Chapter 04

Nursing Management in Blood Sample Collection. Organization, Preanalytical Phase, and Quality of Care (English Version)
ISBN: 978-9915-9869-8-2
DOI: 10.62486/978-9915-9869-8-2.Ch04
Pages: 21-30

©2024 The authors. This is an open access book, distributed under the terms of a Creative Commons Attribution (CC BY) 4.0 License.

Findings on the practice, organization, and timing of the process

Hallazgos sobre la práctica, la organización y el tiempo del proceso

Existence of protocols or guidelines for blood collection

Analysis of the responses revealed a marked perception of the absence of regulatory tools to guide the practice of blood sampling. Most nursing professionals indicated that they do not have specific institutional protocols or guidelines for standardizing this procedure.

In terms of distribution, four-fifths of the respondents reported the absence of formal documents regulating the technique, operational sequence, or quality criteria associated with blood collection for laboratory testing. Only a minority reported the presence of any guidelines or protocols applicable to this practice.

This finding suggests the presence of potential variability in the execution of the procedure, depending largely on individual experience, informal knowledge transfer, and the internal dynamics of each shift or care unit.

In relation to the importance of a study, they suggest that interference related to the activity of healthcare personnel (doctors, nurses, and laboratory staff) is generally due to noncompliance with operating standards. Among the most frequent methods are errors in sample collection, identification, and handling; delays in sending samples to the laboratory; incomplete or incorrect patient preparation; incomplete collection in the case of serial samples; and inaccurate, incomplete, or illegible information sent to the laboratory.[29]

One of the main purposes of laboratory test results is to reduce the doubts that arise in medical reasoning as a result of the patient's clinical history and physical examination. For the clinical laboratory to adequately serve this purpose, it is essential that all phases of patient care be carried out in accordance with the highest principles of technical correctness, taking into account the existence and importance of various biological variables that significantly influence the final quality of the work.[12]

Health and safety requirements oblige clinical laboratories to incorporate the concept of quality into their daily tasks, mainly because they are health services that affect the quality of life of the population. One way to improve care in health institutions is to measure quality indicators aimed at monitoring the main processes that occur in them and the subsequent implementation of improvement actions to achieve the established goals.[48]

Various authors stress the importance of defining and constructing indicators that focus primarily on the critical points of the processes, especially those that have the greatest impact, according to the interests of the organization.[49,50,51]

Nursing staff perceptions of the laboratory service

Most of the respondents (62 %) reported being dissatisfied with the service provided by the laboratory, followed by those who reported being satisfied (38 %). No one reported being very satisfied.

A study argued that, as an integral part of a healthcare institution, every laboratory should have a quality management program based on the organized participation of all laboratory members, aiming for long-term success through patient satisfaction and providing benefits for all laboratory members and society. In this way, the quality of analytical results can be achieved through continuous review of procedures (continuous quality improvement), correction of problems when they are detected (corrective actions), and even prevention of such problems (preventive actions), as well as the study of the efficiency of the information generated.[52]

No studies have evaluated satisfaction globally; the studies consulted analyzed satisfaction in a specific and segmented manner according to various quality indicators.[43,44,52,53]

Although our study revealed low levels of satisfaction with the service provided by the laboratory, the possible causes were not investigated. This could be the subject of future research using a more qualitative study method, with the aim of gaining a more comprehensive view of the problems affecting the processes.

Training of nursing staff in obtaining blood samples

Analysis of the collected responses revealed that a low proportion of professionals had received formal training in blood sampling procedures for clinical analysis. The vast majority of the nursing staff stated that they had not participated in structured training related to this practice.

Only a small fraction of respondents indicated that they had received any specific training, whereas the prevailing perception reflected a lack of systematic training in techniques, quality criteria, or updating of protocols related to the blood collection process.

This finding suggests that the performance of the procedure could be based mainly on experience acquired during daily practice, informal knowledge transfer among colleagues, and individual adaptation to service routines. In highly complex clinical settings, such as neonatal and pediatric intensive care units, this situation can lead to variability in technique, adherence to preanalytical standards, and consistency of processes.

A study evaluating the quality of management of a hospital clinical laboratory in Costa Rica interviewed 42 people, 71,4 %[30] of whom had received fewer than 11 training sessions per year. Although our study did not quantify the number of qualifications received per year, a priori, the results are much lower than those reported.[53]

Antiseptics used in blood collection

The distribution of responses revealed a clear predominance in the use of 70 % alcohol as an antiseptic agent prior to blood sampling. Most nursing staff indicated that they routinely used this product, whereas a considerably smaller proportion reported using povidone-iodine.

The marked preference for 70 % alcohol suggests the adoption of practices in line with widely disseminated recommendations in clinical settings, where this antiseptic is valued for its rapid action, adequate efficacy, and lower potential interference in certain biochemical determinations.

The lower frequency observed in the use of povidone-iodine could be associated with operational criteria, institutional availability, or habits acquired in daily practice. However, the variability identified highlights the importance of having clear guidelines that favor the

standardization of procedures within healthcare units.

These findings are consistent with those of other studies, such as the randomized study conducted by a study. In the emergency departments and inpatient wards of a university hospital, they compared the effects of four different skin preparations (10 % povidone-iodine, 70 % isopropyl alcohol, 47 % iodine tincture with ethyl alcohol, and 70 % povidone-iodine with ethyl alcohol) and reported that alcohol-based formulations were more effective than povidone-iodine in reducing the rate of blood culture contamination (2,51 % vs. 3,15 %; p=0,006). However, the authors defined a drying time of at least one minute for all antiseptics in their protocol, which is insufficient for povidone-iodine to reach its maximum bactericidal activity.

In vitro studies have indicated that povidone-iodine has greater bactericidal activity than chlorhexidine does, but the results are not consistent in vivo because of the neutralization of iodinated compounds by the presence of fat, blood, and proteins on the skin surface. In in vivo studies, alcohol has shown great immediate bactericidal activity, whereas chlorhexidine gluconate and povidone-iodine appear to have greater residual bactericidal effects.[46,54,55]

Perception of the importance of the order in which tubes are filled

Most nursing professionals stated that they recognized the importance of the order in which tubes are filled during blood sample collection. A majority of respondents considered the filling sequence to be an important aspect of the procedure, whereas a minority indicated that they did not attribute significant value to it.

This result suggests that there is widespread awareness of the influence that the order of collection can have on the quality of samples and, consequently, on the reliability of the analytical results. The order of filling, associated with the prevention of cross-contamination between additives and anticoagulants, is a key element in the preanalytical phase.

However, the presence of responses that relativize its importance reveals the persistence of conceptual variability among professionals, which could reflect differences in training, in the transmission of operational knowledge, or in the availability of explicit institutional protocols.

The preanalytical phase is when nurses fill the blood sample tubes. According to various authors, the most frequent errors detected in relation to sample collection are poor quality due to hemolysis, clotting, or turbidity; insufficient quantity; inappropriate tube; and improper collection.[41,56]

Our responsibility as nurses requires us to develop guidelines for the correct order of filling blood sample tubes, in addition to taking into account other characteristics of the patient who may have a decisive effect on the quality of the final results.[27,47]

The order of the tubes is important to prevent contamination of the samples by unwanted anticoagulants.[47]

The purpose of a laboratory test is to determine the concentration or activity of a diagnostically relevant analyte in a sample to provide information about the patient's clinical condition. This means that the composition of the samples to be analyzed must not change during the preanalytical phase (sampling, transport, storage, and sample preparation).[57]

Sample collection times in the laboratory

The distribution of responses revealed considerable variability in the time elapsed between blood sample collection and collection by laboratory staff. A significant proportion of professionals indicated that this interval exceeds 45 minutes, making this the most frequently reported category.

A significant group of respondents indicated that the waiting time was approximately 30 minutes, whereas a smaller fraction reported shorter intervals, closer to 15 minutes. These results reveal the coexistence of different operational dynamics within the sample processing circuit.

The predominance of long periods suggests the possible presence of delays in logistics flow or in the coordination between healthcare units and the laboratory. In the preanalytical phase, these intervals are particularly important, as they can influence the stability of certain analytes, sample preservation, and the timeliness of clinical decisions.

The variability observed could also reflect differences in workload, internal service organization, or the availability of resources for sample transport.

In a study conducted in Catalonia, Spain, reported that, in relation to the perception of this waiting time, 15,3 % said that the time they waited was very short, 15,3 % said it was short, 39,9 % said it was adequate, 22,4 % said it was long, and 7,1 % said it was extremely long.[58]

In a report published by the International Federation of Clinical Chemistry and Laboratory Medicine (IFCCE), a study reported that clinical samples must be transported under appropriate conditions, using refrigerators equipped with thermometers to ensure that the correct temperature is maintained throughout the journey, as well as recording the time elapsed between blood collection and arrival at the clinical laboratory;[59] hence, the speed between sample collection and arrival at the laboratory for processing is important.

Clinical laboratory response times

The responses from the nursing staff reflected a heterogeneous distribution in relation to the time required by the laboratory to issue the analytical results. The predominant category corresponded to intervals of approximately 60 minutes, as indicated by the majority of respondents.

A significant group indicated that results are usually available in approximately 30 minutes, whereas a smaller proportion reported shorter times, approximately 15 minutes. This variability suggests differences in processing circuits, laboratory workload, or the nature of the tests requested.

The predominance of longer response times is particularly important in neonatal and pediatric intensive care settings, where clinical decisions often depend on the timely availability of diagnostic information. In this context, the time between sample collection and result issuance is an essential component of perceived quality of care.

The data collected show that, from the perspective of nursing staff, response times are not uniform and can be a relevant factor in the dynamics of care, especially in situations that require immediate clinical intervention.

Most laboratory results are reported one hour after the sample is taken (62 %), followed by those reported after half an hour (30 %) and, finally, those reported after approximately a quarter of an hour (8 %).

A clinical laboratory study in the Cariarien Health Area of Costa Rica, conducted by a study, reported that the most critical point in response capacity was the waiting time to receive the result. Most of the interviewees (65 %) felt that this time was too long, which coincides with our results. Researchers have suggested that this could be due to the complexity of the laboratory analysis processes and the unjustified downtime.

The lack of personnel in hematology, serology, clinical chemistry, and urinalysis is one of the causes of delays in processing analyses. Another source of the problem is the lack of high-tech equipment and the automation of various procedures. In the case of emergency tests, there are delays in delivery because the doctor requests tests that are not included in the basic emergency package, thus delaying the results.[53]

After reviewing the available scientific evidence, each laboratory measurement or test must have a defined response time, understood as the maximum time that can elapse between the arrival of the request at the clinical laboratory and the issuance of the result. Failure to meet response times is another cause of error at this stage. It is recommended that a document containing this information be made available to all clinical laboratory staff so that everyone is aware of the need to comply with these response times. It is also advisable to periodically review compliance with response times, especially in areas where it is of utmost importance, such as the emergency laboratory.[59]

Perception of factors associated with coagulation and hemolysis

The responses obtained revealed diversity in the perceptions of the nursing staff regarding the factors that can influence coagulation or hemolysis in blood samples. Although different potential causes were identified, the most frequently selected option was the simultaneous recognition of all the proposed factors.

More than half of the professionals considered that variables such as the time elapsed between collection and processing, the extraction technique, inadequate sample volume, and agitation during homogenization can jointly contribute to altering sample quality. To a lesser extent, some respondents pointed to specific factors in isolation.

This pattern suggests a general understanding of the multifactorial nature of preanalytical errors, particularly in relation to the physical and biochemical integrity of samples. However, the question design did not allow for the establishment of hierarchies or levels of impact among the factors mentioned, which limits interpretation in terms of operational prioritization.

The observed distribution suggests that, from the staff's perspective, alterations such as coagulation or hemolysis are not attributed to a single element but rather to the interaction of multiple conditions in the process.

Although respondents differentially identified the factors that influence coagulation/ hemolysis in a sample, more than half identified all the factors as incidents (58 %), although this question did not consider the order or hierarchy of these factors.

Table 1. Distribution of staff according to their perceptions of factors considered to influence the coagulation/hemolysis of a sample

Factors considered to influence the coagulation/ hemolysis of a sample	N	%
Time elapsed between sample collection and processing	14	28
Extraction technique	5	10
Poorly leveled sample	1	2
Vigorous shaking when homogenizing samples	1	2
Related to catheter size	0	0
All are correct	29	58
Total	50	100

Experience shows that most errors, 70-80 %, occur in the preanalytical phase. Inadequate patient identification and sample collection are errors related to nursing work and are those for which the nurse is responsible.

The main failures related to sample collection include poor quality due to hemolysis, clotting, or turbidity; insufficient quantity; inadequate tubes; and improper collection. Errors in this phase have a significant impact on measurement results, leading to variations in clinical judgment, whereas mistakes in the other phases involve minor changes.[42,60]

Perception of the volume of blood discarded prior to sample collection

Analysis of the responses revealed marked heterogeneity in the perceptions of the volume of blood discarded prior to obtaining samples for laboratory testing among the nursing staff. The options selected showed wide dispersion, reflecting variability in the criteria applied during clinical practice.

A significant proportion of respondents indicated that, in neonatal patients, the discarded volume is approximately between 1 and 2 ml. However, multiple responses indicated alternative volumes or different discard criteria, both in the neonatal and pediatric populations.

The diversity observed suggests the absence of clearly established operational consensus or uniform institutional protocols to guide this technical decision. In the context of the preanalytical phase, the discarded volume is relevant, as it can influence the validity of the sample, the prevention of contamination by maintenance solutions, and the preservation of hemodynamic balance, especially in neonates.

These results highlight the coexistence of different practices within the same healthcare setting, which could lead to inconsistencies in diagnostic processes.

Research that assesses the most appropriate amount of blood to discard before a blood sample is drawn from a venous catheter (both peripheral and central) for coagulation tests revealed that the amount of blood discarded reported in the scientific literature varies greatly (from 5 ml to 25 ml), depending on factors such as the type of catheter and whether it is heparinized.

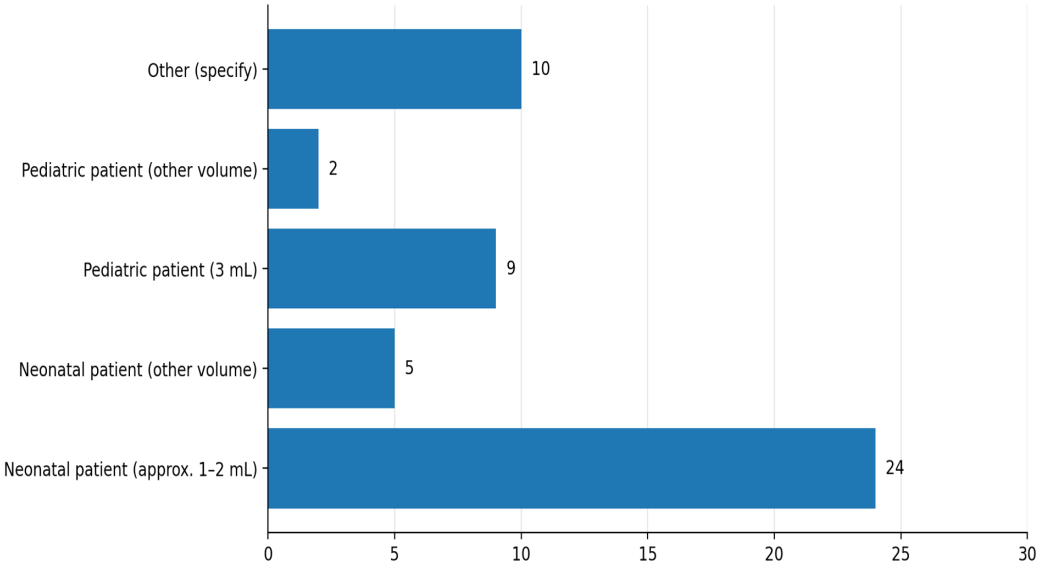

Figure 1. Distribution of staff according to their perception of the amount of blood discarded before a sample is taken to the laboratory

The Guide to Good Nursing Practice for the Care and Maintenance of Vascular Access, published by the Registered Nurses Association of Ontario (RNAO), indicates that no consensus has been reached on the most appropriate method for taking blood samples through vascular access; with regard to the "discard" method, significant blood loss (anemia) can occur over time. The amount of blood discarded reported in the literature varies widely; however, the amount must be sufficient to obtain an uncontaminated sample. Some authors recommend 3 to 6 ml.

Behaviors adopted in response to delays in sample collection

The responses of the nursing staff varied in the measures adopted in response to delays or failure to collect blood samples in the laboratory, particularly in critically ill patients. The strategies reported reflect different ways of resolving interruptions in the usual processing circuit.

Some professionals indicated that they repeatedly contacted the laboratory by telephone until the phlebotomist arrived. Others noted that, in clinical emergencies, a sample is taken directly to the laboratory by a member of the healthcare team. Consistent behaviors were also identified, such as post-poning sample collection until the arrival of laboratory personnel, especially in patients with central catheters.

To a lesser extent, some respondents said they opted for temporary refrigerated storage of samples, whereas a small group described alternative measures.

The observed variability suggests the lack of uniform operating criteria for managing these situations, which could lead to differences in the storage, traceability, and stability of samples. In the context of critically ill patients, these decisions are clinically relevant, given the potential impact on diagnostic validity and therapeutic opportunity.

Table 2. Distribution of staff according to the action taken when a blood sample from a critically ill patient is not collected by the laboratory

Action taken when a blood sample is not collected from a critically ill patient	N	%
Repeat the call to the laboratory until the phlebotomist arrives	14	28
A doctor or nurse takes the sample to the laboratory	13	26
In patients with a central catheter, the sample is taken when the phlebotomist arrives at the ward.	15	30
Store samples in the refrigerator	5	10
Other	3	6
Total	50	100

According to these results, previous studies have suggested that the laboratory is entirely responsible for all samples it processes, even those not collected within its own facility. However, it is advisable for there to be a close relationship between the clinician and the laboratory, as this will lead to better use of laboratory resources because information will be available on the services offered, response times, preanalytical quality, and reference centers, which will enable the laboratory to solve problems and, if not, to know who to contact for help in making a decision.

The collection, handling, and processing of the sample before performing the analysis are essential. The validity of the data obtained from the samples depends largely on this aspect, in addition to other aspects, such as the quality of the technique used, the proper handling of the equipment, and the use of reagents. An incorrect request for an analysis is the cause of countless errors and delays in the analytical process. It is essential to have unambiguous data identifying the patient (name, surname, age, medical record number), the doctor, and the requesting department. It is also important to know the diagnosis or clinical suspicion to avoid unnecessary repetition of tests in which values outside the analytical range are obtained.

Relationship between operating time and laboratory response

When we analyzed whether there was a correlation between the time elapsed from the collection of the blood sample until the laboratory staff picked them up and the time it took the laboratory to report the analysis results (figure 2), a statistically significant correlation was found ($r = 0,8857$; $P<0,0001$; 95 % confidence interval for $r = 0,7717$-$0,9446$).

According to a study, the purpose of the clinical laboratory is to contribute to medical diagnosis by confirming or rejecting hypotheses, thus highlighting the importance of knowing how to interpret diagnostic tests correctly.

The fact that a statistically significant correlation was found between these two variables highlights the importance of promptness not only in sample collection but also in reporting results, on which decision-making with the patient largely depends.

In this context, diagnostic tests are considered tools that aid in clinical decision-making. Their use is considered adequate or appropriate if the result answers the question that the clinician had asked before requesting the test and, at the same time, if it helps them decide on a therapeutic action that will benefit the patient.[9]

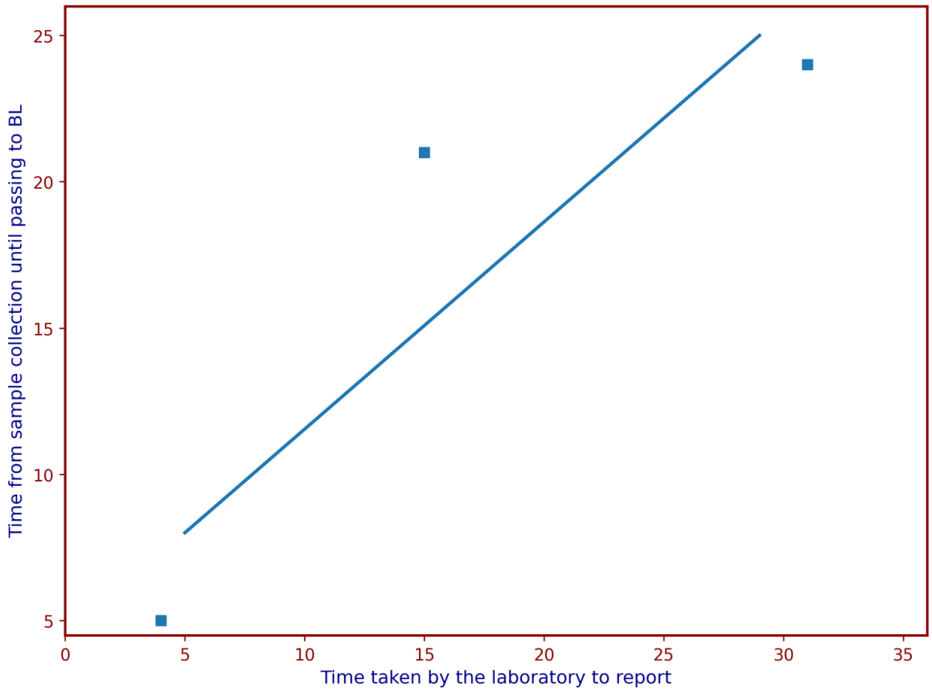

Figure 2. Correlations between variables