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Journal of Clinical and Laboratory Research
Karen Cristina Barbeiro *

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Review Article

Re-Print: Importance of Quality in the pre-Analytical Phase

Karen Cristina Barbeiro

FHO - Hermínio Ometto Foundation - (Collection technique II). Araras, SP, Brazil.

***Corresponding Author:** Karen Cristina Barbeiro, FHO - Hermínio Ometto Foundation - (Collection technique II). Araras, SP, Brazil.

Received Date: January 03, 2024 | **Accepted Date:** January 26, 2024 | **Published Date:** February 02, 2024

Citation: Karen C. Barbeiro (2024), *Re-Print:* Importance of Quality in the pre-Analytical Phase, *Journal of Clinical and Laboratory Research*. 7(2); **DOI:**10.31579/2768-0487/120

Abstract

The laboratory examinations in the diagnostic medicine assist doctors in clinical decisions, discoveries of diseases and, finally, in verifying the evolution of t h e patient in the face of treatments, being the responsibility of the laboratory, the performance and delivery of the result in a precise and reliable way. For this, we divided the analysis into three phases: pre-analytical phase encompassing the choice of the exam by the doctor, until the transport of the sample to the analysis site, the analytical phase where the analysis takes place and finally, the post-analytical phase where it is released and interpreted the results. The pre-analytical phase is the least automated and has the participation of the largest number of professionals from different areas, so the possibility of errors is greater, impairing the quality of the sample and interfering with the results of the exams, causing a great impact on the patient's life. This study aims to inform health professionals about the importance of a well-executed pre-analytical phase, preventing future errors.

Key words: pre-analytical phase; quality control; clinical laboratory techniques

Introduction

Diagnostic medicine laboratories play an important role in medical decisions for patients. It is therefore important to establish trust and confidence in laboratory reports. In order to reduce errors and increase the safety and reliability of pre-analytical processes, a series of activities are required aimed at the continuing education of professionals involved in the processes of obtaining and handling biological samples. Diagnostic medicine services are therefore required to take responsibility for alllaboratory tests and seek to reduce errors. (1)

There are four reasons for requesting a laboratory test:diagnostic support; monitoring (e.g. drug effect); screening and research (understanding the disease). As a result, the number of laboratory tests available to doctorshas grown since 1920, when Folin and Wu used the firstserum glucose quantification test. The current list of tests offered by a large laboratory exceeds 3,000 analytes. (2) A test is appropriate when it is effective, properly indicated, inexpensive and available to the population.

When requesting a test, the cost/benefit ratiRoBmACu.s2t0b22e;5a4s(s4e):s3s5e1d-3,5i9.e. whether the test will be beneficial for diagnosis,prognosis or treatment. Otherwise, the test may be unnecessarily expensive and increase the risk of incorrect results, leading to new investigations and erroneous changes in therapy, delays in diagnosis or increased hospitalization.(3) The correct and routine training of the professionals who collect the diagnostic blood specimen (arterial, venous and/or capillary blood), with regard to thecorrect posture of the patient, the time of collection, the time the tourniquet is applied, the inappropriate procedure for constricting the forearm muscle and the correct sequence of tubes in vacuum system collections, are essential conditions for the quality of the result(4). To maintain this quality, we also divide laboratory procedures into three distinct phases: pre-analytical, analytical and post-analytical. Of all the phases, the pre-analytical phasehas the highest number of recorded errors, and is therefore the one most depreciated by the public.health professionals.(5)

It's important to note that early detection of errors will prevent biological samples from being re- collected andadditional costs due to repeat analyses, which, in additionto compromising the reputation of laboratories, can appear to be an inefficiency in the quality of the serviceprovided(6). Other reasons for the reason for the high failure rates in this laboratory stage is the low level of automation, the difficulty in controlling the items in this stage, such as the informationgiven by patients during questioning on the eve of the test,for example, omitting to check if they are fasting, havetaken medication or exercised, which can compromise thequality of the test. Thus, the success of the pre-analytical phase depends not only on the health professional, butalso on the patient's compliance. (7) Therefore, erroneous results can jeopardize the interpretation of a disease and the prescription of treatment. For this reason, External Quality Control in clinical laboratories aims to increase the quality of the services provided for the patient. (8) Finally, technological developments have been a driving force behind the implementation of quality concepts in clinical laboratories. However, the new practices cause an increase in the cost of laboratory processes and do not always keep pace withthe growth in remuneration from paying sources. On the contrary, clinical laboratories, particularly in Brazil, havecome under pressure from supplementary health serviceproviderstoreduce the costs of carrying out tests. (3) Medical services need reliable laboratory support tomake appropriate decisions and formulate policies. Thelaboratory accreditation

system is necessary for the acceptance of test results at national and international level. This process has a positive impact on the image of theinstitution, giving reliability to the quality of the services,which translates into trust both for the professionals whoare part of the institutions and for the clients and users ofthese services.(9)

Theoretical Framework

The clinical analysis laboratory

The clinical analysis laboratory assists in diagnosticand therapeutic choices by issuing reports, which are documents containing the results of laboratory analysis, validated by the technical manager. (10) It is therefore necessary to be assertive in the results issued, as these data influence the decision making of the requesting physicians and the diagnosis of patients. (1) In health care,services that assist in the medical management of patients' clinical situations are essential. In this context, clinical analysis laboratories are fundamental, as they contribute to health care and promotion through the operation of different sectors (hematology, biochemistry, immunology,etc.), bacteriology, parasitology and uroanalysis, among others) and,due to advances in automation, they can act in an interrelated way in the analysis of various biological samples (blood, urine, feces, cerebrospinal fluid, sputum, among others) and in the issuing of reports (biochemical, hematological, immunological, microbiological,uroanalysis) containing the patient's physiological state, inaddition to issuing results quickly, precisely, accurately and reliably. Once they have been correctly interpreted by the doctor, they can prove, establish or add to a diagnosis that isconsistent with the patient's clinical history. In this way,laboratory tests can influence approximately 70% of the medical decisions made about a patient.(6) In order to have a trustworthy organization, it is important to have control of all procedures, identifying faultsand taking action to reduce their consequences. For this reason, it is important to constantly train staff, from reception to the release of the report, keeping them up todate, providing the Standard Operating Procedure (SOP) ifthere are any doubts during a procedure, identifying thecauses of failures and intervening effectively before theyreach the patient, causing inconvenience or compromisingtreatment or even inflicting any risk to their health.(8) It is worth noting that releasing an incorrect report can lead to an increase in medical consultations and laboratory and imaging tests, increasing the cost of health services.(3) Therefore, biosafety measures in laboratories aim toreduce or eliminate the risks inherent in the activities, witha view to the health of patients, preservation of the environment and the quality of results, and it is worth emphasizing that professionals must be aware of thesemeasures and be trained and evaluated. Effective guidanceprocedures to promote standardization, harmonization, detection and the handling of samples by competent and well-trained personnel are essential to guarantee a resultwith the optimum degree of accuracy, precision and reliability provided by the laboratory. (8)

The analytical phases in the clinical analysis laboratory

Tests in the clinical analysis laboratory go through a series of phases, which are used to obtain a laboratoryreport that will help diagnose the patient and begin outside the laboratory. (1) The process that ends in the execution of a laboratory test begins with the clinical evaluation, where a diagnostic hypothesis is establishedand the tests are requested. The final process takes the form of the doctor using the information generated by the laboratory.(3) This cycle is made up of the following phases: pre- analytical, analytical and post-analytical, which are subjectto various possible errors that affect the quality and reliability of the result.(2) The pre-analytical phase begins after the doctor has defined which tests to order, taking into account other tests, patient reports and anamnesis; it continues with preparation for collection, when it is important to provide guidance on medications to be used or avoided, hygiene care, diet, among others; after this stage, the collection, handling and storage of the specimen begins before analysis.(5) Intheanalyticalphase, thesampleis analyzed. Thisstageisthe most automated and its control includes evaluatingparameters such as precision, sensitivity, specificity andaccuracy, among others. When evaluating these indices,attention must be paid to the calibration of the equipment, the conservation of reagents and the use of mathematical calculations, such as the Levey-Jennings control chart, which analyzes the imprecision of a given analyte.(7) Finally, in the post-analytical phase, the test results are delivered in accordance with current legislation, taking into account legal aspects and subsequent analysis by thedoctor, who will use the data provided as a reference toconclude the diagnosis and start the appropriate procedure.To this end, it is important that professionals in clinical analysis laboratories follow the recommendations in order to reduce errors that can occur during the three phases. They are also related to patient orientation for the collectionprocedure, the execution of the collected material and theevaluation of the agreement in the result, thus offeringsecurity in the medical diagnosis. Therefore, all the variableslisted are subject to recurring errors in clinical analysis and must be assessed by professionals with professional responsibility and qualifications. It is not correct to say thaterrors only occur in the extra-analytical stage, because theyinvolve people, and that machines don't make mistakes, butwith the involvement of several team members, there is a risk of increasing the probability of failures. (5) In view of this, laboratories adopt various types of methodologies to ensure the credibility, precision andaccuracy of the reports issued. This includes methods toreduce errors in the pre-analytical, analytical and post-analytical phases, internal and external quality control procedures, such as monitoring of the analyses carried out, laboratory accreditation and laboratory certification programs and patient information prior to the biological material. (6)

The pre-analytical phase

It is in the pre-analytical phase that a high number oferrors occur in the analysis of biological samples, due to the difficulty in controlling pre-analytical variables, since this phase involves numerous non- automated activities such as sample collection, handling, transportation and preparation. (11) Studies indicate that approximately 40% to70% of errors occur in the pre-analytical phase. (2) In Brazil, few laboratories have fully automated pre-analytical systems. (4)

In order to reduce error rates, it is important to instructthe patient on how to prepare when the tests are requested. According to the Brazilian Society of Clinical Pathology/Laboratory Medicine (SBPC/ML), the requesting doctor or their direct assistants should be responsible for first instructing the patient on the conditions for carrying out the test, informing them of any need for preparation,such as fasting, stopping the use of any medication, a specific diet, or even not carrying out any physical activitybefore the tests are collected. Before taking the samples, the phlebotomist must be aware of and observe relevant information about the patient, the so-called pre-analytical condition: gender, age,body position, physical activity, fasting, diet and the use ofdrugs for therapeutic purposes, smoking and alcohol consumption, as this data could compromise the accuracy ofthe results.(1) There are also variations in laboratory results that can bepredicted by taking into account non-modifiable biologicaland circadian cycles. With knowledge of these biological cycles and rhythms, it is possible to choose the best time to collect the biological sample, in which the analyte of interest is within the expected clinical parameters. It is important to note that the majority of analytes of medicalinterest can undergo significant variations as a result of the habits that precede the collection of the biological sample,compromising the precision and accuracy of the analyses.It is possible to see that in the studies investigated, the biological parameters most susceptible to alterations are the dosages ofglucose, cholesterol, triglycerides, enzymes and electrolytes.(6)

In order to carry out a collection in suitable conditions,the phlebotomist must be properly instructed and trained.They must also comply with biosafety regulations and written instructions, such as standardized manuals for venous or arterial blood collection, so that the collectionprocedure is safe for both the patient and the person carrying out the collection.(1) The antisepsis process should be carried out with circular movements from the center to the top. at the puncture site, and not with linear movements from distal to

proximal on the forearm, in order to induce venousstasis, a factor that affects the quality of the diagnostic specimen. Contamination at the puncture site can be favored by performing this procedure incorrectly. The time taken toapply the tourniquet should not exceed 1 minute. Applyingthe tourniquet during collection significantly increases the concentration of various analytes from 1 minute onwards, when compared to collection using a transdermal illumination system. To ensure that the application of the tourniquet does not interfere with the quantitative determination of the analytes, it should be removed when the needle is introducedinto the vein. The erroneous act of constricting the forearmmuscle, represented by the movement of opening and closingthe hand that many patients perform spontaneously or on request, should be monitored, as it allows us to assess thephlebotomist's level of attention and any vices. Studies haveshown that constriction of the forearm muscle causes an increase in serum potassium, significantly affecting the results and inducing a false diagnosis. (4) In 1982, Calam and Cooper observed that the order of withdrawal of blood into tubes containing additives can alterpotassium and calcium. These recommendations werevalidated by the Clinical and Laboratory Standards Institute and have been slightly modified over the years with theintroduction of plastic instead of glass tubes and thedevelopment of clot activator and gel separator additives.(12) It is also important to note that according to the Brazilian Society of Clinical Pathology/Laboratory Medicine (SBPC/ML), the World Health Organization (WHO) and the Clinical Laboratory Standards Institute (CLSI), in order to obtainacceptable quality and avoid contamination of samples by metals or anticoagulants present, a specific order is suggestedfor collection in vacuum tubes: sodium citrate (light blue), serumwith or without clot activator (red), heparin (green), ethylenediamine tetraacetic acid (EDTA, purple), oxalate/fluoride (gray). However, research carried out in Belgium has shown that there is no relevant interference inlaboratory tests, regardless of the order in which the tubes arecollected. However, this statement still needs to be analyzedcarefully, as it contradicts the common sense that had existeduntil then about the importance of the order of collection. (10)

Observing the correct homogenization of the specimen diagnostic makes it possible to monitor a critical stage ofthe phlebotomy procedure. Correct homogenization the complete inversion of the tubefollowed by the return to the initial position for the numberof times recommended by the manufacturer. (4)

To keep patient and sample identification safe, at leasttwo forms of identification should be used

f o r the tubes collected. For example, the patient's full name anddate of birth should be asked clearly and objectively, and the samples should be identified at the time of collectionor at the time of delivery to the clinical laboratory. Biological samples from patients must be transported and preserved in isothermal containers, where required, whichare hygienic, impermeable, identified with the biohazardsymbol and the words "Specimens for Diagnosis", and with the name of the laboratory responsible for sending them, guaranteeing the stability of the collection until the test is carried out. Once the samples have been collected andproperly identified, they should be sent as quickly as possible for processing, which may be located in the samephysical structure where the collection took place, or atvarying distances. According to the Mercosur Standardization Association (AMN), which drew up the Mercosur Standard (NM311-4:2009), which establishes the criteria for rejectingbiological samples in clinical laboratories, the samples must be collected, identified, transported and processedin accordance with the rules, with the aim of reducing pre- analytical treatment interferences. For laboratory results to be accurate, samples must be representative, so, they must present the patient'shomeostatic conditions at the time of collection. For this reason, samples that show one or more of the following characteristics should be rejected:

- Clotted sample for tests such as blood count and coagulation tests;
- Collection carried out with incorrect anticoagulant;
- Tubes collected with the wrong proportion of blood andanticoagulant;
- Tubes containing samples with incorrect identification;
- Incorrect tubes and no patient identification;
- Hemolyzed, lipemic or insufficient blood samples;
- Samples not transported properly. (1)

Some publications contain the indicators most used byclinical laboratories and their limits of acceptability. This dataenables other laboratories to monitor their processes insearch of improvement. In addition, the improper choiceof laboratory tests or their panels also can be considered a pre-analytical error. For all these reasons, during the request for a laboratory test, the requesting doctor must give precise and clear instructions on the precautions necessary before collecting the biological sample, since the patient is not a null factor and is capable of compromising the quality of the service provided. Inaddition, the patient should contact the laboratory before the sample is taken to reinforce the information receivedand eliminate any relevant doubts. (6)

Laboratory errors and their impact on patients

Errors in diagnosis are a major threat to patient safety,as they can lead to fundamental delays and/or missed diagnoses, especially when it comes to patients with seriousmedical conditions such as heart disease, endocrine diseasesand cancer. It is estimated that approximately 70% of alldiagnoses are made on the basis of laboratory tests, and that their results are responsible for affecting between 60% and 70% of decisions on patient admission, discharge and treatment regimen. (1)

Risks define laboratory indicators as numerical measures of errors or failures in a given process in relationto its total number (hits and errors). They are specificationsof quality, because the performance of a process is adequate when it is within the limits set by the indicators.Their aim is not just to provide answers, but to point outpotential problemRsBtAhCa. t20re2q2; u5i4r(e4) p:3re51v-e3n5t9ive action. (3)

The pre-analytical phase has failures ranging from 46%to 68.2%, the most common of which are insufficient samples, collection errors, inadequate handling and transportation and incorrect identification. In the analytical phase, errors can vary from 7% to 13%, and canoccur when samples are exchanged, interference and equipment malfunctions. Finally, in the post-analytical phase, where 18.5% to 47% of errors occur, the vast majority are due to incorrect entry of information, data andresults. Generally, when errors start in the pre-analyticalphase, they are only corrected in the last stage of the laboratory process. (8)

The relevance of pre-analytical errors as a public health problem is related to potential harm to patients and extra costs for the system. Increasing automation inhealth services is not always the best indication in terms ofquality control, as it can expose patients to risks and systematic errors beyond their control, which could putpatients at risk and lead to unnecessary costs.(13) We shouldnote that the most important element of pre-analytical in the production of errors in the pre-analytical phase is dueto human activity, in which multiple individuals interact in the diagnostic specimen process.(5) These problems generally result from staff turnover, negligence, lack of understanding of good laboratory practices and ineffective training.(1,2)

Patient safety and confidence in the clinical analysis results issued are currently a priority in laboratories. The occurrence of errors is also related to failures in the planned action, whether intentional or not, or to the application of an incorrect plan in the procedure. (8) In orderto minimize pre-analytical errors, it is necessary to correctly advise patients regarding the need to fast prior to sample collection, the suspension of strenuous physicalexercise in the period prior to collection, and other information regarding smoking habits and the period ofthe menstrual cycle. It is important to obtain informationon the use of medication and therapeutic drugs. The mainerrors

are also in the identification of samples, inadequatefilling of tubes, hemolysis and lack of information about thepatient.

Therefore, the right training is needed in order to carry out the task. When collecting biological materials invasively (arterial, venous and/or capillary blood), to avoid interfering with laboratory results, such as the patient's posture at the timeof collection, the time the tourniquet is applied, the effect of constricting the forearm muscle before puncturing, thecorrect order of the tubes in vacuum system collectionsand homogenization. To avoid major errors in the pre- analytical phase, at the time of collection, the punctureshould not be carried out in areas where previous punctureshave been carried out, such as mastectomies, intravenous infusions, edema, hematomas; "do not apply tourniquets", because hemolysis can occur, especially in elderly patientswith atheroma, because the plaque could be displaced,with serious consequences.(5)

These are the main changes that resulted in the errorsdescribed in the research:

- time in storage (78.6%);
- time with the tourniquet (78.6%);
- techniques of the phlebotomist (64.3%);
- incorrect information to patients (64.3%);
- incorrect blood/anticoagulant balance (57%);
- incorrect tubes (50%);
- samples with some kind of contamination (43%);
- medicines (29%);
- variations between laboratories (29%).

The demonstration of laboratory errors varies according to the laboratory and depends on a good QMP (Quality Assurance Program) that is evaluated frequently, professional development programs or refresher courses, inwhich the laboratory worker goes through the various laboratory sections. An efficient QMP helps with the choice of methods, equipment, reagents and personnel, as well as promoting constant observation of all activities. Itsaim is to increase the safety of results and effectively guarantee a quality end product. (7)

Management and quality in the clinical analysislaboratory

Quality is defined as compliance with user and/or client requirements, and refers to the satisfaction of needsand expectations. It is therefore important that health services focus on the individuals who use them directly or indirectly. With the complexity of laboratory processes, it is necessary to implement quality programs in order to improve the quality of the service, increase productivityand lower costs. (14) A quality management program is indicated for improvements in laboratory processes using risk management and process improvements. (1)

Management requires organizing the main laboratory processes involved:

- People management;
- Infrastructure;
- Information technology;
- Equipment management;
- Customer service;
- Production of laboratory tests;
- Biosafety;
- Business management;
- Logistics;
- Quality management;
- Environmental management;
- Project management.

In Brazil, the RDC (Collegiate Board Resolution) thatregulates the operation of clinical laboratories is No. 302/2005. It was published on October 30, 2005, and clinicallaboratories and collection points had 180 days (April 2006) to comply. This resolution had some requirementsclarified through Technical Note No. 039/2014 (GRECS/G TES/Anvisa) and RDC No. 30/2015. It is importantbecause it regulates the operation of clinical laboratories in the general organizational conditions, human resources, infrastructure, laboratory equipment and instruments, diagnostic products for in vitro use, waste management andbiosafety. It also organizes the operational processes of the analytical, pre-analytical and post-analytical phases, guaranteeing quality control and records for laboratory traceability. (14)

Quality as a management model began in Japan and was later adopted by North American and Europeancompanies.(9) In the industrial evolution of the 1920s, thewar industries needed to increase the production ofarmaments because of the World War. This led to theintroduction of inspection with the aim of evaluating theproduct and separating defective products to preventthem from being marketed. The first phase in the evolutionof quality was the creation of the production engineering department in the industries, instituting statisticalinstruments aimed at measuring and controlling quality, used for product analysis. In the decades that followed, the evolution of qualitybecame more and more important. This was especially evident in Japan, which needed torebuild economically after the war. The quality assurance phase began, with the aim of prevention. This led to concern about quality in companies. In 1950, W. EdwardsDeming created a new concept in quality called the PDCAcycle, whose initials stand for plan, do, check and act. Nowadays, quality is important for the survival of organizations in the market, especially customersatisfaction. Therefore, the need for quality, increased productivity and r e d u c e d costs have become essential for a company to remain in the market and becompetitive.(3)

The concepts of quality in healthcare are the same asin industry. A product or service that meets customer needs is a quality principle applicable to the various healthcare services. Therefore, laboratories must adopt a quality management system with controls for all phases, inorder to identify and deal with non- conformities, applyingcorrective and preventive actions, with the aim of guaranteeing the quality of laboratory analyses, correct diagnosis and minimizing negative impacts on patients' health. (9)

The SBPC/ML (Brazilian Society of Clinical Pathology/Laboratory Medicine) has played a fundamental role in the history of quality and laboratory accreditation. When it was founded in 1944, its statute already had the objective of setting standards for the performance of different types of laboratory tests. laboratory tests. In the 1970s, he recommended revisingand adapting the practices of the College of American Pathologists (CAP) to the Brazilian reality, with the Brazilian Journal of Clinical Pathology, a publication of the SBPC/ML itself.

In 1977, it obtained a contract with Control-Lab andwas thus able to set up the first internal and external qualitycontrol program in the country, called Programa de Excelênciade Laboratórios Médicos (PELM), and in 1998 it createdPALC (Programa de Acreditação de Laboratórios Clínicos),which were revised and updated in 2004, 2007 and 2010.PALC provides Brazilian laboratories with a guideline forcontinuous quality improvements, mainly due to peer audits, i.e. by laboratorians, allowing for the exchange of technical knowledge between auditors and auditees. Recently, in partnership with Control-Lab, SPBC/ML made the Laboratory Indicators Program available, giving Brazil's clinical laboratories the possibilityof standardizing indicators, as well as comparing them. In 1999, the ONA (National

AccreditationOrganization) was created with the aim of implementingimprovements in the quality of health care, encouraging services to achieve high quality standards (www. ona.org.br). In 2001/02, the National Health Surveillance Agency (ANVISA) officially recognized the Brazilian Accreditation System through Resolution No. 921/02 and signed an agreement with ONA for technical collaborationand staff training, which included the participation of theSBPC/ML. (3)

In the provision of health services there are two basiccomponents of quality: operational, corresponding to the process, and perception, in which the clients' view of the service offered is noted. Both are measured by quality indicators and by the recognition obtained through certification or accreditation processes. (3) The indicators also allow for internal and external comparisons with other services with the same characteristics. In quality management, they are called control items. (2) Certificationis also important, as it proves that certain products, processes or services are carried out or fulfilled in accordancewith specified requirements, as is the case with International O rganization for Standardization (ISO) standards. In accreditation, processes are evaluated in order to verify their suitability for the services being offered, as well as compliance with the requirements demanded in a certification. For example, accreditation of the National Accreditation Organization (ONA), the Joint Commission on A ccreditation of H ealthcare O rganizations (JCAHO) and the Clinical Laboratory Accreditation Program (PALC) of the Brazilian Society of Clinical Pathology/Laboratory Medicine (SBPC/ML). (3)

Quality in the pre-analytical phase of laboratory medicine is essential. Thus, we can define indicators that are related to the overall quality management system in laboratories, which is fundamental to reducing vulnerabilities, emergence and the proliferation of errors. (13) It is therefore important to reconcile cost andbenefit, paying attention to the quality of the service. The quality movement, known as Total Q uality Management (TQM), has brought about practical changes in management, both in the production of goods and in the service sector. Initially, this movement focused more onthe technical quality standards defined by professionals inthe sector and, later, began to consider and pay attentionto the quality standards and expectations perceived bythe customer. In this respect, the literature indicates that satisfied customers bring benefits to companies, as theytend to make repeat purchases from the same supplier, as well as spontaneously contributing to the company's "word of mouth" advertising. (15)

Even with all the recognition of the pre-analytical phase, it lacks specific indicators within the quality management system in clinical laboratories, making it more vulnerable to the appearance and increase of errors. This finding characterizes the dark side of the problems associated withlaboratory quality. (4)

Material And Methods

In order to present the proposed theme, research wascarried out on scientific databases. The articles were analyzed for their recognition of the topic. In view of thenew circumstances in which clinical analysis tests havebecome essential for medical diagnosis, this study aimed topresent a tool to avoid errors in the pre- analytical phase, through a literature review, with data collection in the National Library of Medicine (PubMed) and Scientific Electronic Library Online (SciELO).

Conclusion

From the studies analyzed in the review, it can be seenthat pre-analytical errors will always occur, as it is a phase which involves the largest number of people from differentareas and backgrounds. However, they can be minimized with the support of quality control strategies adopted byeveryone who works in diagnostic medicine. However, it isimportant to maintain knowledge of the consequences of laboratory errors and their impact on health care, which can mean losses to the public purse and unnecessary expenditure on medicines and medical procedures, prolonging hospitalization time, new biological sample collections, repeat tests or even delaying or not performinga surgical intervention. Errors during healthcare can have serious consequences for the patient, ranging fromdisability to death.

With this review, we hope to organize information that will be of great value in alerting all professionals to theimportance of the pre-analytical phase for medical diagnosis.

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