

## ORIGINAL ARTICLE

## ASSESSMENT OF PREANALYTICAL BLOOD SAMPLING ERRORS IN CLINICAL SETTINGS

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**Background:** Blood sampling is one of the common procedures done in every ward for disease diagnosis and prognosis. Daily hundreds of samples are collected from different wards but lack of appropriate knowledge of blood sampling by paramedical staff and accidental errors make the samples inappropriate for testing. Thus the need to avoid these errors for better results still remains. We carried out this research with an aim to determine the common errors during blood sampling; find factors responsible and propose ways to reduce these errors. **Methods:** A cross sectional descriptive study was carried out at the Military and Combined Military Hospital Rawalpindi during February and March 2014. A Venous Blood Sampling questionnaire (VBSQ) was filled by the staff on voluntary basis in front of the researchers. The staff was briefed on the purpose of the survey before filling the questionnaire. Sample size was 228. Results were analysed using SPSS-21. **Results:** When asked in the questionnaire, around 61.6% of the paramedical staff stated that they cleaned the vein by moving the alcohol swab from inward to outwards while 20.8% of the staff reported that they felt the vein after disinfection. On contrary to WHO guidelines, 89.6% identified that they had a habit of placing blood in the test tube by holding it in the other hand, which should actually be done after inserting it into the stand. Although 86% thought that they had ample knowledge regarding the blood sampling process but they didn't practice it properly. **Conclusion:** Pre analytical blood sampling errors are common in our setup. Eighty six percent participants though thought that they had adequate knowledge regarding blood sampling, but most of them were not adhering to standard protocols. There is a need of continued education and refresher courses.

**Keywords:** paramedical staff, blood sampling, errors, pre-analytical errors

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## INTRODUCTION

Blood sampling is one of the common procedures done in every ward for disease diagnosis and prognosis. The quality, accuracy and reliability of results depend on and are influenced by the pre-analytical variables.<sup>1</sup> Inappropriate pre-analytical procedures of collection, handling or storing blood samples may result in haemolysis<sup>2</sup>, making reliability of the results doubtful.<sup>3</sup> Step wise methodical venous blood sampling has an assurance to complete satisfactory clinical diagnosis and suitable treatment plan may only be designed according to the outcome of the tests.<sup>4</sup>

Even in the most advanced laboratories, delay in the processing of samples has been found as well.<sup>1</sup> Differences and discrepancies in collection of samples, which might be considered trivial, have been found to have significant effect on the results. Lack of compliance to the blood drawing standards leads to erroneous results. This misleads the medical practitioner, who relies on basic diagnostic modalities for a definitive diagnosis and thus complicates the whole diagnosis making phenomenon. Once the wrong diagnosis is made, the treatment plan is totally altered to a different direction.<sup>5</sup>

## MATERIAL AND METHODS

This was a cross sectional descriptive study carried out in Military and Combined Military Hospital Rawalpindi, between February 2014 and March 2014. A venous blood sampling questionnaire (VBSQ) was designed after consulting instructors at MH Rawalpindi, CMH Rawalpindi and Nursing School AFGMI Rawalpindi, keeping in view content validated Venous Blood Sampling questionnaire (VBSQ) designed by Karin Bölenius *et al.* for assessment of sampling errors for Sweden healthcare.<sup>6</sup> The questionnaire designed after extensive deliberation included questions regarding background characteristics (3 questions), patient identification and paperwork (2 questions), sample collection and technique (6 questions), sample storage and transport (2 questions) and error reporting and ranking (3 questions). However, the questionnaire was not tested for content, validity and reliability in Pakistani healthcare context.

It was filled by the staff on voluntary basis in front of the researchers. Sample size was 228, calculated using WHO calculator. The staff was briefed on the purpose of the survey before filling the questionnaire and consent was taken. Results were analysed using SPSS-21.

## RESULTS

A total of 228 paramedical staff was included in the study, out of which 44 were male and 180 were females. Most interesting was to note that 39.5% never received any recent education in blood sampling techniques in past 10 years where as only 37.2% received it 5 years back.

When asked about writing an error report after making a blood sampling error, 95.2% never wrote any report after making any errors. When enquired about the reason for not writing a report, 49% said that they didn't have enough time while 45% were of firm belief that there had never been any errors.

Ninety eight percent negated that there were any documented SOPs in wards for blood sampling where as 38.4% didn't even know how to apply the alcohol swab correctly before sample taking.

According to the WHO guidelines, in order to put blood in the test tube, the test tube needs to be placed in a stable stand before the blood transfer from syringe to the test tube is made. When asked in the questionnaire, 90% of the participants wrote that they held the test tube in other hand, not adhering to the guidelines. Contrary to the standard protocols, 84% remarked that they felt the vein after disinfection of the blood sampling area, which makes the process of disinfection to lose its significance.

After putting blood in test tube with additives, the test tube needs to be inverted in order for the blood to be mixed properly with the additives. Fifty eight percent of the staff responded that they never inverted the test tube after filling the test tube with blood.

According to the questionnaire, the practice by 83% of the paramedic staff was to mark the test tubes more than 30 minutes before sampling, at times even forgetting which test tubes belonged to which patient.

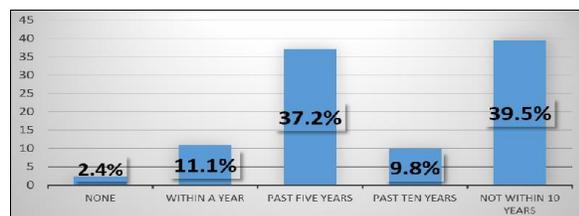


Figure-1: Most recent education in blood sampling

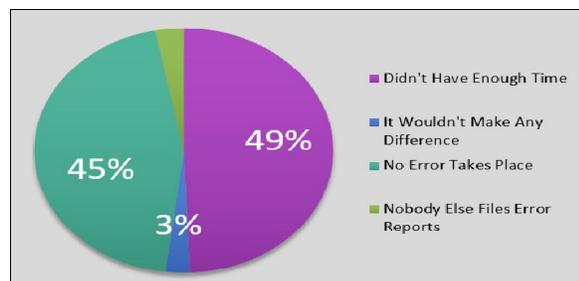


Figure-2: Reason for not filling an error report

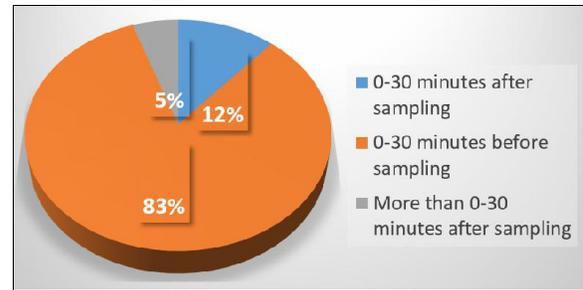


Figure-3: Marking time and date of sampling

## DISCUSSION

Laboratories have become the backbone of clinical practice. Accuracy, precision and speed are expected from them, as the results change the course of treatment altogether. Pre analytical phase is the most important phase in laboratory medicine<sup>7</sup> and most errors in laboratory medicine are pre-analytical in nature. These may arise during preparation of the patient, collection of sample, storage or transport.<sup>8</sup> Quality indicators may be utilized for this purpose.

Pre-analytical process includes the process of making a proper legible request form for specific blood test along with the sample in appropriate and separate test tubes (i.e., for blood glucose, coagulation profile etc.), to be sent to the laboratory<sup>9</sup>, with complete patient details attached to the test tube for referral and return of the results to the concerned patient<sup>9,10</sup>. Improper marking of the sample leads to wrong reports to be sent to the patient who eventually will lead to wrong diagnosis of the underlying disease and a major loophole in the treatment plan.<sup>10</sup>

The method of sampling along with the timing of the sampling plays a vital role in the adequate outcome of the blood test reports in order to help the clinical treatment plan. Standard protocols are to be followed in order to fulfil this role effectively providing better health care to the patients.<sup>11</sup>

Improving the quality of service provided by clinical laboratories is critical as the laboratory results affect up to 60–70% of clinical decisions.<sup>12</sup> In our setup, work load and time constraints have to be considered in addition, as they are important factors affecting the efficiency of health professionals. Even the timely transportation of the samples to the laboratories plays an integral role in systemic blood sampling procedure. Any delay or temperature difference can lead to blood haemolysis and destroy the blood samples for the processing.<sup>10,11</sup> Thus marking the test tubes immediately after taking the samples and sending the samples simultaneously is imperative in order to avoid any discrepancies in the reports. Methodical request form for the blood sampling is to be sent along with the blood samples

to eliminate any cause of the confusion at time of disposal of the samples at the laboratory or the collection of the results afterwards.<sup>10</sup>

Each ward at tertiary health care centre needs to be provided with the standard operating procedures (SOPs) for blood withdrawal. The necessary documents with requisite guidelines are to be clearly displayed in all the wards. Quality control and standardized techniques and procedures are to be worked out and implemented to avoid any inadequacy of the blood sampling procedure.<sup>10</sup>

Quality control in venous blood sampling is a need to increase patient safety in modern health care. Auditing of the blood sampling procedure needs to be done from time to time basis in wards. Paramedical staff techniques need to be reviewed in front of the auditor in order to confirm that they are adhering to conventional system protocols.<sup>4</sup> Any deficiencies needs to be overcome by introduction of refresher courses on quarterly basis and re audit of the blood drawing technique.

Imprecision in results of blood haemoglobin levels can affect the overall health care system and the general practice of the doctors as small changes in the readings can alter the course of diagnosis immensely.<sup>13</sup> Total analytical errors, which involve the natural biological variations and the proficiency of laboratory methods needs to be taken into account for minimizing these expected analytical errors.<sup>14,15</sup> These results variations cannot be easily overcome and more complicated pre-analytical procedures and protocols are required for decrease the bias. Medical practitioners are to apply their own medical acumen and should cater for all the expected and unexpected discrepancies in the laboratory results. Thus making a diagnosis clinically and relying less on the laboratory results.<sup>16</sup> Specific recommendations are to be made according to quality control standards in our local health care setup. First priority is to provide paramedical staff training, streamlining the system of sampling and the result output.<sup>17,18</sup> The complete process starting from the patient identification to the labelling of the test tubes and transportation of the samples to the labs are found to be most deficient in major cases leading to re drawing of the samples making the process of the laboratory diagnosis lengthy and time consuming.<sup>15,19,20</sup>

Training of the paramedical staff is mandatory for the basics of the procedure of blood sampling techniques and then assessment of the techniques according to the set pre-analytical standard operating procedures (SOPs).<sup>21,22</sup>

There is still capacity for improvement of the pre-analytical procedure at the laboratory level which has an immense impact on clinical grounds leading to better health care facilities.<sup>23</sup>

## CONCLUSION

Pre analytical blood sampling errors are common in our setup. Eighty six percent participants thought that they had adequate knowledge regarding blood sampling, but most of them were not adhering to standard protocols. The methodical systematic procedure for disinfection, blood drawing, timely labelling of test tubes and transportation is already framed. There is a need of implementation of these guidelines and continuous refresher courses for blood drawing techniques of the paramedics on quarterly basis with an audit assessing their techniques after the required training. This will help in standardized and coherent medical care for the patients. Better and effective tertiary care will be possible with the reduction in the pre-analytical blood sampling errors.

## AUTHOR'S CONTRIBUTION

NZ: Conceiving research plan, literature review and analysing, finalizing manuscript. AH: Composition of questionnaire, paper writing. QA: Data collection and analysis. SS: Data collection and literature review. SA: Data collection and analysis

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