause analysis (RCA) provides laboratories with a structured approach to address errors and to enforce corrective actions with the aim to minimize the likelihood of repeating diagnostic errors [18]. Although laboratory technology and quality improvement initiatives have come a long way, there are still a number of factors affecting the efficiency of service delivery and diagnostic accuracy, as well as patient satisfaction. These challenges demand novel solutions, policy adjustments, and technological progress to enable long-lasting positive changes in laboratory services. Workforce shortages and training gaps is one of the top challenges facing this sector. Insufficient laboratory technical manpower is a concern across the globe, leading to overload, errors in diagnosis and delayed processing of tests. To us, professional development on an ongoing basis, competency-based assessment (using the right tools and techniques), and AI-based training modules are a must to fill these gaps and improve staff efficiency. Cost constraints and resource allocation are another considerable barrier [19], especially in low resources settings. From advanced laboratory automation, to AI-driven diagnostics, and digital health solutions, they all necessitate significant investments, which can weigh heavily on the financial sustainability of healthcare institutions. Limited funding also denies the community access to modern diagnostic tools, leading to poor quality of patient care and a lack of timely intervention.

As there is an increase in the use of electronic health records (EHRs) and digital laboratory systems, data management and cybersecurity threats are becoming major issues. However, maintaining trust and safeguarding patient confidentiality require protecting sensitive patient information from cyber threats while ensuring compliance with regulations such as Health Insurance Portability and Accountability & Act (HIPAA) and General Data Protection Regulation (GDPR) [20].

Laboratory operations are further complicated by regulatory and compliance barriers. Laboratory accreditation (ISO 15189, Clinical Laboratory Improvement Amendments [CLIA]) demands strict requirements, including documentation, quality assurance programs, and laboratory performance evaluations. While the methodologies and quality control measures have been standardised and automated, international laboratories still struggle with standardisation of diagnostic procedures and interpretation of results [21].

Laboratory service delivery quality is limited by patient-centered care as well. This can lead to patient dissatisfaction because of long wait times, inefficient scheduling systems, and inadequate communication surrounding test results. Of great importance are the accessibility and convenience of laboratory services, such as home sample collection and telepathology; these will improve the patient experience and enhance engagement [22]. To address these issues and enhance the laboratory services on an ongoing basis, the following strategies should be employed. In Table 1, the key challenges in laboratory services and their corresponding future strategies are summarized.

Table 1: The key challenges in laboratory services and their corresponding future strategies.

Challenges	Impact on Laboratory Services	Proposed Solutions
Workforce Shortages	Increased workload, delays in test processing, risk of diagnostic errors	AI-driven training, competency-based assessments, automation
Cost Constraints	Limited access to modern diagnostics, financial strain on institutions	Investment in cost-effective automation, public-private funding
Cybersecurity Risks	Threats to patient data privacy, risk of compliance violations	Enhanced data encryption, compliance with HIPAA & GDPR
Regulatory Compliance Barriers	Differences in standards between regions and administrative burden.	Harmonization of global accreditation, streamlined documentation
Patient-Centered Care Limitations	Long wait times, inadequate communication, dissatisfaction	Home sample collection, real-time result access, telepathology
Sustainability Concerns	Environmental impact of lab waste and energy consumption	Adoption of green lab practices, eco-friendly reagents

By enabling the adoption of these solutions, laboratories can be assured of enhanced diagnostics, better patient experience and future sustainable service delivery. AI and automation will only grow in importance in improving diagnostic accuracy, decreasing human error and streamlining workflow. AI-based clinical decision support systems (CDSS) can support healthcare providers in data-backed decisions, while robotic process automation (RPA) can also enhance sample processing, TAT, and operational efficacy [23].

Digital health and telemedicine services integration will empower laboratory service accessibility. Increased EHR interoperability will help data sharing trigger with many encountered healthcare providers,

increasing efficiency and lessening unnecessary treatment. With telepathology, specialists will be able to review samples and cases from far-flung locations, enabling them to provide timely diagnosis and treatment — even in underserved communities [24].

Laboratory services as they are evolve to meet the changing needs of patients, increasingly with the personalized and patient-centered focus that will become the hallmark of these approaches going forward. Real-time patient feedback mechanisms will allow laboratories to act on concerns immediately and strive for greater service excellence. POCT and home-based diagnostics are expected to provide more convenience to patients by accelerating test outcome time, reducing the need for patients to seek the outcome from a medical facility [25].

Laboratory excellence depends on fortifying workforce development. As a result, investing in AI-driven training platforms, certification programs, competency-based learning, and more will fulfill the goal of addressing these shortages while ensuring that laboratory personnel is well-versed in the latest technology. Through collaboration, laboratory professionals, clinicians, and data scientists can cultivate new ways to approach diagnostics and healthcare delivery in a collaborative environment.

Future laboratory operations will need to focus more on sustainability and promote green laboratory initiatives. Implementing plastic waste reduction practices, energy-efficient equipment, and biodegradable reagents will contribute to worldwide sustainability. Sustainable testing kits and minimal-waste laboratory workflows will reduce the environmental footprint of diagnostic services.

4. Conclusion

Patient satisfaction with laboratory services depends on multiple factors and represents an important indicator of quality in the healthcare process, as it impacts diagnostic accuracy, clinical decisions, and patient trust. The current review has highlighted the key predictors of customer satisfaction, including turnaround time, accessibility of services, professionalism of staff, and integration of digital health technologies. Aspects like laboratory automation, artificial intelligence (AI), telemedicine, and so on have changed the service efficiency and patient experience.

However, even with these advances, challenges persist. Laboratory operations continue to be challenged by workforce shortages, cost constraint, regulatory compliance barriers, and cybersecurity risks. Indeed, tackling these challenges calls for a multi-layered response, potentially involving a blend of investment into AI-led educational pathways, automation, sustainable laboratory practices and uniform international legislative systems. In addition, implementation of patient-centric approaches such as home sample collection, real-time feedback systems, and on-site, point-of-care testing (POCT) can also improve service accessibility and quality.

Future progress in laboratory medicine should lie in operational efficiency, diagnostic accuracy, sustainability, and patient engagement. Laboratories can improve diagnostic services and contribute

to better healthcare outcomes by adopting innovative technologies, strengthening workforce training, and pursuing regulatory harmonization. If successfully implemented, these solutions will help propel laboratory services to continue to play a central role in high-quality, patient-centered medical care as the healthcare model evolves to meet the nation's changing needs.

Competing Interests

The authors declare that no conflict of interest would prejudice the impartiality of this scientific work.

Authors' Contribution

All authors of this study have contributed to data collection, data analysis, and manuscript writing.

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