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Knowledge Level of Clinical Biochemistry among Iraqi Doctors

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Keywords: Pre analytical Errors, Sample preparation, Clinical Biochemistry

Abstract

Clinical biochemistry is a scientific discipline within the larger field of medicine, which integrates knowledge gained from fundamental and applied research for understanding the biochemical and physiological processes of humans and application of the resulting knowledge to the diagnosis, treatment, and prevention of disease. There are many laboratory tests available for clinicians to obtain useful information related to diagnosis and treatment; however, if these tests are conducted inappropriately, they are at best useless and at worst misleading and dangerous. most laboratory errors occur in the pre-analytical phase. the aim of the present study was to investigate the state of knowledge of clinical biochemistry among a group of Iraqi doctors in Basra province with particular emphasis on the rate of pre-analytical phase errors related to ordering, collection, and sample handling.

Subject and Methods

This study was based on the collection of participant responses from a structured questionnaire on the knowledge of clinical biochemistry that was sent out between 20 March and 9 April of 2014. A total of 243 responses were returned from six main hospitals in Basra. The questionnaire covered the main areas of pre-analytical variables for which treating physicians might be responsible, including six questions on sample collection (maximum score of 6) and four questions on patient variables (maximum score of 4). Other questions explored the need for teaching different topics related to clinical biochemistry and how confident the responder was in requesting and interpreting the laboratory tests.

Results

Among the 243 questionnaires returned from different hospitals, 205 were from central hospitals and 28 were from district hospitals. The respondents were distributed into 78 (32.1%) residents in the first year of their career, 83 (34.2%) SHOs, and 75 (30.9%) specialists from different types of specialities. With respect to knowledge of sample collection, 48.9% of the respondents failed to reach the

minimum knowledge score of >3 with the highest failure rates observed for residents (55.8%), followed by SHOs (47.2%) and then specialists (43.1%) . Only 20.7% of those surveyed failed to succeed in answering questions related to patient preparation knowledge. When the doctors were asked about the benefits of teaching certain biochemical tests, they indicated the lowest perceived benefits for teaching the following topics: sample collection, haemolysed sample interpretation, serum calcium, magnesium and phosphate, PTH, and patient preparation

Conclusion

In conclusion, knowledge in clinical biochemistry is an essential aspect for the appropriate management of patients, and lack of such knowledge would play a considerable role in pre-analytical errors, which are mainly the responsibility of the treating physician. In particular, our survey shows that knowledge on sample collection and patient preparation needs to be enhanced, which could be accomplished through seminars and tutorials for the residents and SHOs in addition to incorporating these topics in the curricula of medical colleges.

Introduction

Clinical biochemistry is a scientific discipline within the larger field of medicine, which includes laboratory-based analysis of body fluids, cells, and tissues with subsequent interpretation of the results in relation to health and disease [(1).] The discipline integrates knowledge gained from fundamental and applied research for understanding the biochemical and physiological processes of humans and application of the resulting knowledge to the diagnosis, treatment, and prevention of disease. Therefore, the scope of clinical biochemistry is not only confined to laboratory activities but is also strongly interrelated with patient care and treatment [(2)]. There are many laboratory tests available for clinicians to obtain useful information related to diagnosis and treatment; however, if these tests are conducted inappropriately, they are at best useless and at worst misleading and dangerous [(3)]. Advances in instrument technology and automation in recent years have simplified the tasks involved in laboratory diagnostics, thereby reducing errors during analysis to improve the quality of test results. Nevertheless, most laboratory errors occur in the pre-analytical phase [4] (4). One study showed that the pre-analytical error rates in laboratories were quite high, ranging from 32% to 75%, including errors in patient variables, test order, sample collection, and sample handling [(5)]. Therefore, doctors, especially in the early years of their career, have an important responsibility in requesting and interpreting the results of a tests ordered for their patients. Although the curriculum of the clinical biochemistry program at Basrah Medical College in Iraq is continuously updated, there is limited space available for students [(6)]. Thus, there is considerable concern among laboratory staff as to whether doctors have received sufficient knowledge in basic sciences and the optimal use of typical laboratory tests. The Tomorrow Doctors' report published by the General Medical Council in 2009 highlighted some important points related to this issue:

1) Basic knowledge: "Graduates must have a knowledge and understanding of the clinical and basic sciences ... (including) ... normal and abnormal structure and function, ... responses to illness and the response to treatment."
2) Skills: "Graduates must be able to do the following safely and effectively: interpret the results of commonly used investigations ... (and) make clinical decisions based on the evidence they have gathered."
3) Teaching: "The clinical and basic sciences should be taught in an integrated way throughout the curriculum."

However, there is sparse literature on the role of the physician in pre-analytical errors or in the ordering of unnecessary tests. Smellie et al. found that 25% of all emergency requests were inappropriate [7]. Similarly, Grantham et al. demonstrated a high frequency in the rate of unnecessary tests ordered [8].

Therefore, the aim of the present study was to investigate the state of knowledge of clinical biochemistry among a group of Iraqi doctors in Basra province with particular emphasis on the rate of pre-analytical phase errors related to ordering, collection, and sample handling.

Subject and Methods

This study was based on the collection of participant responses from a structured questionnaire on the knowledge of clinical biochemistry that was sent out between 20 March and 9 April of 2014. Both printed and electronic versions of the questionnaire were adapted with the help of the "surveymonkey" website (https://www.surveymonkey.com/s/KV8Z923).

The questionnaire covered the main areas of pre-analytical variables for which treating physicians might be responsible, including six questions on sample collection (maximum score of 6) and four questions on patient variables (maximum score of 4). Other questions explored the need for teaching different topics related to clinical biochemistry and how confident the responder was in requesting and interpreting the laboratory tests.

The printed copies of the questionnaire were sent to the six main hospitals in Basra, including Al Sadr Teaching Hospital, Basra General Hospital, Ibn Ghazwan Maternity Hospital, Children's Hospital, Faiha Hospital, and Al Mawani General Hospital. In addition, the two main district hospitals were included: Abu Al Kasib Hospital and Al Zubair Hospital.

A total of 243 responses were returned from these hospitals and through the electronic survey. The participants included first year residents, senior house officers (SHOs), and specialists. The received responses were uploaded using an Excel spreadsheet stored on a Google drive, and all data were analysed with Student t-tests using Statistical Package for the Social Sciences (SPSS) version 15.0 for Windows XP (SPSS, Inc., Chicago, IL, USA). A p-value of
< 0.05 was consider statistically significant.

Results

Among the 243 questionnaires returned from different hospitals, 205 were from central hospitals and 28 were from district hospitals. The respondents were distributed into 78 (32.1%) residents in the first year of their career, 83 (34.2%) SHOs, and 75 (30.9%) specialists from different types of specialities; 7 (2.9%) of the respondents did not answer the first question.

Figure 1 shows the overall level of confidence that the respondents felt when requesting different aspects of clinical biochemistry tests. Overall, 33.7% of the respondents reported feeling not confident in requesting urine osmolality tests, followed by a high lack of confidence in requesting magnesium and phosphate analyses (25.1%), parathyroid hormone (PTH) test (18.6%), and creatine kinase (CK)-MB and troponin analysis (15%).

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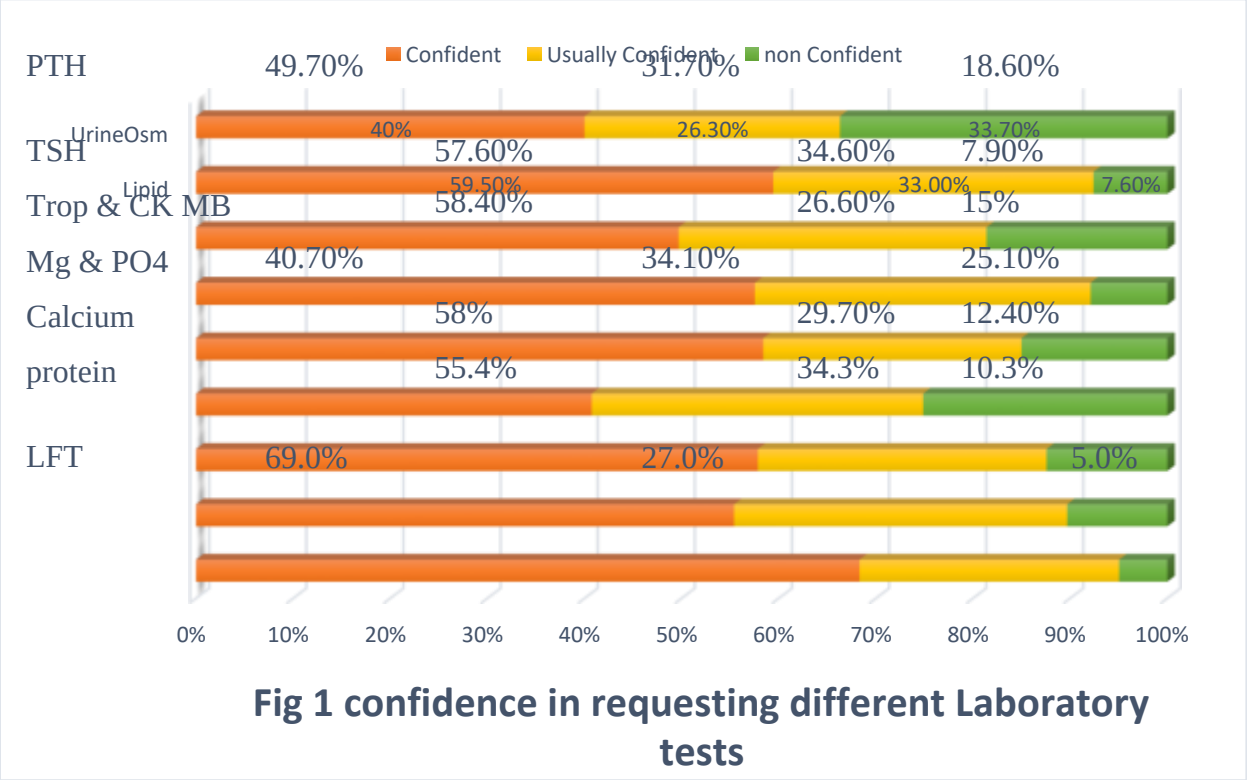

Fig 1 confidence in requesting different Laboratory tests

Figure (1). Self-reported level of confidence in requesting different laboratory tests.

Figure 2 shows the level confidence reported with respect to the interpretation of different laboratory tests. Overall, the respondents reported high levels of low confidence in interpretation of urine osmality tests (33.3%), followed by magnesium and phosphate (18.6%), troponin CK-MB (17.4%), and PTH tests (14%).

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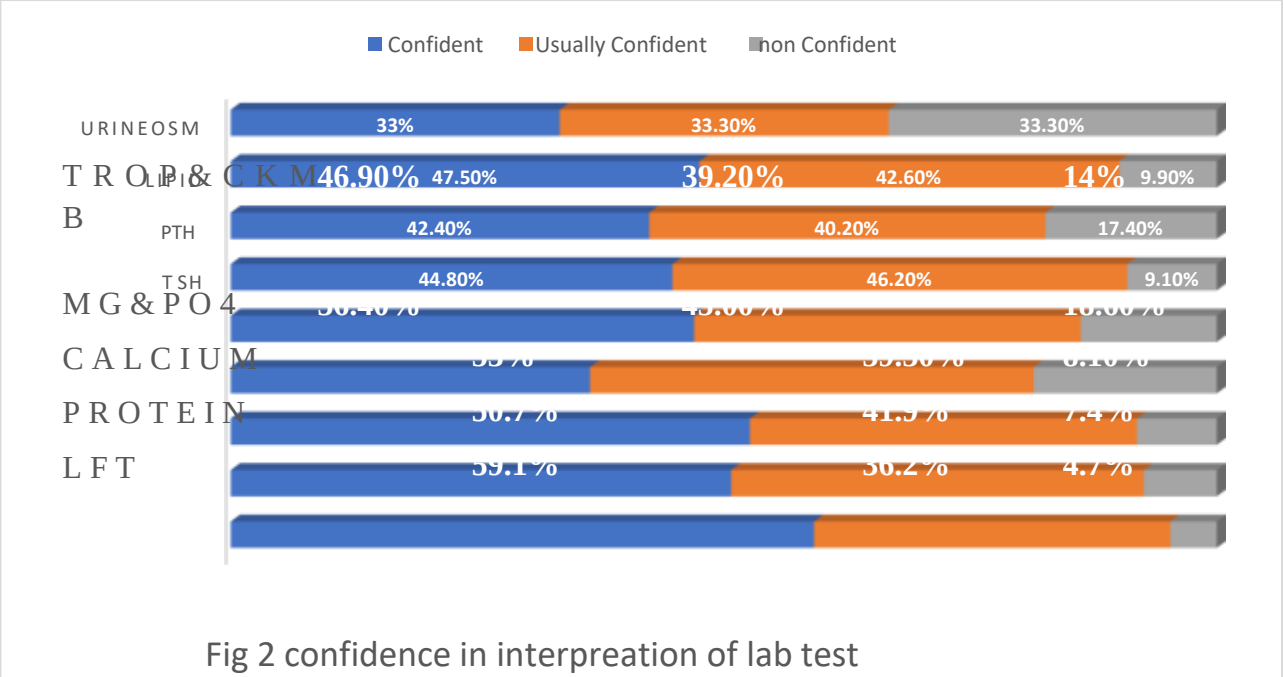

Figure (2). Self-reported level of confidence in interpretation of laboratory tests.

Overall, the SHOs reported higher levels of non-confidence, followed by residents in the first year of their career.

With respect to knowledge of sample collection, 48.9% of the respondents failed to reach the minimum knowledge score of >3 (Fig. 3), with the highest failure rates observed for residents (55.8%), followed by SHOs (47.2%) and then specialists (43.1%) (Fig. 4). Table 1 shows that the questions with the lowest rates of correct responses were those related to tube selection (correct response rate of 14.7–21.5%), followed by tourniquet effects, sample separation, and finally those related to haemolysed samples, which had the highest percentage of correct answers at 82.7%.

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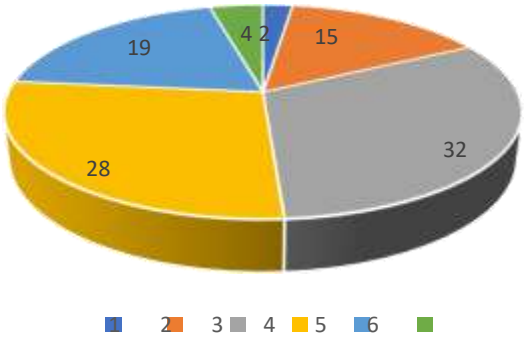

Fig 3 Percentage of Score in Sample collection knowledge related

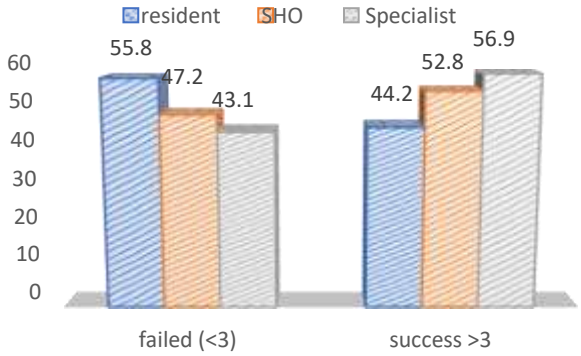

Fig4thesuccessrateinsamplecollection knowledge

Figure 3. Percentage of scores to knowledge on sample collection

Figure(4). Success rate in answering questions related to sample collection.

Table(1). Distribution Of The Success Rate In Answering Different Questions Concerning Sample Collection.

	Success Rate		
Question Type	**Resident**	**SHO**	**Specialist**
Haemolysed Sample	**82.3%**	**81.7%**	**82.7%**
Tube Collection	**21.5%**	**19.5%**	**14.7%**
Sample Separation	**57.0%**	**56.1%**	**72.0%**
Tourniquet Effect	**37.53%**	**43.9%**	**48.0%**

Only 20.7% of those surveyed failed to succeed in answering questions related to patient preparation knowledge (score of 4) (Fig. 5), with the highest rate of failure detected among the SHOs (27.8%), followed by the residents (24.7%) (Fig. 6). Table 2 shows that the questions with the least amount of correct answers in the patient preparation category were those related to the circadian rhythm (28%) followed by patient preparation and the effect of changing posture on sample collection (47.6–73.3%). These findings are in line with a previous report showing that 47% of all pre- analytical errors could be attributed to inaccurate quality of the sample [9] (9).

Table (2). Success Rate For Different Questions Concerning Patient Preparation.			
	Success Rate		
Question Type	Residents	Shos	Specialists
Circadian Rhythm	27.8%	28.0%	28.0%
Patient Preparation	50.6%	52.4%	57.3
Changing Posture	57.0%	47.6 %	73.3%

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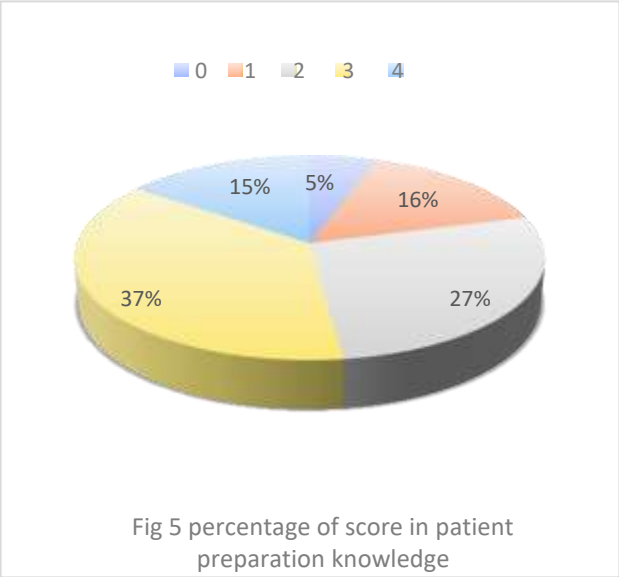

Fig 5 percentage of score in patient preparation knowledge

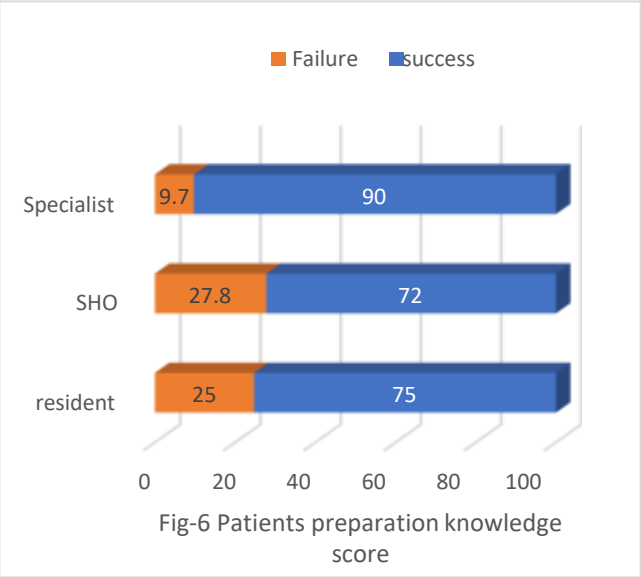

Fig-6 Patients preparation knowledge score

Figure (5_). Percentage of scores received on questions related to patient preparation.

Figure(6). Distribution of patient preparation knowledge scores among types of doctors.

When the doctors were asked about the benefits of teaching certain biochemical tests, they indicated the lowest perceived benefits for teaching the following topics: sample collection, haemolysed sample interpretation, serum calcium, magnesium and phosphate, PTH, and patient preparation (Fig. 7)

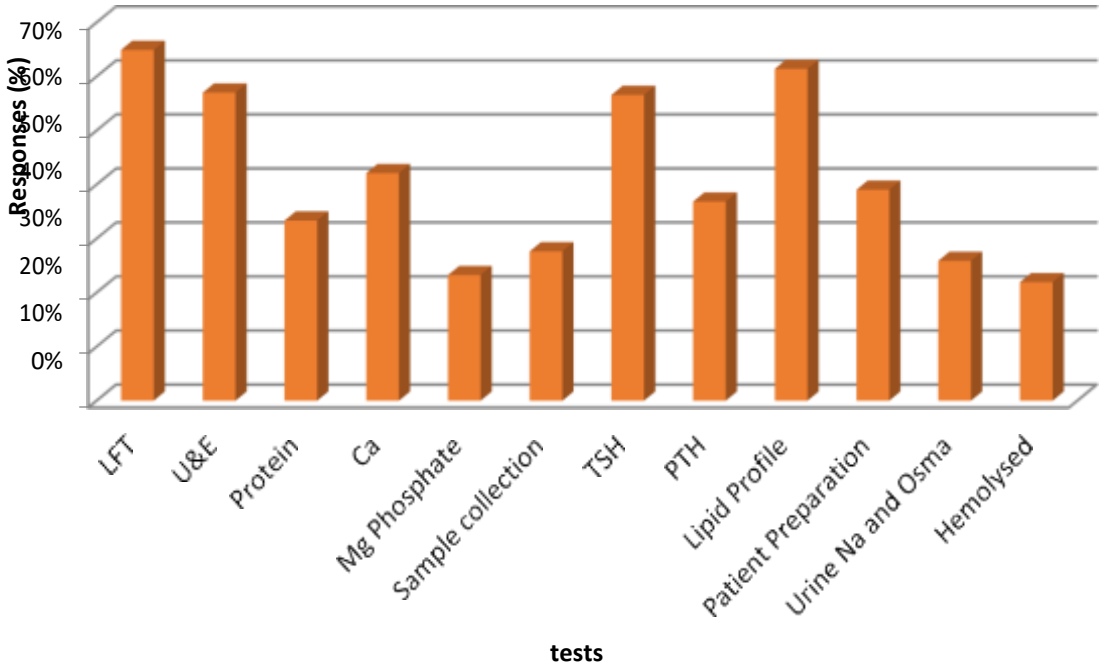

Fig (7) subjects on which doctors's benefit from teaching certain biochemical tests

Figure (7). Degree of benefit perceived for teaching doctors about certain biochemical tests.

Discussion

This study was carried out to demonstrate the state of knowledge related to clinical biochemistry tested among Iraqi doctors in Basra. We mainly focused on the degree of pre-analytical errors that could be made due to a lack of knowledge, since such errors were previously reported to account for up to 75% of all errors in laboratory tests [(5)]. Some of these pre-analytical errors, especially those related to patient preparation, incorrectly requesting a laboratory test, and poor sample collection procedures, could be primarily the responsibility of the resident or treating physician. Currently, knowledge related to biochemistry is mostly obtained in the second year of studies at Basrah Medical College, and the curriculum largely covers the metabolic aspects of the normal body. Although many new topics have been adapted and are taught at Basrah Medical College to expand knowledge with emphasis on clinical aspects of biochemistry, including LFT and cardiac markers, there is clearly still a large gap in knowledge related to sample collection, with a failure rate of 55.3% among residents and 48.2% among specialists detected in the present study. Similarly, Patura et al. found that approximately 47% of all pre-analytical errors could be attributed to the inaccurate quality of the sample (10). This problem could ultimately affect the decision made for treating the patient, especially in the emergency department, where inappropriate sample collection is potentially more likely. We found that knowledge on patient preparation was slightly better than that related to sample collection; nevertheless, a significant percentage of residents or specialists were still unaware of some essential steps in patient preparation such as the circadian rhythm, which may contribute to inappropriate or incorrect patient management.

We further found that approximately 15% of the doctors were not confident when requesting the important laboratory test of cardiac troponin or in interpreting the results of the test, which is considered to be the cornerstone in the management of myocardial infarction [11] (11). Such low confidence in interpreting the results of cardiac troponin levels may pose a risk to patients admitted to the emergency department, especially if these results are not correctly interpreted by resident doctors. Other laboratory tests in which the doctors reported low confidence for requesting and interpreting included calcium, phosphate and PTH, and urine osmality and electrolyte tests. Although these tests are less frequent in the emergency department, they may be extremely valuable in the management of patients.

The doctors surveyed indicated some topics that they believed would benefit from more extensive teaching, especially LFT, TSH, and urine examination. Nevertheless, there are clearly still some areas of clinical biochemistry that need to be covered during training, including sample collection, patient preparation, and haemolysed samples, which play important roles in the high frequency of pre-analytical errors. Knowledge in these areas could be improved by expanding the topics of clinical biochemistry through the curriculum developed for second-year students and by introducing the concept of laboratory medicine to the sixth-year medical students as well as to the residents or SHOs during their practice.

In conclusion, knowledge in clinical biochemistry is an essential aspect for the appropriate management of patients, and lack of such knowledge would play a considerable role in pre-analytical errors, which are mainly the responsibility of the treating physician. In particular, our survey shows that knowledge on sample collection and patient preparation needs to be enhanced, which could be accomplished through seminars and tutorials for the residents and SHOs in addition to incorporating these topics in the curricula of medical colleges.

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