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The pre-analytical phase in clinical analysis laboratories: an integrative literature review (2020-2025)

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The preanalytical phase in clinical analysis laboratories: an integrative review of the literature (2020-2025)

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SUMMARY

Introduction: The pre-analytical phase accounts for 60% to 90% of total errors recorded in routine laboratory work, being the most vulnerable stage and prone to manual errors in the diagnostic process. Technical interferences and biological variables directly impact patient safety and the reliability of issued reports. **Objective:** To analyze, through scientific literature, the main pre-analytical interferences and the importance of the biomedical professional's strategic role in error prevention and quality management. **Methodology:** This is an integrative review, based on articles published between 2020 and 2025, focusing on clinical biochemistry and performance indicators. **Results:** Hemolysis stands out as the main factor of technical interference, responsible for 40% to 70% of sample rejections.

Biological (fasting, exercise) and pharmacological variables mimic pathological states, leading to erroneous clinical interpretations. The "cost of non-quality" manifests itself in heavy financial burdens resulting from re-collections, rework, and waste of supplies, especially in inpatient units. **Discussion:** The standardization of Standard Operating Procedures (SOPs) and the continuing education of multidisciplinary teams are essential tools to mitigate risks. **Conclusion:** The technical qualification of the biomedical professional and the continuous monitoring of indicators are crucial to ensure the economic viability of the laboratory and the integrity of the final diagnosis.

Keywords: Pre-analytical phase. Biomedical. Laboratory tests. Clinical biochemistry.
Quality control.

ABSTRACT:

Introduction: The pre-analytical phase accounts for 60% to 90% of total errors in the laboratory routine, representing the most vulnerable stage for manual failures in the diagnostic process. Technical interferences and biological variables directly impact patient safety and the reliability of issued reports. **Objective:** To analyze, through scientific literature, the main pre-analytical interferences and the strategic importance of the biomedical scientist's role in error prevention and quality management. **Methodology:** This is an integrative review based on articles published between 2020 and 2025, focusing on clinical biochemistry and performance indicators. **Results:** Hemolysis is the leading technical interference factor, accounting for 40% to 70% of sample rejections. Biological (fasting, exercise) and pharmacological variables can mimic pathological states, potentially leading to misleading clinical interpretations. The "cost of non-quality" manifests as heavy financial burdens from re-collections, rework, and wasted supplies, especially in inpatient units. **Discussion:** Standardization through Standard Operating Procedures (SOPs) and continuous multidisciplinary team education are essential tools for risk mitigation. **Conclusion:** Technical qualification of the biomedical scientist and constant indicator monitoring are decisive in ensuring laboratory economic viability and diagnostic integrity, providing excellence in patient care.

Keywords: Pre-analytical phase. Biomedical scientist. Laboratory tests. Clinical biochemistry.
Quality control

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1. INTRODUCTION

The reliability of a laboratory report is not strictly limited to the stage of analysis, but it depends on a rigorous workflow that begins in the pre-analytical phase, with quality being the primary concern. The biological sample is the central pillar for successful diagnosis. Currently, it is estimated that Between 70% and 90% of medical decisions and clinical diagnoses are based on results. laboratory tests, directly influencing everything from drug therapies to procedures complex surgical procedures. This high level of dependence reinforces the strategic responsibility of the sector. since laboratory medicine acts as an essential science for generating information clinical applications through the analysis of analytes in biological fluids.

However, the literature is unanimous in highlighting that the pre-analytical phase remains... as the most vulnerable and error-prone stage, accounting for between 46% and 90% of errors. totals recorded in routine laboratory work (SILVA; BELO, 2025; NORDIN et al., 2024). This The high statistical index constitutes a critical warning for the health sector, given that most These nonconformities originate manually and occur outside the laboratory environment, which This makes continuous monitoring difficult. Unlike the analytical phase, which has become highly Although automated, pre-analysis still relies substantially on human intervention and... manual operational processes (NORDIN et al., 2024).

Among the most prevalent technical failures, hemolysis stands out as the main factor. interference and cause of rejection, accounting for 40% to 70% of samples. inadequate (SANTOS et al., 2021; NORDIN et al., 2024). The physical-chemical process The process involves the rupture of the red blood cell membrane, with the consequent release of intracellular contents into the serum, which artificially elevates sensitive analytes, such as potassium, lactate dehydrogenase (LDH), and transaminases. In addition to hemolysis, other Critical technical indicators include the presence of fibrin after centrifugation, coagulation undue error resulting from inadequate homogenization and insufficient sample size. (FERREIRA et al., 2024).

Beyond operational failures, biological variables have a clinical impact. significant in the stability of blood components prior to analysis. Studies show what shortcomings were in instructing the patient regarding fasting time and the practice of physical exercise. And habits like smoking can mimic pathological states, inducing misinterpretations. Incorrect medical advice (SANTOS et al., 2021). The absence of clear instructions results often in contaminated or diluted samples; one study revealed that the lack of

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Prior guidance is responsible for up to 23% contamination in urine samples (MORAIS et al., 2023).

The interference of pharmacological factors also represents a significant challenge to reliability of biochemical and hematological results. Many medications and Supplements used by patients may react with laboratory reagents or alter results. physiological processes, masking clinical conditions or altering glucose and blood glucose levels. Glycated hemoglobin (RODRIGUES et al., 2022). In this sense, conducting an anamnesis is essential. Detailed information provided during registration is essential for the analyst to consider possible candidates. Drug interactions during the critical validation of results, avoiding inappropriate conduct. unnecessary therapies (BARBOSA et al., 2021).

Logistical management, which includes the storage and transportation of samples, is another A critical variable that directly influences the integrity of biological material. Exposure Prolonged exposure to inadequate temperatures or excessive processing delays can to allow the degradation of biomolecules and the proliferation of microorganisms, making the sample invalid for analysis (SILVA; BELO, 2025). Strict control of the time between collection and Centrifugation is crucial to ensure that the results reflect the actual metabolic state. of the patient at the time of venipuncture (MONTEIRO; EGITO, 2024).

The incidence of pre-analytical errors tends to vary according to the service profile. with inpatient and emergency units being those that most frequently report non-compliance. compliance. This occurs because, in these environments, collection is frequently carried out by professionals external to the laboratory's technical team, resulting in error rates of up to 4.54% (FERREIRA et al., 2024; NASCIMENTO et al., 2024). Furthermore, the complexity Clinical care for critically ill patients, such as neonates and oncology patients with venous access. Fragile, it requires greater technical skill to avoid errors in identification and handling. (FERREIRA et al., 2024).

From a management perspective, such failures reinforce the concept of "the cost of non-quality". generating a negative impact on the entire health system. Each need for a new collection This leads to the waste of supplies, reagents, and the team's productive time, in addition to causing... Physical strain and unnecessary stress on the patient (SOUZA et al., 2024). Efficiency in collection The initial approach therefore emerges as the most effective mechanism for avoiding operational expenses. redundant; it is estimated that excess collected tubes can account for up to 77.8% of costs. direct with supplies in hospital units (SOUZA et al., 2024).

In this scenario, technological advancements have transferred diagnostic precision to the

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human and managerial monitoring, positioning the biomedical professional as a strategic interface of
This professional is responsible for ensuring the standardization of workflows.
and the continuing education of the team, using performance indicators and tools of
Quality, such as the Sigma metric, is used to mitigate risks (BARBOSA et al., 2021; AZOCAR GONZÁLEZ et al., 2024). Given the above, this work aims to analyze...
the main interfering factors in the pre-analytical phase and the importance of strategic action by
Biomedical professionals in error prevention and quality management.

2. THEORETICAL FRAMEWORK

2.1 Quality and management in clinical analysis

Quality in clinical analyses is one of the fundamental pillars for obtaining
For reliable laboratory results and patient safety. The clinical laboratory
plays an essential role in the medical decision-making process, since it largely
Part of the diagnosis, therapeutic monitoring, and prognostic assessments depends
of the results of laboratory tests. In this context, quality must be present in
all stages of the laboratory process, from the test request to the release of the report.
As highlighted by BARBOSA et al. (2021), quality assurance involves
implementation of standardized procedures, continuous monitoring of processes and
Adoption of indicators that allow for the identification of non-conformities and the promotion of improvements. continuous.

Furthermore, quality management systems in clinical laboratories establish
Strict requirements for technical competence, organization, and complete control of analytical workflows.
The adoption of structured management tools allows for the qualification of professionals, and
Sample traceability, rigorous equipment control, and systematic assessment of risks associated with daily activities. According to AZOCAR GONZÁLEZ et al.
(2024), quality management is not limited to the internal environment, but encompasses all interfaces
from laboratory testing, being indispensable for reducing operational errors and mitigating costs.
arising from errors and ensuring the excellence of the services provided.

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2.2 Phases of the laboratory process

The analytical process in clinical laboratories is traditionally structured in three interdependent stages, known as the pre-analytical, analytical, and post-analytical phases, that make up the complete patient care cycle. The pre-analytical phase is the stage initial and encompasses all procedures that precede the technical analysis, beginning with The examination is requested by the doctor, followed by rigorous instructions and preparation. patient, through the collection of the biological sample and the transport and reception of the material in laboratory for screening. According to SANTOS et al. (2021), this step must have a Standardization must be carefully defined and constantly monitored, as the activities Actions taken before the trial have a definitive impact on the quality of the results delivered.

The analytical phase consists of the technical processing of the biological sample to generate... of quantitative or qualitative results, depending heavily on technologies. Automated processes, equipment calibration, and scientifically validated methods. By Finally, the post-analytical phase encompasses obtaining the raw data and its critical analysis by The technical manager is responsible for the release and issuance of the signed report, concluding with the delivery of the... result to the patient or the attending medical team. According to SILVA and BELO (2025), the The reliability of laboratory diagnosis and clinical effectiveness depend on rigorous control. of all these integrated steps, since failures in any one of them compromise the safety of care and the integrity of the care provided.

2.3 Concepts and classification of pre-analytical errors

A laboratory error is technically defined as any failure in an operation. planned that was not completed as expected or was executed incorrectly in any phase of the testing cycle. In the specific case of the pre-analytical phase, the error manifests itself. when the technical acceptability criteria for the biological sample are not met, what This makes it impossible to obtain a reliable result that reflects the patient's actual condition. As highlighted by RODRIGUES et al. (2022), it is estimated that this phase concentrates between 60% to 90% of all errors observed in routine clinical laboratory work, being widely... recognized as the most vulnerable and prone to variations throughout the entire process diagnosis.

These errors can be systematically classified into variables related to

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patient preparation, technical collection procedures, and transport or delivery conditions
sample storage. The scientific literature also subdivides these failures into stages.
Extralaboratory factors, which involve external professionals and the patient's own behavior,
and in intralaboratory stages, which occur internally during receiving, the verification
and the sorting of the material. According to MONTEIRO AND EGITO (2024), the predominance of
Errors at this stage stem from the complexity of manual operations and the inherent difficulty of...
continuous monitoring of activities performed outside the controlled technical environment, which
It requires a much more assertive and vigilant risk management approach.

2.4 Main pre-analytical errors related to the patient and sample collection

Patient-related errors, in the vast majority of cases, stem from critical failures.
in communicating and providing guidance on essential pre-exam requirements,
such as strict adherence to fasting time and temporary abstinence from medication or
of physical exercise. Lack of proper instruction can drastically alter the parameters
biological and metabolic factors, resulting in inadequate samples that do not provide a comprehensive view.
It requires the individual's clinical condition at the time of analysis. According to MORAIS et al.
(2023), failures in prior preparation, especially the omission of information about the use of
Drugs are extremely common causes of interference that generate the need for
expensive and uncomfortable recollections.

Regarding the technical act of collection, hemolysis is identified in the literature as the non-occurrence of hemolysis.
most frequently occurring nonconformity, responsible for 40% to 70% of sample rejections in
Clinical laboratories of various sizes. It occurs mainly due to puncture techniques.
Inadequate venous practices, such as the use of needles of the wrong gauge, excessive time in
Tourniquet-like or vigorous shaking of the tubes after collection. Other serious errors during this
These steps include incomplete or incorrect patient identification on the tube, and volume collection.
Insufficient blood for analysis and failure to follow the correct order for drawing the tubes.
vacuum, which can lead to cross-contamination by additives and invalidate the results of
electrolytes and coagulation (FERREIRA et al., 2024).

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2.5 Pre-analytical interferents and their impact on laboratory tests

Pre-analytical interferents exert a direct and often invisible influence.
in the reliability of analytes, which may mask existing pathologies or mislead physicians.
Dangerous false-positive and false-negative diagnoses. Hemolysis, for example, causes...
rupture of red blood cells and release of intracellular components into the plasma, falsely elevating the serum levels of potassium, magnesium, and the enzyme lactate dehydrogenase (LDH), which compromises clinical interpretation (FERREIRA et al., 2024). Similarly, the presence of fibrin in serum samples, due to failure to comply with the time required for retraction of A clot can obstruct the aspiration systems of the analyzers, resulting in reading errors. and significant delays in the delivery of final reports (FERREIRA et al., 2024).

Biological and behavioral factors, such as alcoholism, smoking, and the practice of Intense physical exercise prior to collection also acts as a potent interfering factor in... Chemical and enzymatic reactions in laboratory tests. Improper transportation is another a crucial variable for the integrity of the material; samples kept at temperatures outside of Patterns or processes with delays suffer rapid degradation of sensitive biomolecules, such as Glucose, which promotes cell lysis and bacterial proliferation in urine samples. According to RODRIGUES et al. (2022), rigorous control of all these interfering factors is indispensable to ensure that the analyzed aliquot accurately represents the metabolic state. from the patient at the exact moment of collection, ensuring the validity of the diagnosis.

2.6 Clinical and economic consequences of pre-analytical errors

The clinical consequences of errors in the pre-analytical phase are severe, because can lead to misguided therapeutic approaches, to drug treatments unnecessary and even inappropriate surgical interventions for the patient. Results Inaccurate laboratory results directly jeopardize the patient's safety and can lead to... late diagnoses of serious illnesses and unjustified increases in hospital stays hospital. According to MONTEIRO AND EGITO (2024), it is estimated that most decisions Crucial medical decisions are based on laboratory results, which makes any failure at this stage... initially, a real and direct threat to the patient's health, well-being, and favorable prognosis.

From an economic standpoint, pre-analytical failures represent a financial burden. significant for healthcare institutions, due to the large-scale waste of supplies and

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to the operational time of the technical teams. SANTOS et al. (2021) documented, in their
The study revealed a significant expenditure of R$ 23,330.71 solely on sample re-collection over 19 months.
highlighting the direct negative impact on the profitability and sustainability of the laboratory.
Furthermore, SOUZA et al. (2024) highlight that the excessive number of requests for tests and the collection
Unnecessary pipework contributes to extremely high costs, which can represent 77% of the total.
Total costs analyzed in a hospital cost report, which burdens the healthcare system.
as a whole.

2.7 Strategies for preventing and controlling pre-analytical errors

Effective mitigation of pre-analytical errors requires a multidisciplinary approach and
continuous, primarily focused on the education and technical training of all
Professionals involved at the forefront of the process, including nurses and phlebotomists.
implementation of standard operating procedures (SOPs), the creation of manuals for
Management and the use of illustrated teaching guides help standardize collection techniques and patient
guidance. According to AZOCAR GONZÁLEZ et al.
(2024), recurring staff training is essential to reduce human variability.
and ensure that samples are collected and processed strictly in accordance with the
established quality requirements.

The adoption of cutting-edge technologies emerges as another essential strategy, with particular emphasis.
for the use of barcode identification and full traceability systems, in order to
To minimize sample mix-ups and critical registration errors, utilize management tools.
Advanced tools allow managers to identify the magnitude of failures and promote cycles of...
Continuous improvement based on objective statistical data. Finally, the structuring of sectors.
efficient screening and constant monitoring through quality indicators (QIs)
They ensure the robustness of laboratory processes, strengthening diagnostic safety and...
excellence in patient care (FERREIRA et al., 2024).

3. MATERIALS AND METHODS

This study is characterized as an integrative literature review, a methodology
which allows for the synthesis of multiple published studies, making it possible to draw conclusions.
general information about an area of interest from various methodological approaches. The search for

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The articles were published on the Coordination for the Improvement of Higher Education Personnel (CAPES) Periodicals Portal.
Higher Education Institutions (CAPES), considering their scope and access to databases.
multidisciplinary. For sample selection, the following criteria were established
Inclusion criteria: articles published between 2020 and 2025; studies available in full (open access);
articles that necessarily addressed the topic of pre-analytical errors in laboratories.
of clinical analyses. Studies that were not available in were excluded from the sample.
complete format or that did not present a direct correlation with quality management in
pre-analytical phase.

To extract the information, a structured instrument (table) was used.
Compile the data from the 11 selected articles. The data extracted for analysis were: author
Main title, year of publication, study objective, main results and conclusions. After the
After extraction, descriptive and comparative analysis of the data was performed. The information was...
grouped into thematic convergences, allowing the identification of non-conformity patterns.
most frequent, as well as mitigation strategies and operational and financial impacts.
as reported by the authors. The comparative analysis allowed for a comparison of the different approaches to studies.

4. RESULTS AND DISCUSSION

The bibliographic selection carried out in the databases, following the pre-established inclusion criteria,
established (open access articles published between 2020 and 2025), resulted in the identification
From 11 studies that address quality management in the pre-analytical phase. Data synthesis.
The extracted data reveals a significant convergence among the authors regarding the centrality of this.
stage in the laboratory process. In short, the data extracted from the 11 articles corroborate the
the need for evidence-based management, in which continuous monitoring of
Pre-analytical stages are not just a normative guideline, but an imperative for viability.
Technical and financial aspects of contemporary clinical analysis laboratories.

The detailed characteristics of these studies, including their main objectives and
The results are summarized in Table 1.

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Table 1 – Articles selected from the database: CAPES Journals

Article Title/Year	Authors	Objective of the article	Article conclusion
Impact on costs due to pre-analytical errors in clinical analysis laboratories / 2021	SANTOS, PR *et al.*	To measure the financial impact of failures in the initial phase for the institution, with a focus in the recoleta indicators.	Efficient cost management is vital to the financial health of the laboratory and prevents dissatisfaction among doctors and patients.
Evaluation of pre-analytical, analytical, and post-analytical errors in the examination. EAS: a systematic review / 2025	SILVA, SP; BELO, SCB	To identify the most common errors in urinalysis (EAS) at all stages of the laboratory process.	Diagnostic accuracy depends on rigorous control of all stages, aided by automation and multidisciplinary strategies.
Preanalytical Errors in Clinical Laboratory Testing at a Glance: Source and Control Measures / 2024	NORDIN, N. *et al.*	Analyze the sources of pre-analytical errors and suggest practical control measures to mitigate these occurrences.	Sample integrity is the weakest link; continuing education and... Standardized guidelines are the best tools for prevention.
Benchmarking of pre-analytical errors in the clinical pathology laboratory of the Hospital of Cancer I / 2024	FERREIRA, R. GSS *et al.*	To track pre-analytical errors in an oncology setting and compare local performance with international standards (IFCC).	Hemolysis and fibrin are the most critical points; management manuals are essential to standardize processes and reduce failures.
Interference of pre-analytical factors in laboratory tests / 2023	MORAIS, RP G. *et al.*	To assess how external variables and initial phase techniques can compromise the accuracy of the reports.	It is essential to empower professionals to identify and reverse problems before analysis, ensuring reliable results.
Quality assessment in the pre-analytical phase of the clinical biochemistry laboratory of a hospital in Recife. PE: A Cost Report / 2024	SOUZA, AA S. *et al.*	To correlate the quality of pre-analytical processes in the biochemistry sector with the waste of financial resources.	Failures in collection and transportation significantly burden the public system, requiring audits and quality-focused processes.
Identifying non-conformities and proposing corrective actions in the pre-analytical phase at a public maternity hospital / 2024	NASCIMENTO, BS *et al.*	To identify the frequency of errors in a maternity ward and propose interventions to improve workflow.	Quality indicators allow for monitoring performance and suggest that team training is the most effective corrective action.

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Article Title/Year	Authors	Objective of the article	Article conclusion
Preanalytical interferences in laboratory tests: a narrative review / 2021	RODRIGUES, AB *et al.*	To consolidate the literature on the interferences that distort biochemical results.	Rigorous quality control is essential to avoid misdiagnosis and adverse clinical outcomes.
Laboratory environment and quality control: attention to the most frequent pre-analytical errors / 2021	BARBOSA, R. F. *et al.*	Describe the most frequent pre-analytical errors and their direct implications for therapeutic conduct.	Standardization through Standard Operating Procedures (SOPs) and the use of daily indicators are necessary to ensure technical excellence and patient safety.
Importance of the Pre-analytical Phase and its Impact on Tests Laboratory tests / 2024	MONTEIRO, G. F.; EGYPT, E. MN	To investigate the most common errors in the initial phase and assess how they affect the quality of health services.	Transportation and storage Inadequate performance is a critical failure; professional qualification is the cornerstone for reliable results.
Pre-analytical Errors in Clinical Laboratories: An Integrative Review / 2024	AZOCAR GONZÁLEZ, I. *et al.*	To identify the available scientific evidence on pre-analytical errors and their prevalence in clinical practice.	Standardization and continuous training are essential to reduce operational costs and protect patient integrity.

The analysis of the selected studies reaffirms the premise that the pre-analytical phase It constitutes the most vulnerable link in the laboratory production chain, responsible for the largest part. of the failures that culminate in inconsistent diagnoses and delays in clinical management (NORDIN et al., 2024; MORAIS et al., 2023; NASCIMENTO et al., 2024; RODRIGUES et al., 2022). Although the literature shows convergence regarding the critical importance of this stage, studies They differ in their approaches — ranging from narrative reviews to benchmarking studies and cost analyses—which allows for a holistic view of the challenges faced by contemporary clinical laboratories.

One point of consensus among the authors is the manual and decentralized nature of the steps. pre-analytical factors are a predominant factor in the occurrence of errors. MORAIS et al. (2023) highlight that routine exams, because they largely depend on manual processes outside the environment strictly controlled laboratory tests exhibit failure rates that vary. significantly (from 46% to 68.2%). This scenario is corroborated by NORDIN et al. (2024), which reinforce that failures in requesting, collecting, and transporting are critical sources of interference, citing hemolysis, lipemia, and jaundice as frequent causes of erroneous results.

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When analyzing the typology of errors, a presumed prevalence of physical causes is noted. and operational. While FERREIRA et al. (2024) identified that hemolysis and the presence Fibrin levels after centrifugation are the most critical performance indicators, NASCIMENTO et al. (2024) point out that, in a public maternity setting, "samples not received" (50.7%), followed by coagulation (13.3%) and contamination (8.2%), were the nonconformities most relevant. This comparison suggests that the nature of the error may vary depending on the profile. the institution's care structure (e.g., oncology hospital versus maternity ward), reinforcing the the need for each laboratory to identify its specific vulnerabilities instead of adopt a single control model.

Regarding management tools, the use of quality indicators (QIs) proves to be... indispensable. FERREIRA et al. (2024) demonstrate the robustness of using metrics and control. of errors in aligning with high-performance institutional standards. On the other hand, NASCIMENTO et al. (2024) propose a practical approach, using the same IQs for to justify immediate corrective actions, such as ongoing team training and the creation of of sorting sectors. Both approaches, although distinct in terms of complexity, They converge on the conclusion that data-driven management is the only way to... sustainable improvement.

A key point of convergence is the operational nature of the errors. BARBOSA et al. (2021) and SILVA; BELO (2025) emphasize that, regardless of type of examination — whether it's a general biochemical profile or specific tests like urinalysis. Type I) —, the pre-analytical failure precedes the technical analysis and compromises the entire diagnosis. While SILVA and BELO (2025) direct their analysis towards the need for rigor in all the stages (pre-analytical, analytical and post-analytical), specifically in EAS, BARBOSA et al. (2021) expand the focus to quality control of the environment as a whole. It is noted, Therefore, the reading suggests that standardization should not only be technical, but also... structural.

In contrast to purely technical approaches, AZOCAR GONZÁLEZ et al. (2024) bring a crucial dimension: the role of care teams and the human factor. To conduct an integrative review, the authors emphasize that the pre-analytical phase depends on a Management that goes beyond the walls of the laboratory, directly involving collection and transportation. of samples outside the technical environment. This interdisciplinary perspective complements the studies de MONTEIRO and EGITO (2024), suggesting that error mitigation does not depend solely on technology, but also work processes that integrate different categories

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Professionals in the care and accuracy in patient identification.

Finally, a critical analysis reveals a relevant distinction regarding the impact of these... flaws. If most authors (BARBOSA et al., 2021; MONTEIRO; EGITO, 2024; SILVA; BELO (2025) justifies the need for improvements based on patient safety and... diagnostic accuracy, SANTOS et al. (2021) offer a pragmatic approach to measuring The financial impact. By quantifying which recollection errors generated costs exceeding R$ 23,000.00 in a specific time frame, SANTOS et al. (2021) demonstrate that the Managing the pre-analytical phase is also a matter of survival and of Institutional sustainability. This economic perspective contrasts with the exclusively institutional focus. clinical findings from other studies reinforce the idea that laboratories that ignore pre-test quality... analytical processes incur waste that compromises both clinical effectiveness and... financial viability.

The financial impact of pre-analytical errors is also a key point in the analysis. de SOUZA et al. (2024). In reporting that 77% of the total costs of a biochemistry laboratory Clinical outcomes were influenced by errors in collection and an excess of tubes, the authors highlight. that poor quality in the pre-analytical phase is not just a patient safety problem, but also a severe financial challenge, requiring audits and processes aimed at quality.

In summary, the dialogue between the works analyzed reveals that, regardless of methodology or scenario — whether in literature reviews that point to the causes of errors (RODRIGUES et al., 2022; MORAIS et al., 2023) or in case studies that measure impact and propose improvements (FERREIRA et al., 2024; SOUZA et al., 2024; NASCIMENTO et al., 2024) — the solution necessarily involves the harmonization of processes, education continued teamwork and constant monitoring through validated indicators.

In short, the literature converges on the understanding that the pre-analytical phase is not... It's not just a technical step, but also a strategic management process. While the studies de SILVA; BELO (2025) & MONTEIRO; EGITO (2024) reinforce the need for control in the execution of tests to guarantee diagnostic safety, AZOCAR GONZÁLEZ et al. (2024) and SANTOS et al. (2021) demonstrate that the solution necessarily involves Multiprofessional integration and cost optimization through reduced re-collection. Therefore, the discussion points to a laboratory model in which quality control is, Simultaneously, a commitment to providing care and a strategy for operational efficiency.

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FINAL CONSIDERATIONS

Conducting this integrative review allowed us to consolidate the evidence that the pre-phase The analytical stage is the most critical and vulnerable in the diagnostic process, accounting for between 60% and 90% of laboratory failures. Studies have unequivocally demonstrated that the nature manual and decentralized approach to the initial steps — from patient orientation to transportation. of the samples — favors the emergence of biological and technical interferents, with emphasis for hemolysis and fasting variables. Such inconsistencies not only compromise the patient safety, impacting approximately 70% of medical decisions, but also imposing a high "cost of non-quality" for institutions.

The analysis of the articles showed that the waste of resources and the rework generated by Recalls compromise the economic sustainability of laboratories, especially in the sector. public. Given this scenario, the strategic role of the biomedical professional proves indispensable. serving as a link between quality management and operational routine. It is concluded that mitigation Error reduction depends on rigorous standardization through SOPs and investment in education. continued multidisciplinary teams and constant monitoring of indicators performance.

Furthermore, rigorous monitoring of HIL indices and conducting a thorough clinical history are essential. Detailed information is essential to avoid false or altered reports that mimic existing conditions. Pathological errors lead to unnecessary treatments. Diagnostic accuracy must be maintained. for a proactive organizational culture that prioritizes traceability and continuous validation. of all pre-analytical variables. Therefore, quality at this initial stage must be considered not only as a regulatory requirement, but also as an ethical commitment and Fundamental administrative process to ensure the reliability of the reports issued and excellence. in the comprehensive care provided to the patient.

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