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Research Article

Evaluation of Users (Doctors and Head Nurses) Satisfaction about Clinical Chemistry Laboratory Services in King Abdulaziz University Hospital

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ABSTRACT

Background: One of the important recommendations of International Organisation for Standardization is the customer satisfaction as an essential request of the quality management system requirements especially for the medical laboratories.

Objective: The current study aimed at evaluation of the users (doctors and head nurses) satisfaction by the different available chemical laboratory services at the King Abdulaziz University Hospital (KAUH).

Methods: A cross sectional study was carried out for a period of six months among the medical staff team who use the clinical chemistry laboratory of the KAUH. The current survey covered the tests in all four areas of the lab including the routine chemistry, hormones, special chemistry and therapeutic drug monitoring (TDM). The selection of customers was by simple random sampling. A well designed and validated questionnaire was used and distributed through official emails. The collected data was statistically analysed and represented in tables.

Results: The response rates among the consultants, residents, and specialists were 53.3%, 85.7% and 75% respectively. The clinical chemistry laboratory provides all tests needed by most of the participants (66.7%). The areas of hormones and TDM had got less satisfaction rates compared with the other lab areas. All the participants agreed that turnaround time (TAT) was acceptable (> 60-80%). the laboratory technologist responses were highly satisfied for the most of participants (? 70%).

Conclusion: The survey outcome concluded that most of the participants were satisfied about KAUH clinical chemistry laboratory. The better understanding of the satisfaction rates of the clinical chemistry laboratory customer at KAUH as well as the areas of weakness in hormone and TDM areas will be useful in constructing an action plan for further improvement.

Keywords: User satisfaction;Clinical chemistry; Laboratory areas; Questionnaire; Doctors; Nurses

INTRODUCTION

The Clinical Chemistry Laboratory at King Abdulaziz University Hospital (KAUH) is one of the most developed laboratories, being almost fully automated. Some of its instruments, such as Dimension Vista ® 1500 System, which performs up to 2,000 tests per hour, are unique and not available in other laboratories in the Middle East. KAUH has been enrolled in Accreditation Canada Program. This development helps to improve quality, reliability, efficiency, and turnaround time [1].

Some authors in their study of leveraging the full value and impact of accreditation stated that the value and impact of accreditation are optimized when the tools of accreditation are utilized continuously in the organization's quality improvement program. The methodology and application of accreditation have the potential to be the force to improve the care quality [2]. The most common samples received by a clinical chemistry laboratory are body fluids such as blood, urine, and CSF, and less often pleural, ascitic, and drain fluids [3].

Meeting customers' needs is the main aim of all organizations. Customer satisfaction measurement is very valuable in the quality assurance programs of clinical laboratories. It is one of accreditation requirements by big organizations and institutes, such as the College of American Pathologists (CAP) Laboratory Accreditation Program (LAP) and the Joint Commission on Accreditation for Healthcare Organizations (JCAHO) [1,4]. Accuracy, precision, tests' speed, etc., are not the only applications needed by customers; their satisfaction is also an important approach to be applied [5].

A medical laboratory must implement strategies to fulfill the essential requirements. For instance, there are 1,515 conformance requirements that should be considered in all processes of the operations area covered by ISO 15189:2012. It is important to know that meeting all ISO 15189:2012 accreditation requirements is not easy [6]. Clause 4.14.3 focuses on assessment of users' feedback through collecting information about their needs and requirements related to laboratory services. Their feedback is not the final step that should reached, but the solution of noted defects to improve the service is the main goal [7].

Physicians and nurses are considered the primary customers of laboratory services. Physicians ordered testing whereas nurses responsible for sample collection and results follow up [1]. Developing methods to find out customers' feedback help laboratories to identify and improve areas of defect. One of the useful ways to obtain customers feedback is to carry out satisfaction surveys [8]. This type of survey could provide the rate of satisfaction, but underlying defects behind dissatisfaction may remain unclear. Therefore, sometimes, direct contact with unsatisfied customers is required along with surveys [9,10].

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The aim of this study is to assess the satisfaction of physicians and nurses from different clinics and departments of the King Abdulaziz University Hospital (KAUH) aiming to pick up the weak points that causing dissatisfaction in clinical chemistry at KAUH.

MATERIALS AND METHODS

The current study was a cross sectional study using a designed survey in an educational hospital in the Jeddah, Saudi Arabia [King Abdulaziz University Hospital (KAUH)] in the second half of 2016. This survey was carried out using a questionnaire planned using the collected data of the literature review materials and validated by an expert. The questionnaire designed through a U.K. website, the statements were designed to cover all tests and the important aspects of clinical chemistry laboratory services at KAUH.

448 online questionnaires were sent to the doctors from different positions including consultants, senior registrars, registrars, specialists, and house officers, as well as nurses from different departments in KAUH through their official emails. The ethical clearance was obtained from the hospital's ethical review committee to access the official emails of the staff, the questionnaire was preceded by a detailed explanation of the purpose of the study. Moreover, the respondents were asked to provide us with their contact information to allow us to contact them if needed.

The questionnaire had ten online pages and was divided into four main sections reflecting the various lab sections: routine chemistry, hormones, special chemistry, and Therapeutic Drug Monitoring (TDM). Each section consisted of five questions: Order Frequency (OF), Easy to Order (EO), has a clear abbreviation, how much are the results agreeable with their expectations regarding the patient condition, and how are they satisfied with Turnaround Time (TAT) for results. Other general questions were also provided: using services of other biochemistry labs in other hospitals, the name (s) of the lab (s)/ hospital (s) if applicable, whether they find a difference between the biochemistry lab in KAUH and others, number of calls/number of orders, reasons for calling, lab staff response, and statements of improvement suggestions.

Scales of respondents' satisfaction

The respondents were instructed to rate their satisfaction using different scales. For OF "order frequency" (# of orders/week), five scales were used: 1-10 tests/week, 11-20, 21-30, 31-50, and >50. For "has a clear abbreviation," "using services of other biochemistry labs in other hospitals," "if they find a difference between the biochemistry lab in KAUH and others," and "if the lab cover all their needs," only Yes and No statements were used. For EO "easy to order," "result and expectation compatibility," and "satisfaction with turnaround time" (in%), five scales were used: 1-20, 21-40, 41-60, 61-80 and 81%-100%. For "# of calls/# of orders", "reasons for calling", "lab staff response", and "statements of improvement suggestions" (in%), 10 scales were used: 10, 20, 30 until 100%. In the question of "if they used the services of other biochemistry labs," if the participants answered with Yes, they were requested to indicate the type of that lab/hospital, governmental, private, or both. In the question of "if they find a difference between the biochemistry lab in KAUH and others" if the participants answered with Yes, they were requested to indicate which one is better and-optionally-to mention the name(s) of 1-4 lab (s)/hospital(s). The respondents were also informed to choose the "not applicable" option if appropriate. Additionally to these closed statements, the respondents were asked some of open-ended questions such as; How many inpatients do you see per day? How many outpatients do you see per week? And how many samples for chemistry lab do you order per day?

The collected responses were analyzed using the Statistical Product and Service Solutions (SPSS) program. The descriptive analysis of data was presented as tables for the frequencies and percentages. Also, the responses to the open-ended questions were analyzed using content analysis.

RESULTS

The degrees of the shared staff and the departments in their frequencies were summarized in Table 1. The response rates from the Hematology, Obstetrics and Gynecology, and Surgical departments were the same (10.7%), whereas Orthopedic showed the lowest rate of response (7.1%), shown in Table 1.

Table 1: The response rates of the customers according to the positions and departments (Dept) involved in the study.

		Count	%
Position	Consultant	13	46.4
	Nurse	4	14.3
	Resident	7	25
	Specialist	4	14.3
Dept	Hematology	3	10.7
	Medicine	8	28.6
	Obstetrics and Gynaecology	3	10.7
	Orthopedic	2	7.1
	Pediatric	9	32.1
	Surgical	3	10.7

The satisfactory rates between using KAUH chemistry laboratory and other services were recorded in Table 2. The response rates among the consultants, residents, and specialists were 53.3%, 85.7% and 75% respectively, believed that the result of KAUH laboratory is more reliable.

The Orthopedic department satisfaction rate was 100% with the services provided by the chemistry laboratory at KAUH compared with other laboratories. This satisfaction reached to 75% in the Medicine department followed by 66.7% in the Hematology and Surgical departments. Moreover, it reduced as low as 33.3% in both the Obstetrics and Gynecology department and the Pediatric department, as shown in Table 2.

Regarding the routine chemistry area, the order frequency (OF), easy to order (EO), the agreeable of results with participant expectation regarding the patient condition (Agree) and the satisfaction of participant about the result turnaround time (TAT) were presented as mean, percentage and summarized in the Table 3. The mean of the OF showed that all participants (except nurses) request more than 10 orders per day. Consultants believe that ordering tests were more difficult (>40%) than residents and specialists (>80% each). Moreover, the results of requested tests by consultants, residents and specialists were not consistent with their expectations (>60%), (>80%) and (>80%). All the participants agreed that TAT was acceptable (>60%-80%), shown in Tables 4a and 4b. Twelve out of sixteen checked abbreviations as listed in Table 5 were not clear, with different percentages. The most ambiguous test abbreviations with all positions were CTNI, HCY, and PROBNP, followed by CE, PREALB, and BFT.

Table 2: The satisfactory rates between using KAUH chemistry laboratory and other services according to participants' positions and departments (Dept).

		Which is better laboratory							
		KAUH Lab		N/A		Other		Same	
Position	Consultant	7	53.8	4	30.8	1	7.7	1	7.7
	Nurse	0	0	4	100	0	0	0	0
	Resident	6	85.7	0	0	0	0	1	14.3
	Specialist	3	75	1	25	0	0	0	0
Dept	Hematology	2	66.7	1	33.3	0	0	0	0
	Medicine	6	75	2	25	0	0	0	0
	Obstetrics and Gynecology	1	33.3	2	66.7	0	0	0	0
	Orthopedic	2	100	0	0	0	0	0	0
	Pediatric	3	33.3	3	33.3	1	11.1	2	22.2
	Surgical	2	66.7	1	33.3	0	0	0	0

Table 3: Results (mean and frequency) of different items in routine chemistry area.

Chemistry	Position			
	Consultant	Nurse	Resident	Specialist
OF	1.1 (>20%)	_	1.1 (>20%)	1.4 (>20%)
EO	2.8 (>40%)	_	4.3 (>80%)	4.1 (>80%)
Agree	3.5 (>60%)	_	4.1 (>80%)	4.1 (>80%)
TAT	3.3 (>60%)	4.1 (>80%)	3.2 (>60%)	3.9 (>60%)

OF: Order Frequency; EO: Easy to Order; Agree: The agreeable of results with participant expectation regarding the patient condition, TAT: The satisfaction of participant about the result turnaround time.

Table 4a: Frequency of clear test abbreviations according to the different positions in routine chemistry area.

Chemistry abbreviations	clear	Position							
		Count	%	Count	%	Count	%	Count	%
U/E	No	0	0		0	0	0	0	0
	Yes	13	100	7	100	4	100	4	100
LFT	No	0	0	0	0	0	0	0	0
	Yes	13	100	7	100	4	100	4	100
RFT	No	2	15.4	1	14.3	1	25	0	0
	Yes	11	84.6	6	85.7	3	75	4	100
BFT	No	3	23.1	1	14.3	2	50	3	75
	Yes	10	76.9	6	85.7	2	50	0	0
CE	No	4	30.8	3	42.9	3	75	3	75
	Yes	9	69.2	4	57.1	1	25	0	0
LIPIDS	No	0	0	1	14.3	0	0	0	0
	Yes	13	100	6	85.7	4	100	4	100
LDL/HDL	No	0	0	0	0	0	0	0	0
	Yes	13	100	7	100	4	100	4	100
Amylase	No	0	0	0	0	0	1	25	0
	Yes	13	100	7	100	3	75	4	100

Abbreviations: U/E: Urea; Creatinine and Electrolytes; LFT: Liver Function Tests; RFT: Renal Function Tests; BFT: Bone Function Tests; CE: Cardiac Enzymes; Lipids: Cholestrol and Triglesrides; LDL-HDL: Low Density Lipoprotein-High Density Lipoprotein.

Table 4b: Frequency of clear test abbreviations according to the different positions in routine chemistry area.

Chemistry abbreviations	clear	Position							
		Count	%	Count	%	Count	%	Count	%
FBS	No	0	0	1	14.3	0	0	0	0
	Yes	13	100	7	85.7	4	100	4	100
RBS	No	0	0	0	0	0	0	0	0
	Yes	13	100	7	100	4	100	4	100
MMB	No	5	38.5	2	28.6	3	75	2	50
	Yes	8	61.5	5	71.4	1	25	0	0
CTNI	No	8	61.5	3	42.9	3	75	2	50
	Yes	5	38.5	4	57.1	1	25	0	0
HCY	No	5	38.5	3	42.9	3	75	2	50
	Yes	6	46.2	4	57.1	1	25	0	0
PROBNP	No	7	53.8	4	57.1	2	50	2	50
	Yes	3	23.1	3	42.9	2	50	0	0
HCO3	No	2	15.4	0	0	0	0	0	0
	Yes	11	84.6	7	100	4	100	3	75
PREALB	No	5	38.5	3	42.9	2	50	0	0
	Yes	4	30.8	3	42.9	2	50	2	50

Abbreviations: FBS: Fasting Blood Sugar; RBS: Random Blood Sugar; MMB: Mass-CKMB; CTNI: Cardiac Troponin I; HCY: Homocystein; PROBNP: Prohormone-Brain Natriuretic Peptide; HCO3: Bicarbonate, PREALB: Pre-Albumin.

Table 5: List of unclear abbreviations according to the different positions in the routine chemistry area.

Routine chemistry (Clear abbreviation) (NO) (%)	Position			
	Consultant	Nurse	Resident	Specialist
RFT	15.4	0	14.3	25
BFT	23.1	100	14.3	50
CE	30.8	100	42.9	75
LIPIDS	0	0	14.3	0
AMYLASE	0	0	0	25
FBS	0	0	14.3	0
MMB	38.5	100	28.6	75
CTNI	61.5	100	42.9	75
HCY	46.2	100	42.9	75
PROBNP	69.2	100	57.1	50
HCO3	15.4	0	0	0
PREALB	61.5	0	57.1	50

Abbreviations: RFT: Renal Function Tests; BFT: Bone Function Tests; CE: Cardiac Enzymes; Lipids: Cholestrol and Triglesrides; FBS: Fasting Blood Sugar; MMB: Mass-CKMB; CTNI: Troponin I; HCY: Homocystein; PROBNP: Prohormone-Brain natriuretic peptide; HCO3: Bicarbonate, PREALB: Pre-albumin.

The data collected from the hormonal area was summarized in Tables 6-8 as mean and frequency (percentage). The mean order of frequency (OF) by both the consultants and the resident's requests were less than 10 orders per day, however, more than 10 orders by specialists. The frequency of consultants who reported that ordering tests is more difficult was (>40%) than residents and specialists (>80% each). Unfortunately, the consistency of hormone results from consultants' perspective was just >20%, but this measure was higher for residents (60%) and specialists (>80%). The opinion of consultants and residents about TAT was almost the same (>20%), which increased in case of specialists and nurses (60% and 80% respectively in Table 6. Hormone area panel included 15 different tests were shown in Tables 7a and 7b. Twelve of them had a problem in their abbreviations with various percentages, according to the participants' responses. The highest unclear percentages (50%-100%) for most of the tests were recorded by specialists. GFT, DHT, and 17OHP were 100% unclear! While PTH, ACTH, renin, and insulin show 100% clear meanwhile, the unclear abbreviation percentage was low in consultants, shown in Table 8.

Table 6: Results (mean and frequency) of the studied items in the hormonal area according to participants' positions.

Hormone	Position			
	Consultant	Nurse	Resident	Specialist
OF	0.49 (>20%)	_	0.44 (>20%)	1.33 (>20%)
EO	2.34 (>40%)	_	4.56 (>80%)	4.87 (>80%)
Agree	1.88 (>20%)	_	2.88 (>40%)	4.13 (>80%)
TAT	1.86 (>20%)	4.33 (>80%)	2.01 (>40%)	3.29 (>60%)

OF: Order Frequency, EO: Easy to Order, Agree: The agreeable of results with participant expectation regarding the patient condition, TAT: The satisfaction of participant about the result turnaround time.

Table 7a: Frequency of clear abbreviations according to the different positions the hormone area tests.

Hormone abbreviations	clear	Position							
		Consultant		Nurse		Resident		Spercialist	
		Count	%	Count	%	Count	%	Count	%
TFT	No	0	0	0	0	0	0	0	0
	Yes	13	100	4	100	6	100	2	100
GFT	No	5	38.5	1	25	3	50	1	50
	Yes	8	61.5	3	75	3	50	0	0
PTH	No	0	0	3	75	0	0	0	0
	Yes	13	100	1	25	6	100	1	50
GH	No	0	0	0	0	0	0	0	0
	Yes	13	100	4	100	6	100	1	50
ACTH	No	0	0	0	0	0	0	0	0
	Yes	12	92.3	4	100	6	100	1	50
Renin	No	0	0	0	0	0	0	0	0
	Yes	12	92.3	4	100	6	100	1	50
INSULIN	No	0	0	0	0	1	16.7	0	0
	Yes	13	100	4	100	5	83.3	1	50
VITD	No	1	7.7	0	0	1	16.7	0	0
	Yes	12	92.3	4	100	5	83.3	1	50

Abbreviations: TFT: Thyroid Function Tests; GFT: Gonadal Function Tests; PTH: Parathyroid Hormone; GH: Growth Hormone; ACTH: Adrenocoticotrophic Hormone; VITD: Vitamin D (total).

Table 7b: Frequency of clear abbreviations according to the different positions in the hormone area.

Hormone clear abbreviations		Position							
		Consultant		Nurse		Resident		Spercialist	
		Count	%	Count	%	Count	%	Count	%
IGF1-IGF3	No	3	23.1	0	0	2	33.3	0	0
	Yes	8	61.5	4	100	3	50	1	50
Insulin stress test	No	0	0	0	0	0	0	0	0
	Yes	12	92.3	4	100	4	66.7	1	50
Anemia panel	No	2	15.4	0	0	1	16.7	0	0
	Yes	11	84.6	4	100	5	83.3	1	50
CORT	No	1	7.7	0	0	2	33.3	0	0
	Yes	11	84.6	4	100	3	50	1	50
DHT	No	5	38.5	1	25	1	16.7	1	50
	Yes	7	53.8	3	75	4	66.7	0	0
17-OHP	No	2	15.4	3	75	2	33.3	1	50
	Yes	9	69.2	1	25	3	50	0	0
HA1C	No	0	0	0	0	1	16.7	0	0
	Yes	13	100	4	100	6	100	2	100
VITD	No	1	7.7	0	0	1	16.7	0	0
	Yes	12	92.3	4	100	5	83.3	1	50

Abbreviations: IGF1-IGF3: Insulin Growth Factor1-Insulin Growth Factor3; CORT: Cortisol; DHT: Dihydroxytestosterone; 17-OHP: 17-Hydroxyprogesterone; HA1C: Hemoglobin A1C.

Table 8: List of the unclear abbreviations of the hormonal area tests according to the participants.

Hormone (Clear abbreviation) (NO) (%)	Position			
	Consultant	Nurse	Resident	Specialist
GFT	38.5	25	50	100
PTH	0	75	0	0
ACTH	7.7	0	0	0
Renin	7.7	0	0	0
Insulin	0	0	16.7	0
VITD	7.7	0	16.7	50
IGF1/IGF3	38.5	0	33.3	50
Insulin stress test	0	0	16.7	50
Anemia panal	15.4	0	16.7	50
CORT	7.7	0	33.3	50
DHT	38.5	25	16.7	100
17OHP	15.4	75	33.3	100

Abbreviations: GFT: Gonadal Function Tests; PTH: Parathyroid Hormone; ACTH: Adrenocoticotrophic; VITD: Vitamin D (total); IGF1-IGF3: Insulin Growth Factor1-Insulin Growth Factor3; CORT: Cortisol; DHT: Dihydroxytestosterone; 17-OHP: 17-Hydroxyprogesterone.

Regarding the ease of test requesting, in the special chemistry areas specialists', it had been found that residents group believed that tests of this area are easy to order (3.39), followed by consultants (1.69), then specialists (1.0). The high compatibility of results with a doctor's diagnosis was evident in the specialist's group (5.0) compared with residents (2.88) and consultants (1.55). Specialists are more satisfied about the turnaround time than nurses (3.33), residents (2.57), and consultants (1.59), shown in Table 9.

The abbreviations of 10 tests out of 12 in the special chemistry area were relatively unclear. Five of that ten got unclear abbreviation ratings of more than 40%. CYSC was 100% unclear with specialists and nurses, 45.5% with consultants, and only 16.7% with residents. The same percentages recur in 5HIAA with specialists, residents, and nurses, but not with consultants (27.3%). Bence-Jones protein was 100% unclear with specialists and less than 40% with others. All recorded values were summarized in Tables 10a and 10b and in Table 11.

Regarding the data collected from Therapeutic Drug Monitoring (TDM) Area was recorded in Table 12. The percentage of order frequency in this area was higher among specialists by 1.0. This percentage was lower in residents and consultants by 0.84 and 0.40, respectively. Specialists' data was (5.0) easy to order compared with consultants (2.51) and residents (1.60). Furthermore, compatibility of results with physicians' perspectives and TAT of TDM results show 5.0 for specialists, 1.70 for consultants, and 1.30 for residents. As shown in Tables 13a and 13b, all TDM tests were unclear by various percentages with residents and consultants only. Residents show unclear abbreviations approximately for all tests.

The participants' responses towards the laboratory communication were assessed in this survey. We found that 60% of participants need to call the laboratory 10 times every 100 orders. Of the total participant calls, 10% were to correct or delete an order, followed by inquiries about sample receiving time and container/tube used showed in Table 14.

Under some conditions health team providers needed to contact the clinical chemistry laboratory to clarify different issues regarding patients. The most common reasons for calling were listed in the Table 15. Fortunately, the laboratory technologist responses were highly satisfied for the most of participants (≥ 70%). However, 20% of the participants assessed the effectiveness of laboratory staff response in general as well as the positivity of first call response at only 10% showed in Table 16.

Regarding the patient report formatting, the participants were asked about their opinions about the patient report format including the following criteria: general design, patient's information, clarity of results, presence of normal ranges, font size and type, and arrangement of tests. Most of the participants (≥ 80%) did not suggest any format changes on the patient report. 13%-20% of participants were satisfied by just 10%, suggesting a need to make proper improvements in report formatting is showed in Table 17. Overall, the clinical chemistry laboratory services provided all the needed tests by most of the participants in a frequency of (66.7%) satisfaction in this survey shown in Table 18.

Table 9: List of the unclear abbreviations of the hormonal area tests according to the participants.

Special chemistry	Position			
	Consultant	Nurse	Resident	Specialist
OF	0.54 (>20%)	_	0.92 (>20%)	1.33 (>20%)
EO	1.69 (>20%)	_	3.39 (>60%)	1.00 (>20%)
Agree	1.55 (>20%)	_	2.88 (>40%)	5.00 (>100%)
TAT	1.59 (>20%)	3.33 (>60%)	2.57 (>40%)	5.00 (>100%)

OF: Order Frequency, EO: Easy to Order, Agree: The agreeable of results with participant expectation regarding the patient condition, TAT: The satisfaction of participant about the result turnaround time.

Table 10a: Frequency of clear abbreviations in the special chemistry area according to the different positions.

Special chemistry clear abbreviations		Position							
		Consultant		Nurse		Resident		Specialist	
		Count	%	Count	%	Count	%	Count	%
Urinalysis	No	0	0	1	25	0	0	0	0
	Yes	11	100	3	75	6	100	1	100
Urine chemistry	No	0	0	0	0	0	0	0	0
	Yes	11	100	4	100	6	100	1	100
Osmolality	No	0	0	0	0	1	16.7	0	0
	Yes	11	100	4	100	5	83.3	1	100
CYSC	No	4	36.4	4	100	0	0	1	100
	Yes	6	54.5	0	0	4	66.7	0	0
24 hr chemistry	No	1	9.1	1	25	0	0	0	0
	Yes	10	90.9	3	75	5	83.3	1	100
VMA	No	0	0	0	0	1	16.7	0	0
	Yes	11	100	4	100	5	83.3	1	100

CYSC: Cystatin C; VMA: Vanillylmandelic Acid.

Table 10b: Frequency of clear abbreviations in the special chemistry area according to the different positions.

Special chemistry clear abbreviations		Position							
		Consultant		Nurse		Resident		Specialist	
		Count	%	Count	%	Count	%	Count	%
5HIAA	No	1	9.1	4	100	1	16.7	1	100
	Yes	8	72.7	0	0	5	83.3	0	0
Bences-Jones protein	No	0	0	1	25	1	16.7	1	100
	Yes	11	100	3	75	47	66.7	0	0
ABG	No	0	0	0	0	0	0	0	0
	Yes	11	100	4	100	6	100	1	100
Stone analysis	No	0	0	1	25	0	0	0	0
	Yes	11	100	3	75	6	100	1	100
SPEPELE	No	6	54.5	0	0	2	33.3	1	100
	Yes	3	27.3	4	100	3	50	0	0
PET test	No	7	63.6	0	0	1	16.7	1	100
	Yes	2	18.2	4	100	3	50	0	0

Abbreviations: CYSC: 5HIAA: 5-Hydroxyindol Acetic Acid; ABG: Arterial Blood Gases; SPE (PELE) Serum Protein Electrophoresis; PET Test: Peritoneal Fluid Test.

Table 11: List of special chemistry area test abbreviations that are unclear according to the participants' position.

Special chemistry (Clear abbreviation) (NO)(%)	Position			
	Consultant	Nurse	Resident	Specialist
Urinalysis	0	25	0	0
Osmolality	0	0	16.7	0
CYSC	45.5	100	16.7	100
24 hr Chemistry	9.1	25	16.7	0
VMA	0	0	16.7	0
5HIAA	27.3	100	16.7	100
Bences-Jones protein	0	25	33.3	100
Stone analysis	0	25	0	0
SPELEP	54.5	0	50	100
PET Test	72.7	0	33.3	100

CYSC: Cystatin C; VMA: Vanillylmandelic Acid; 5HIAA: 5-Hydroxyindol acetic acid; SPE (PELE) Serum Protein Electrophoresis; PET Test: Peritoneal Fluid Test.

Table 12: Results (mean and frequency) of different items in TDM area according to participants' positions.

Special chemistry	Position			
	Consultant	Nurse	Resident	Specialist
OF	0.40 (>20%)	0	0.84 (>20%)	1.00 (>20%)
EO	2.51 (>40%)	0	1.60 (>20%)	5.00 (>100%)
Agree	1.70 (>20%)	0	1.30 (>20%)	5.00 (>100%)
TAT	1.66 (>20%)	0	1.30 (>20%)	5.00 (>100%)

OF: Order Frequency, EO: Easy to Order, Agree: The agreeable of results with participant expectation regarding the patient condition, TAT: The satisfaction of participant about the result turnaround time.

Table 13a: Frequency of clear TDM area test abbreviations according to the participants' positions.

TDM Clear Abbreviations		Position							
		Consultant		Nurse		Resident		Specialist	
		Count	%	Count	%	Count	%	Count	%
GENT	No	0	0	0	0	1	20	0	0
	Yes	9	81.8	0	0	3	60	1	100
VANC	No	0	0	0	0	1	20	0	0
	Yes	9	81.8	0	0	3	60	1	100
AMIK	No	0	0	0	0	1	20	0	0
	Yes	9	81.8	0	0	3	60	1	100
DIGXN	No	0	0	0	0	1	20	0	0
	Yes	9	81.8	0	0	3	60	1	100
VALP	No	2	18.2	0	0	2	40	0	0
	Yes	7	63.6	0	0	2	40	1	100
CARB	No	1	9.1	0	0	2	40	0	0
	Yes	9	81.8	0	0	2	40	1	100
PTN	No	2	18.2	0	0	2	40	0	0
	Yes	7	63.6	0	0	2	40	1	100

GENT: Gentamicin; VANC: Vancomycin; AMIK: Amicacin; DIGXN: Digoxin; VALP: Valproic Acid; CARB: Carbamazepine; PTN: Phenytoin.

Table 13b: Frequency of clear TDM area test abbreviations according to the participants' positions.

TDM clear abbreviations		Position							
		Consultant		Nurse		Resident		Specialist	
		Count	%	Count	%	Count	%	Count	%
PHENO	No	1	9.1	0	0	0	0	0	0
	Yes	8	72.7	0	0	4	80	1	100
ACET	No	1	9.1	0	0	0	0	0	0
	Yes	7	63.6	0	0	4	80	1	100
METHO	No	1	9.1	0	0	1	20	0	0
	Yes	7	63.6	0	0	3	60	1	100
TACR	No	3	27.3	0	0	2	40	0	0
	Yes	5	45.5	0	0	2	40	1	100
CSA	No	3	27.3	0	0	1	20	0	0
	Yes	4	36.4	0	0	3	60	1	100
CSAE	No	4	36.4	0	0	1	20	0	0
	Yes	2	18.2	0	0	3	60	1	100
AMA	No	3	27.3	0	0	0	0	0	0
	Yes	2	18.2	0	0	4	80	1	100

PHENO: Phenobarbital; ACET: Acetaminophen; METHO: Methotrexate; TACR: Tacrolimus; CSA: Cyclosporine; CSAE: Cyclosporine-Extended; AMA: Amino acids.

Table 14: The frequency of the participants according to the number of the ordering calls.

No. of calls	10	20	30	60
No. of Participants	11	3	2	1
% of Participants	64.7	17.6	11.8	5.9

Table 15: The frequency of the participants according to reason for calling the laboratory.

% of calls reasons		10	20	30	40	50	60	80	90	100
Add tests	Count	9	4	2	0	0	2	0	0	0
	%	52.9	23.5	11.8	0	0	11.8	0	0	0
Correct or delete the order	Count	13	2	2	0	0	0	0	0	0
	%	76.8	11.8	11.8	0	0	0	0	0	0
Result delay	Count	7	2	2	1	1	1	2	0	1
	%	41.2	11.8	11.8	5.9	5.9	5.9	11.8	0	5.9
Discuss the result	Count	10	1	2	1	1	1	1	0	0
	%	58.8	5.9	11.8	5.9	5.9	5.9	5.9	0	0
Test availibility	Count	10	0	2	0	2	0	0	2	1
	%	58.8	0	11.8	0	11.8	0	0	11.8	5.9
Inquire sample receiving time	Count	11	0	2	1	2	0	1	0	0
	%	64.7	0	11.8	5.9	11.8	0	5.9	0	0
Container and tube used	Count	12	0	3	0	1	1	0	0	0
	%	70.6	0	17.6	0	5.9	5.9	0	0	0

Table 16: The frequency of the participants according to of staff response and attitude.

% of Staff response and attitude		10	20	30	50	60	70	80	90	100
Positive response from first call	Count	4	1	0	2	1	0	5	1	3
	%	23.5	5.9	0	11.8	5.9	0	29.4	5.9	17.6
How effective was the resposne	Count	2	2	0	3	1	0	3	3	3
	%	11.8	11.8	0	17.6	5.9	0	17.6	17.6	17.6
Staff attitude	Count	1	0	1	2	1	2	1	3	6
	%	5.9	0	5.9	11.8	5.9	11.8	5.9	17.6	35.3

Table 17: Frequency of the participants' satisfaction regarding the report formatting satisfaction.

% of report formatting satisfaction		10	20	30	40	50	60	70	80	90	100
Gernal design	Count	2	0	0	1	0	2	2	3	3	5
	%	11.1	0	0	5.6	0	11.1	11.1	16.7	16.7	27.8
Patient information	Count	2	0	0	1	1	1	0	2	5	6
	%	11.1	0	0	5.6	5.6	5.6	0	11.1	27.8	33.3
Clarity of result	Count	3	0	0	0	1	0	1	3	3	7
	%	16.7	0	0	0	5.6	0	5.6	16.7	16.7	38.9
Presence of normal value range	Count	2	0	0	1	0	1	0	2	5	7
	%	11.1	0	0	5.6	0	5.6	0	11.1	27.8	38.9
Font size	Count	3	2	0	0	1	0	0	1	3	8
	%	16.7	11.1	0	0	5.6	0	0	5.6	16.7	44.4
Font type	Count	3	1	0	1	1	0	0	1	3	8
	%	16.7	5.6	0	5.6	5.6	0	0	5.6	16.7	44.4
Test order arrangement	Count	2	1	1	0	0	0	1	3	5	5
	%	11.1	5.6	5.6	0	0	0	5.6	16.7	27.8	27.8

Table 18: Frequency of coverage of the participants' needs by the clinical chemistry laboratory tests cover.

		Yes	No
Do the tests cover all your needs?	Count	12	6
	%	66.7	33.3

DISCUSSION

The current cross sectional descriptive study tried to assess the users' satisfaction related to the laboratory services of the clinical chemistry laboratory of one of the highly qualified labs in Saudi Arabia in an accredited hospital, which is the KAUH. This survey covers all clinical chemistry laboratory areas, investigations, test requesting, report formatting, and staff responses.

The satisfactory rates between using KAUH chemistry laboratory and other services among the participants, 57.1% believed that there is a difference between the chemistry laboratory at KAUH and the same services provided by other laboratories. The response rates among the consultants, residents, and specialists are 53.3%, 85.7% and 75% respectively. Just one consultant assumes that other laboratory services are improved. A previous study reported that teaching institutions tended to have higher percentages of below average/poor ratings for communication of relevant information and timeliness of reporting [11].

The current laboratory technologist responses were highly satisfied for the most of participants (≥ 70%). However, 20% of the participants assessed the effectiveness of laboratory staff response in general as well as the positivity of first call response at only 10%. Also, there are high compatible expectations with the doctor's diagnosis especially in the specialist's group (5.0) compared with residents (2.88) and consultants (1.55). The specialists are more satisfied about the turnaround time of results of this area than nurses (3.33), residents (2.57), and consultants (1.59). These findings agree with that of another study, which reported that the overall satisfaction for surgical pathology reports as well as satisfaction with report test turn-around time, completeness and style were high. Report turnaround time received the lowest scores of all parameters [12].

The main problem in any institution that may affect its provided services is poor communication or miscommunication among personnel. Poor or miscommunication from any side will affect the required process needed from that side. This highlights the need for improving the communication skills among laboratory staff and users (doctors and nurses) to improve quality in laboratory services aiming at the patient satisfaction. As mentioned in a previous study that, Patient satisfaction is the degree to which the patient's

desired expectations, goals and or preferences are met by the health care provider and or services [13,14].

Through this survey, we found that specialists are the most satisfied group over other groups. Their satisfaction ratings showed high percentages (60%-100%) over most of the services. Moreover, we found that number of orders is somehow affected by doctor position. The analyzed data reveals that consultants request fewer orders compared with others. This is maybe due to two reasons: because of their experience, they do not need a lot of investigations besides their diagnosis to make decisions, and/or they delegate other doctors of other positions to order the tests.

Carrying out such an action will provide the laboratories and the hospital with profoundly accurate and precise information about the impact of the quality of their services. It will put the basis for the improvement and development of the services. In addition, the whole practice of the lab and the hospital will fulfill the requirements of clause 4.14.3 in ISO 15189:2012. Although most of the participants in this survey had dealt with other chemistry laboratories, a considerable percentage of those participants agreed that the chemistry laboratory at KAUH is the best. However, correcting specific defects identified by one or even a few customers as mentioned in the current study may be of insignificant value to be detected on the radar of subsequent surveys. Previous studies stated that the service providers implement improvements to address defects, they must build an opinion to determine whether or not satisfaction has improved [8,10].

Briefly, the current descriptive study revealed that the clinical chemistry laboratory at King Abdulaziz University Hospital (KAUH) generally provides good services that cover the needs of 66.7% of its users. However, whatever the quality of services provided, there must be points of defect and/or weakness. This study attempted to discover some of these weakness in clinical chemistry laboratory hoping to create a manual guide including the points of weakness, that can help to improve the services in the future.

LIMITATIONS

The most obvious limitation in this study was the small number of participants compared with the total number of doctors and nurses who received the survey, although the survey had been send several times to all hospital staff of doctors and nurses through their emails. In addition, we contacted some of them and their heads of departments personally.

Some abbreviations were unclear for some participants maybe because they do not use these tests in their specialty. If this is not the case, we have to find a way to clarify those abbreviations and frequently update doctors with any changes or updates.

CONCLUSION

In general, the current survey shows that there was a high level of satisfaction about the services provided by the hormones and TDM areas of the clinical chemistry laboratory at KAUH. Most of the participants depended on this laboratory and thought it is better than other laboratories that they used.

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CONFLICIT OF INTEREST

The authors declare that they have no conflicts of interest related to this study.

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