RESEARCH ARTICLE

ACCREDITATION IMPACT ON SERVICE QUALITY IN MEDICAL LABORATORIES: UNIVERSITY HOSPITAL STAFF VIEWPOINTS

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ABSTRACT

The purpose of this study is to investigate the effect of accreditation on service quality in medical laboratories and the factors that explain how accreditation affects service quality through laboratory staffs' viewpoints. A cross-sectional survey form was designed based on El-Jardali et al. (2008), who studied the impact of hospital accreditation on quality of care. This study sampled from medical laboratory staff. Descriptive statistics were used to analyze participants' demographics and medical laboratory staffs' views. Factor analysis was determined the factors effects on accreditation process in medical laboratory. Explanatory factor analysis revealed a five-factor model explaining 75% of the variance. The factors were named Quality Management, Benefits of Accreditation, Accreditation Staff Involvement, Quality Results, and Human Resources Utilization. Gender, age, employment status, degrees, and length of employment in present position at Central Laboratory all affected the participants' perceptions. Medical laboratory staff had positive viewpoints about accreditation and its effect on medical laboratory service quality. This study gives university hospital medical laboratory managers a deeper insight into accreditation and its effects on medical laboratory service quality. Besides, the results will lead the way private and public hospital managers to conduct organizational variables for increase benefit from accreditation. This cross-sectional study was applied to examine the key factors in accreditation process at medical laboratories through factor analysis, which provided empirical evidence for future research.

Keywords: *Quality management, medical laboratory accreditation, university hospital*

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ARAŞTIRMA MAKALESİ

AKREDİTASYONUN TIP LABORATUVARLARINDA HİZMET KALİTESİ ÜZERİNE ETKİSİ: ÜNİVERSİTE HASTANESİ PERSONEL GÖRÜŞLERİ

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ÖZ

Bu çalışmanın amacı, akreditasyonun tıbbi laboratuvarlarda hizmet kalitesi üzerindeki etkisini ve akreditasyonun hizmet kalitesini nasıl etkilediğini açıklayan faktörleri, laboratuvar personelinin bakış açısıyla incelemektir. Kesitsel bir anket formu El-Jardali ve ark. (2008), hastane akreditasyonunun bakım kalitesi üzerindeki etkisini araştırdıkları çalışmasına dayanarak tasarlanmıştır. Bu çalışma tıbbi laboratuvar personelinden örneklenmiştir. Katılımcıların demografik özelliklerini ve tıbbi laboratuvar personelinin görüşlerini analiz etmek için tanımlayıcı istatistikler kullanılmıştır. Faktör analizi ile tıbbi laboratuvarda akreditasyon sürecini etkileyen faktörler belirlenmiştir. Açıklayıcı faktör analizi, varyansın %75'ini açıklayan beş faktörlü bir model ortaya çıkarmıştır. Faktörler; Kalite Yönetimi, Akreditasyonun Faydaları, Akreditasyona Personeli Katılımı, Kalite Sonuçları ve İnsan Kaynakları Kullanımı olarak adlandırılmıştır. Cinsiyet, yaş, kadro durumu, mezuniyet durumu ve merkez laboratuvarındaki mevcut pozisyondaki çalışma süresinin tümü katılımcıların algılarını etkilemektedir. Tıbbi laboratuvar personelinin akreditasyon ve bunun tıbbi laboratuvar hizmet kalitesine etkisi konusunda olumlu görüşlere sahip olduğu görülmüştür. Bu çalışma, üniversite hastanesi tıbbi laboratuvar yöneticilerine akreditasyon ve akreditasyonun tıbbi laboratuvar hizmet kalitesi üzerindeki etkileri hakkında daha derin bir fikir vermektedir. Ayrıca sonuçlar, özel ve kamu hastaneleri yöneticilerinin, akreditasyondan daha fazla fayda sağlamak için organizasyonel değişkenleri yönetmelerine yardımcı olacaktır. Bu kesitsel çalışma, gelecekteki araştırmalar için ampirik kanıt sağlayan faktör analizi yoluyla tıbbi laboratuvarlarda akreditasyon sürecindeki kilit faktörleri incelemek için uygulanmıştır.

Anahtar Kelimeler: *Kalite yönetimi, tıbbi laboratuvar akreditasyonu, üniversite hastanesi*

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I. INTRODUCTION

Accreditation is used worldwide to improve organizational performance Pomey et al. (2010). It is a process whereby an organization is assessed on a set of pre-determined standards (Klazinga, 2000; Montagu, 2003). More specifically, accreditation forms part of quality infrastructure that, by providing conformity certificates, confirms that the organization under consideration is functioning according to the technical criteria determined by a third party.

Accreditation is one of the most important mechanisms for improving the quality of healthcare services and evaluating the accreditation performance of healthcare organizations (Jaafaripooyan et al., 2011). Accreditation first emerged in the US from the 'Minimum Standards for Hospitals' developed by the American College of Surgeons in 1997. In 1947, increasing world trade led to the establishment of the International Standards Organizations (ISO) (Montagu, 2003). In 1951, the foundation of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) marked the beginning of formal accreditation in the US. Canada and Australia started accreditation programs in the 1960s and 1970s, and Europe in 1980s (Alkhenizan and Shaw, 2011). In the 1990s, such programs expanded all globally (Shaw, 2000). JCAHO established the Joint Commission of International Accreditation (JCI) to meet increasing demand for standards-based evaluation in healthcare in the international community (Yıldız and Kaya, 2014). JCI inspects accreditation process in hospitals and other organizations, and has accredited many hospitals in Europe, the Persian Gulf, Thailand, India, and Brazil (Jovanovic, 2005).

Accreditation is accepted as the best tool for encouraging improvement of healthcare service quality while the number of countries using it is increasing continuously (Shaw and Organization, 2006). Studies about accreditation general base on five thematic categories, these are patient safety and health care quality; organizational performance; clinical processes and outcomes; professionals' views and consumers' perception on the effect of accreditation (Swathi et al., 2020). Many studies have demonstrated the strategic importance of accreditation to ensure employee safety and continuous quality improvements in healthcare organizations (Al Tehewy et al., 2009; Beaulieu and Epstein, 2002; Menachemi et al., 2008). Accreditation also plays a critical role in the health sector by ensuring cooperation among healthcare professionals, improving healthcare organizations' corporate image, enabling employee reliance and trust in their organizations, and maximizing efficiency in provision of services (Yıldız and Kaya, 2014). Consequently, healthcare organizations aiming to offer high service quality implement accreditation and provide relevant training and encouragement to their employees. Several countries are developing their own accrediting agencies.

While medical laboratory accreditation is not compulsory, it is a critical process for service quality (Verstraete el al., 1998). Accreditation verifies that medical laboratories conform to the quality and competence standards considered fundamental for reliable and accurate patient testing and staff safety (Rabinovitch, 2002).

To gain accreditation, a healthcare institution must meet previously set standards that determine optimal quality. An accredited medical laboratory then ensures that it applies the viable necessities for its service and demonstrates that it takes the essential precautions for patient and employee safety.

According to Karthiyayini and Rajendran (2017), the critical factors of laboratory accreditation are top management commitment, quality process management, customer focus, technical systems, measurement, monitoring, control and continual improvement, and human resource management. Top management must also be committed to implementing a Laboratory Quality Management System. Many researchers have highlighted top management commitment in implementing and developing quality practices (Ahire et al., 1996; Padma et al., 2008) while leadership is also critical for determining the quality objectives (Bahadori et al., 2018). Human resource management is another efficient and effective tool for improving organizational performance (Issac et al., 2004). In particular, an essential factor in the accreditation process is motivating employees to participate (Sadikoğlu and Temur, 2012).

Yıldız and Kaya (2014) used the survey instrument developed by El-Jardali et al. (2008) to measure the effects of accreditation on quality results and perceptions of nurses regarding the impact of accreditation on quality of care. They identified three dimensions of accreditation, which were significantly positively correlated: Benefits of Accreditation, Employee Participation, and Quality Results. Nurses had high scores for the first dimension. They also found that patient satisfaction increased following accreditation.

Studies of the effects of accreditation on healthcare service quality and quality management in medical laboratories show that more research is necessary to determine health outcomes and that these issues have not yet been adequately discussed (Grrenfield and Braithwaite, 2008). There are few available survey instruments for examining the effects of accreditation in healthcare organizations and none has been accepted worldwide. For the present study, a survey form was designed based on a questionnaire developed by (El-Jardali et al., 2008) and administered to staff in Dokuz Eylül University (DEU) Hospital Central Laboratory in İzmir, Turkey. The scale was adapted and developed to be used by similar institutions. DEU Hospital's Central Laboratory, which was accredited by TURKAK, according to ISO EN 15189 in 2012, was the first accredited university medical laboratory in Turkey. This study aimed to assess the impact of accreditation on the quality of care in medical laboratories. It also investigated the contributing factors to changes in quality of care.

II. METHODS

2.1 Survey instrument

Of the few survey instruments available for measuring the effect of accreditation in medical laboratories, the one developed Jardali et al. (2008) was used in the present study. Their survey tool consist of seven scales, four subscales and 54 items that were rated on a five point Likert-type scale. After we translated the El-Jardali et al. (2008) questionnaire into native language, the management of DEU Hospital Central Laboratory examined it and the questionnaire wording was modified in places before being used for the survey. The modifications reflected the medical laboratory context and business or cultural differences (Modifications can be see Appendix 1-2). While the original survey had seven sections, our survey had eight, comprising 57 items. Responses were recorded on a five-point Likert-type scale (ranging from 1 for "strongly disagree" to 5 for "strongly agree").

2.2 Population and Sample

The survey was administered at DEU Hospital to a population of staff working at DEU Hospital Central Laboratory. The survey was conducted between January 2018 and June 2018. There was no sampling because the aim was to reach all 120 staff in this population in 2018. Within six months of distributing the surveys to the respondents in person, 109 survey forms had been returned, yielding a response rate of 90%.

2.3 Data Analysis

The data were analyzed using IBM SPSS (Version 23.0). The participants' demographic characteristics and responses to the survey items were analyzed using descriptive statistics. Before factor analysis, two tests were performed at each stage: Bartlett's test of Sphericity and the Kaiser-Meyer-Olkin measure of sampling adequacy. The reliability of the survey instrument was evaluated using the Cronbach Alpha value.

2.4 Ethics

This study was approved by the DEU Hospital Ethics Committee. Laboratory staff completed an informed consent form showing that they voluntary agreed to participate.

III. RESULTS

3.1 Participants' Demographic and Descriptive Characteristics

As Table 1 shows, almost all participants were older than 31, about two-thirds were female (62.4%), and the vast majority held at least a Bachelor of Science Degree. Most held administrative personnel positions (83.5%) and most were permanent personnel (86.2%). Nearly half had worked in their present position for up to 10 years (42.2%) while just over half (53.2%) had been in their present position for 11-20 years. Over half had worked for DEU for more 11-20 years (57.8%) while 17.4% had worked there for 21-30 years.

Table 1. Demographic and Descriptive Characteristics of Participants

Variables	Frequency	%	Variables	Frequency	%
Gender			**Age**		
Male	68	62.4	< 31 years	2	1.8
Female	41	37.6	31-45 years	70	64.2
Sum	109	100	46-55 years	27	24.8
Employment Status			> 55 years	10	9.2
Permanent	94	86.2	Sum	109	100
Contractual	15	13.8	**Length of employment in present position at Central Laboratory**		
Sum	109	100	0-10 years	46	42.2
Degrees			11-20 years	58	53.2
High School	8	7.3	21-30 years	4	3.7
Associate degree (2 years)	16	14.7	31-40 years	1	0.9
Bachelor of Science	53	48.6	Sum	109	100
Master/Doctorate Degree	21	19.3	**Length of employment at DEU**		
Other	11	10.1	0-10 years	24	22.0
Sum	109	100	11-20 years	63	57.8
Occupational categories			21-30 years	19	17.4
Unit Supervisor	13	11.9	31-40 years	3	2.8
Nurse	14	12.8	Sum	109	100
Technical Personnel	46	42.2			
Administrative Personnel	27	24.8			
Other	9	8.3			
Sum	109	100			

3.2 Key Service Quality Dimensions

The overall internal consistency reliability (Cronbach's alpha) of the full scale was 0.975 while the Kaiser-Meyer-Olkin value was 0.902 and Bartlett's test of Sphericity was $0.00 < 0.05$. An explanatory factor analysis with varimax rotation was performed to identify the main service quality dimensions of accreditation at the DEU laboratory. The initial factor analysis extracted five factors with eigenvalues greater than one (Table 2). Following Hair et al. (2006), who suggest item reliability values should be above 0.50, after six iterations, we eliminated 19 items that did not load strongly on any factor (< 0.5) or had cross-loadings. The remaining 25 items were again factor analyzed to generate five factors, accounting for 75.35% of the variance. They were labeled as follows: (1) Quality Management, (2) Benefits of Accreditation, (3) Accreditation Staff Involvement, (4) Quality Results and (5) Human Resources Utilization (Table 2) (Ahire, Golhar, and Waller 1996).

Table 2. Explanatory Factor Analysis

	Factors						
Quality Management	**1**	**2**	**3**	**4**	**5**	**Total Variance Exp.**	**Eigen. Values**
L4	0.773						
HR1	0.769						
QP4	0.745						
QM1	0.706						
QP3	0.702					52.081	13.020
HR2	0.675						
HR3	0.640						
QM2	0.617						
L3	0.602						
Benefits of Accreditation							
B12		0.799					
B3		0.794					
B5		0.760					
B8		0.759				7.779	1.945
B4		0.723					
B1		0.713					
QM4		0.517					
Accreditation Staff Involvement							
P5			0.822				
P3			0.806			6.799	1.700
P4			0.759				
Quality Results							
QR1				0.812			
QR2				0.739		4.676	1.169
QR3				0.702			
Human Resource Utilization							
HR4					0.840		
HR5					0.815	4.019	1.005
HR6					0.748		

Note: Extraction Method = Principal Component Analysis. Rotation Method = Varimax with Kaiser Normalization

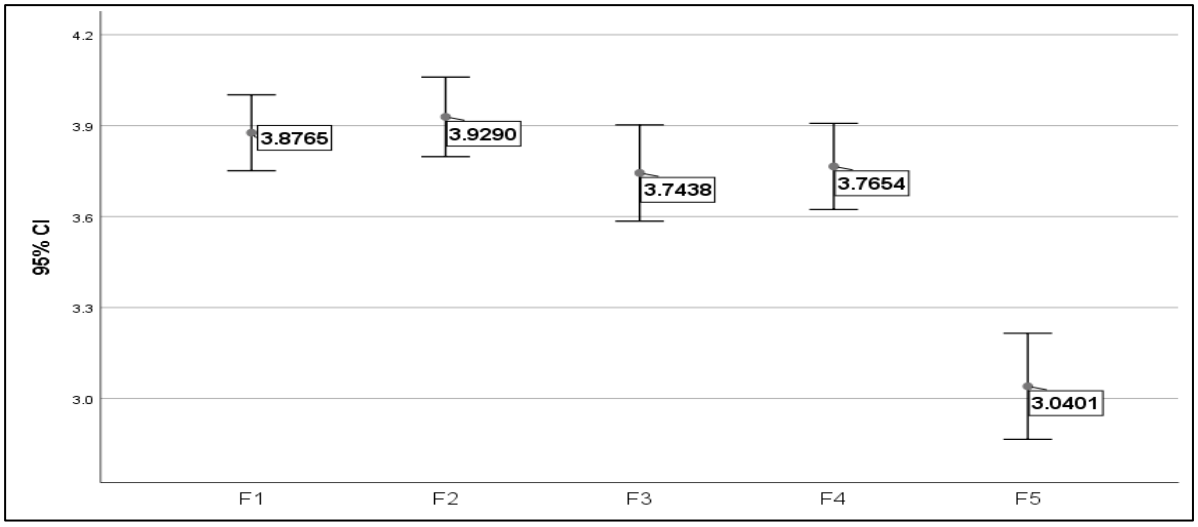
The most important factor was Quality Management because it explained the largest proportion (52.0%) of the total variance. This factor had nine scale items addressing leadership, human resource utilization, planning, and management features of accreditation in medical laboratories. The second factor, Benefits of Accreditation, which explained 7.7% of the variance, had seven scale items. Six of these were the same as in the original survey while one quality management item (QM4) loaded on this dimension. The third factor, Accreditation Staff Involvement, which accounted for 6.7% of the variance, included three items. The fourth factor, Quality Results, representing 4.6% of the total variance, had three items measuring perceptions of accreditation outcomes. Finally, Human Resource Utilization explained 4.0% of the total variance with three items.

3.3 Medical Laboratory Staff's Evaluation of Quality Dimensions and The Effects of Demographic Variables

Figure 1 shows mean scores and error bars for the accreditation factors according to the DEU medical laboratory staff. Human Resources Utilization (F5) had the lowest mean score (3.04), indicating that staff evaluated this factor the most negatively. Conversely, Benefits of Accreditation (F2) had the

highest mean score (3.92), indicating that DEU Medical Laboratory staff believed that accreditation had benefits. Mean scores for F1 and F2, and F3 and F4 were very similar.

Figure 1. Error Bar Graph of Accreditation Factors



Note: F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

Mann-Whitney and Kruskal Wallis tests were conducted to assess the effects of the demographic variables on the quality dimensions. The Mann-Whitney Test was used to test the significance of differences between two groups when the variables are not normally distributed while the Kruskal Wallis Test is used to test the significance of the differences between the means of three or more groups that are not normally distributed. As Table 3 shows, the group means differed significantly according to gender, employment status, age, degrees, occupation categories, length of employment at present position at Central Laboratory, and total length of employment at DEU. In this study significance level was accept at 0.10 ($p<0.10$) as this study will be a reference for further studies.

Table 3. Relationships of Quality Dimensions with Demographic Variables*

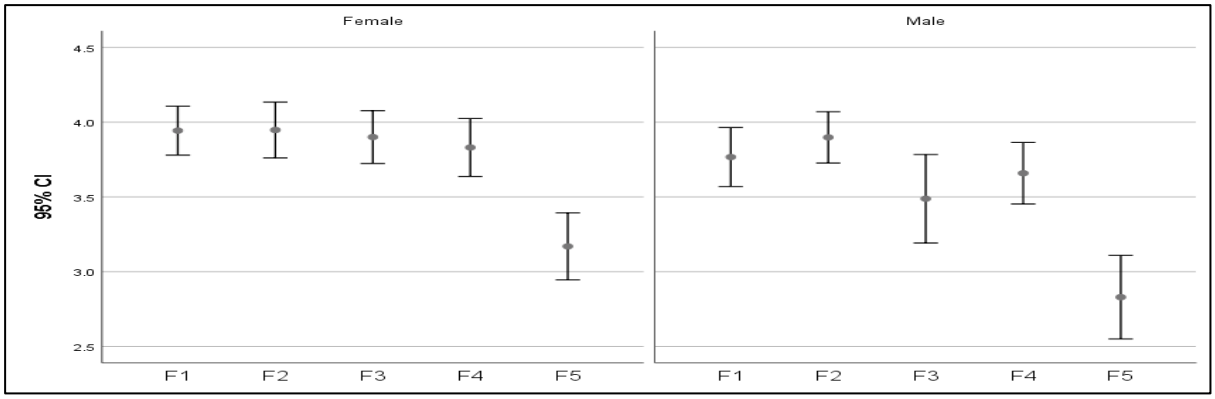
Variables	F1 Quality Management	F2 Benefits of Accreditation	F3 Accreditation Staff Involvement	F4 Quality Results	F5 Human Resources Utilization
Gender[1]	0.171	0.588	**0.027**	0.115	**0.093**
Employment status[1]	0.753	0.677	**0.053**	**0.078**	0.150
Age[2,**]	**0.007**	**0.019**	0.272	0.498	**0.067**
Degrees[2]	0.184	0.545	**0.079**	0.290	**0.069**
Occupation categories[2]	**0.001**	**0.0237**	0.110	0.409	**0.029**
Length of employment in present position at Central Laboratory[2]	0.256	0.88	**0.076**	0.208	0.266
Length Employment at DEU[2]	0.852	0.753	0.334	0.965	0.537

* Frequencies of agree and strongly agree were aggregated as agree while frequencies of strongly disagree and disagree were aggregated as disagree.
1 = Mann-Whitney Test results
2 = Kruskal Wallis Test results
**For the age categories, the two participants under 31 years were excluded from the analysis.

Apart from the length of employment at DEU, all the demographic and descriptive variables significantly affected the participants' scores on one or more of the five dimensions. Mean scores for

Accreditation Staff Involvement and Quality Results differed significantly according to employment status 10% significance level. Quality Management, Benefit of Accreditation, and Human Resources Utilization responses also differed by age category at 10% significance level while Accreditation Staff Involvement and Human Resources Utilization differed by degree category at 10% significance level. Finally, responses to Accreditation Staff Involvement differed significantly according to length of employment at present position at Central Laboratory at 10% significance level.

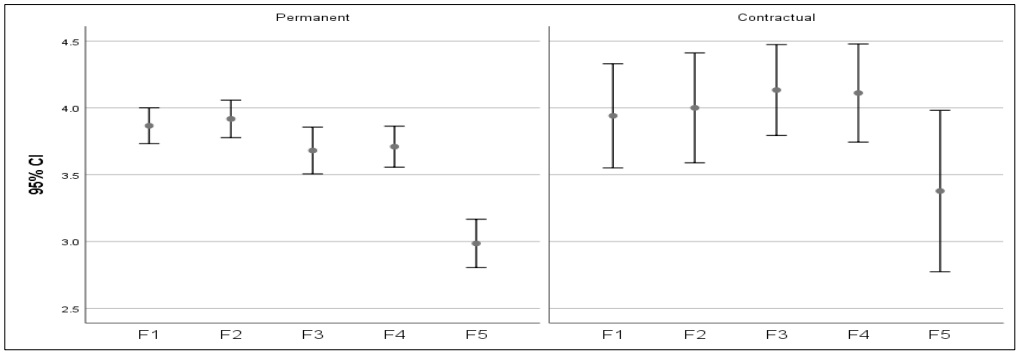
Figure 2. Mean Factor Scores and Error Bars According to Gender



F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

As shown in Figure 2, women staff had more positive attitudes than men for all accreditation dimensions, especially for Accreditation Staff Involvement and Quality Results.

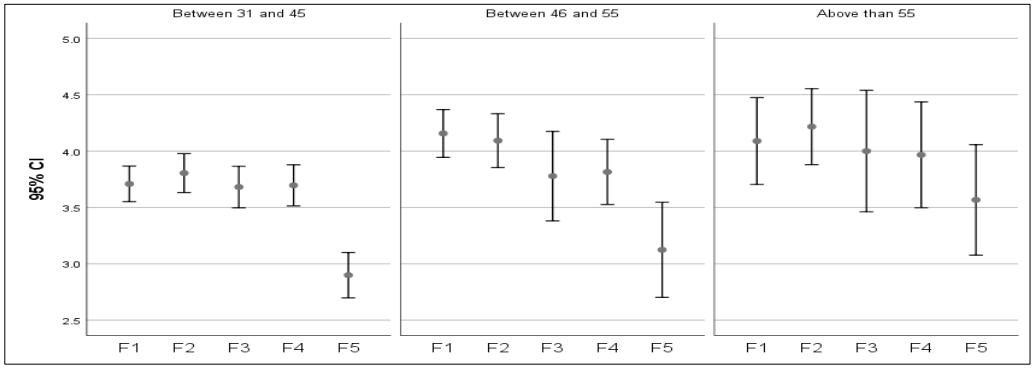
Figure 3. Mean Factor Scores and Error Bars According to Employment Status



F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

Figure 3 indicates that contractual staff had more positive attitudes than permanent staff for all five factors. The positive difference can be seen more preciously at Accreditation staff involvement and Quality Results.

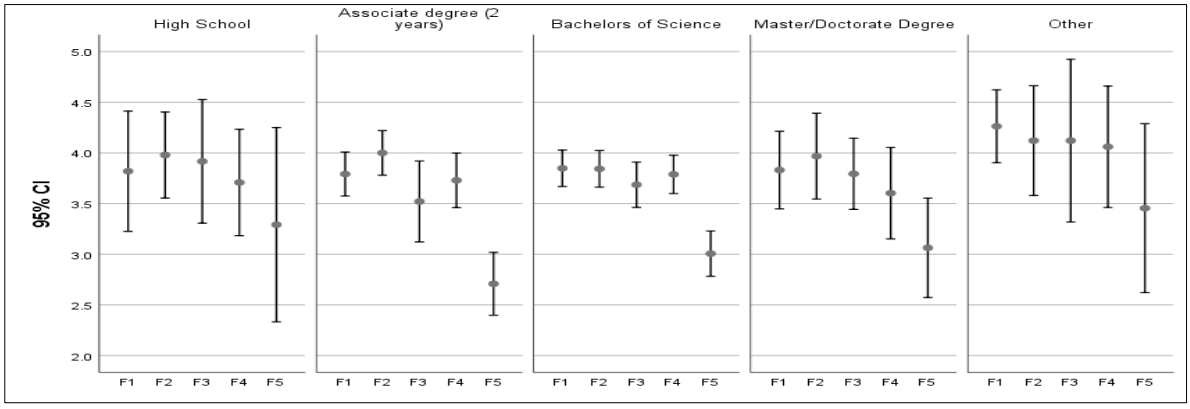
Figure 4. Mean Factor Scores and Error Bars According to Age Categories



F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

Figure 4 shows that participants in the 46-55 age category had less favorable perceptions of Quality Management than both younger and older participants while participants older than 55 had more favorable perceptions of Human Resources Utilization dimension. Overall, younger participants' attitudes are more negative across the five factors than other participants.

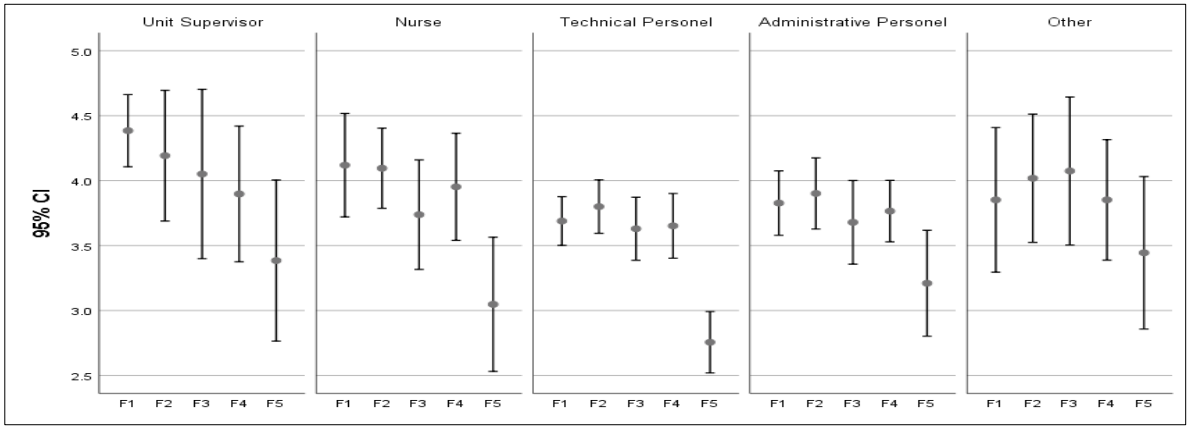
Figure 5. Mean Factor Scores and Error Bars According to Degrees



F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

As shown in Figure 5, the participants in the 'other degree' category gave more positive assessments overall than participants in the other degree categories.

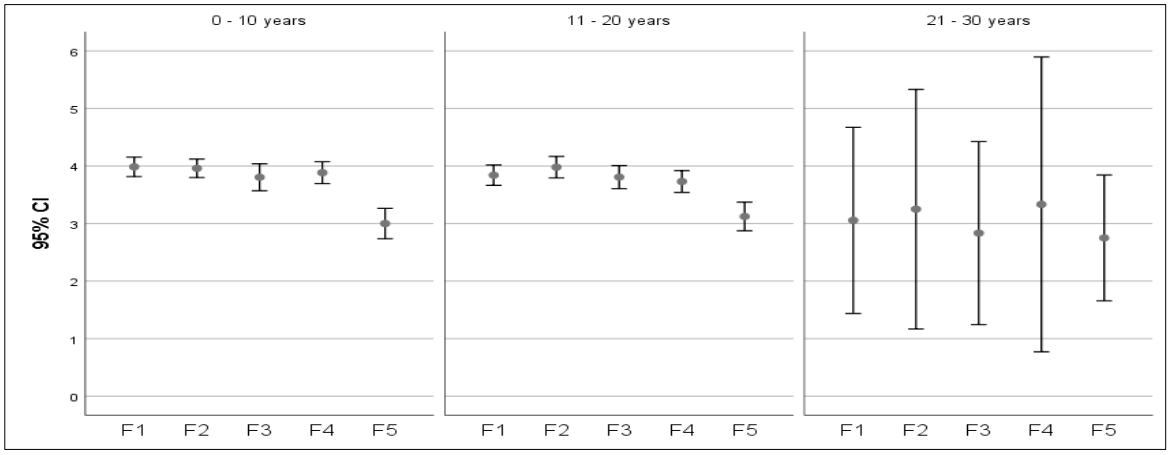
Figure 6. Mean Factor Scores and Error Bars According to Occupational Categories



F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

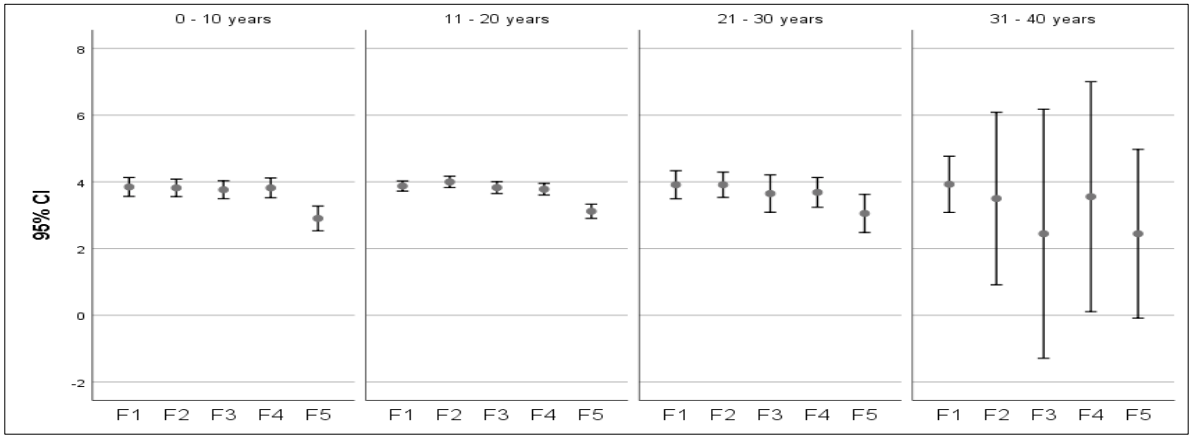
Figure 6 shows that technical personnel gave the least positive assessments while unit supervisors and participants in the 'other' category were the most positive overall. The high scores indicate that unit supervisors had greater commitment than nurses, technical personnel, and administrative personnel.

Figure 7. Mean Factor Scores and Error Bars According to Length of Employment in Present Position at Central Laboratory



F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

Figure 8. Mean Factor Scores and Error Bars According to Length of Employment at DEU



F1: Quality Management; F2: Benefits of Accreditation; F3: Accreditation Staff Involvement; F4: Quality Results; F5: Human Resources Utilization

Figures 7 and 8 show that participants' attitudes became less positive overall if they had been employed for longer, both in their present position in the central laboratory and in DEU in total. The difference between mean factor scores was more apparent at Accreditation Staff Involvement in Figure 7.

IV. DISCUSSION

Our study presents an important contribution to the literature as the first study examining the relationship between medical laboratory accreditation and quality of care through medical laboratory staff viewpoints. This study found that DEU Central Laboratory staff perceived an improvement in quality from the accreditation process, which confirms the findings of many previous studies (Algahtani et al., 2017; Bogh et al., 2018; Schmaltz et al., 2011). Accreditation is particularly necessary to enhance safety culture and quality (Saleh et al., 2013; Uras, 2009). In Tamil Selvi and Ankanagari (2019), study results show that implementation of the quality management system increases test indicators of quality.

The present study showed that accreditation perceptions in a medical laboratory had five dimensions: Quality Management, Benefits of Accreditation, Accreditation Staff Involvement, Quality Results, and Human Resources Utilization. Contrary to our findings, Lebanese nurses perceived seven dimensions. It is possible that the dimension differences are due to the medical laboratory management system. In our study, quality management had the greatest impact as a critical factor in laboratory accreditation, which was consistent with studies in literature (Bahadori et al., 2018; Karthiyayini and Rajendran, 2017). Establishment and execution of efficient quality management system is important for the accreditation process and its sustainability. Patient rights, ethics, planning and implementation of health services, staff motivation, measurement and monitoring of health system stakeholders' satisfaction stand out as expectations that can be possible with a quality management approach. In addition, the increase in patient knowledge and expectations raises the importance of total quality management. Quality management and encouragement from the administration can play a crucial role in achieving organizational goals (Montagu, 2003).

Our results suggest that staff involvement and human resource utilization were also significant as an effective tool for the accreditation process. This finding is in line with the results of previous studies (Avia and Hariyati, 2019). The implementation of accreditation needs involvement, support and motivation from management, and all human resources in the hospital. Staff involvement is also critical for reducing resistance to change and implementing changes like new procedures (Seren and Baykal, 2007). To increase staff involvement, managers need to use motivational tools (Algunmeeyn et al., 2020).

This study revealed that the gender affected responses to accreditation, with women being more positive than men are. As assess the dimension of service quality gender difference can be significant factor (Turan and Bozaykut-Bük, 2016). Age also affected accreditation responses, with participants in the 46-55 age group assessing quality management less positively than both younger and older participants. For Benefits of Accreditation, the participants over 46 had similarly positive evaluations while younger participants had less positive evaluations. Similarly, participants aged 55 years and over regarded Human Resources Utilization more positively. Overall, assessment was more positive as the participants' ages increased. Finally, contractual staff had more positive attitudes towards Quality Results than other groups.

Attitudes also varied by occupational category, with unit supervisors and 'other' participants scoring higher than other occupational categories. Technical staff had the lowest scores. Senior hospital managers should embrace the benefits of accreditation to assure their leadership and commitment for improving health service quality. The higher scores for unit supervisors indicate that senior management is deeply committed to accreditation in their laboratory (El-Jardali et al., 2008). This confirms that accreditation programs can help improve the management of laboratories and laboratory networks (Peter et al., 2010). However, in some studies found that nurse attitudes towards the impact of accreditation on quality results and the accreditation benefits were more positive compared with other groups (Kakemam et al., 2020). Many studies have shown that staff enthusiasm for accreditation activities are related to institutional culture, and degree of support and team working (Shortell et al., 1995).

The study also reveals that evaluations on all dimensions become less positive with length of employment at DEU Central Laboratory, albeit not always statistically significantly. It can be seen in the literature that as the working duration in the current position increases, the perception of accreditation indicated a negative change (Siverbo et al., 2014). For Quality Results, one in five of the participants thought that accreditation had not increased employee satisfaction while almost one third thought that accreditation partially increases employee satisfaction. These findings could be linked to increased workload due to accreditation, as reported by Verstraete et al., (1998). Future studies should determine why the relationship between accreditation and staff satisfaction was not so positive. Finally, overall length of employment at DEU had no significant effects on the participants' responses.

V. CONCLUSION

This study is the first on accreditation and quality in medical laboratories, to the authors' knowledge. Laboratory accreditation provides an internationally approved framework for improved testing quality and reductions in laboratory errors (Peter et al., 2010). Our study evaluated the perceived impact of accreditation on the quality of healthcare services in DEU Central Laboratory, which was accredited in 2012. The great majority of staff in DEU Central Laboratory participated in the study. Overall, the participants thought that laboratory accreditation is a valuable tool for improving the quality of healthcare at the laboratory.

Scale development was used to design an instrument to measure the impact of accreditation on quality in medical laboratories. The final survey questionnaire included seven demographic items (gender, age groups, degrees, employment status, length of employment in present position at Central Laboratory, and total length of employment at DEU) and 50 accreditation and quality scale items. Perceived service quality was significantly affected by the five identified and verified factors, namely Quality Management, Benefits of Accreditation, Accreditation Staff Involvement, Quality Results, and Human Resources Utilization.

According to DEU Central Laboratory' staff, medical laboratory accreditation is a significant tool for improving quality of care. The study findings can thus help inform hospital and medical laboratory managers who are presently working to establish and implement accreditation programs. As to the results, it should be given more attention to medical laboratory staff perceptions towards accreditation. The findings also offer valuable lessons for other developing countries trying to implement accreditation

processes. To make accreditation an efficient and effective regulatory instrument, there is a requirement to assess quality based on staff and patient outcome indicators. This can be achieved by further research.

Ethical Committee Approval: This study was approved by the DEU Hospital Ethics Committee. Laboratory staff completed an informed consent form showing that they voluntary agreed to participate.

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APPENDIX

Appendix 1: Original and Modified Survey Sections

Original Survey Sections	**Version 1 (Applied Survey Sections)**	**Version 2 (Survey Sections After Explanatory Factor Analysis)**
1- Quality Results (Five items)	1. Quality Results (Five items) Question 4 was excluded. One question was added to the survey: o *Accreditation increases employee satisfaction.* (QR1, QR2, QR3, QR4, QR5)	**1. Quality Results** (Three items) (QR1, QR2, QR3)
2- Leadership, Commitment and Support (Nine items)	2. Leadership, Commitment, and Support (Four items) Questions 1, 3, 6, 7, and 9 were excluded. (L1, L2, L3, L4)	No items loaded significantly except L3.
3- Strategic Quality Planning (Seven items)	3. Strategic Quality Planning (Six items) Question 2 was excluded. (QP1, QP2, QP3, QP4, QP5, QP6)	QP1, QP2, QP5, QP6 were not significant. QP3, QP4 loaded onto Quality Management.
4- Human Resources Utilization (six items) *4.1 Education and Training subscale (Three items)* *4.2 Rewards and recognition subscale (Three items)*	*4* Human Resources Utilization (Three items) *4.1 Education and Training Subscale (Three items)* (HR, HR2, HR3) *4.2 Rewards and recognition subscale (Three items)* (HR4, HR5, HR6)	**2. Human Resource Utilization** (Three items) (HR4, HR5, HR6) HR1, HR2, HR3 loaded onto Quality Management.
5- Quality Management (Six items)	*5* Quality Management (Five items) Question 3 was excluded. (QM1, QM2, QM3, QM4, QM5)	**3. Quality Management** (Nine Items) (HR1, HR2, HR3, L3, L4, QP3, QP4, QM1, QM2)
6- Use of Data (Seven items)	*6* Use of Data (Four items) Questions 1, 2, and 7 were excluded. (DU1, DU2, DU3,D4)	No items in this dimension were significant.
7- Accreditation (14 items) *7.1 Staff Involvement (Five items)* 7.2 *Benefits of Accreditation (Nine items)*	*7* Accreditation (20 items) The original survey included two subscales, which were implemented as a different din in our survey. *7.2 Staff Involvement (Six items)* One question was added: o *Staff interest in training increases after accreditation supervision.* (P1, P2, P3, P4, P5, P6) *7.2 Benefits of Accreditation (Fourteen items)* Questions 7, 8, and 9 were excluded while eight questions were added: o *Accreditation increases service reliability (meaning that the service will be completed within the promised time with the desired content).* o *Accreditation ensures assurance to the staff about their work (accuracy of results)* o *Accreditation contributes to the improvement of physical conditions.* o *Accreditation ensures the staff provide services correctly the first time.* o *Accreditation enables the development of organizational culture.* o *Accreditation increase staff job satisfaction* o *Accreditation enables staff to put themselves in the patient's position.* o *Accreditation increases service quality.* (B1, B2, B3, B4,B5, B6, B7, B8, B9, B10, B11, B12, B13, B14)	**4. Accreditation Staff Involvement** (Three items) (P3, P4, P5, P6) P1 and P2 were not significant. **5. Benefits of Accreditation** (Seven items) (B1, B3, B4, B5, B8, B12, QM4)

Appendix 2: Survey Design after Explanatory Factor Analysis

Quality Management	
i.	Based on the accreditation results, DEU Hospital Central Laboratory top management have a thorough understanding of how to improve the quality of services.
ii.	DEU Hospital Central Laboratory staff are given continuous education and training in methods that support quality improvement.
iii.	DEU Hospital Central Laboratory middle managers play a key role in setting priorities for quality improvement.
iv.	DEU Hospital Central Laboratory regularly checks equipment and supplies to make sure they meet quality requirements.
v.	DEU Hospital Central Laboratory staff are involved in developing plans for improving quality.
vi.	DEU Hospital Central Laboratory staff are given the needed education and training to improve job skills and performance.
vii.	DEU Hospital Central Laboratory staff are given education and training in how to identify and act on quality improvement opportunities.
viii.	DEU Hospital Central Laboratory has effective policies to support improving the quality of services (external quality control reviews, internal audits, etc.).
ix.	DEU Hospital Central Laboratory top management have articulated a clear vision for improving the quality of services.
Quality Results	
i.	After accreditation, DEU Hospital Central Laboratory has shown steady, measurable improvements in the quality of patient/clinician satisfaction.
ii.	DEU Hospital Central Laboratory has shown steady, measurable improvements in the quality of services provided to patients.
iii.	DEU Hospital Central Laboratory has shown steady, measurable improvements in the quality of services provided by clinical support departments, such as the phlebotomy unit, secretarial, cleaning staff, etc.
Human Resources Utilization	
i.	DEU Hospital Central Laboratory staff are rewarded and recognized (e.g. financially and/or otherwise) for improving quality.
ii.	DEU Hospital Central Laboratory has shown steady, measurable improvements in the quality of services provided to patients.
iii.	Inter-departmental cooperation to improve the quality of services is supported and encouraged in DEU Hospital Central Laboratory.
Accreditation Staff involvement	
i.	You have learned about the recommendations made to DEU Hospital Central Laboratory since the last survey (if applicable).
ii.	These recommendations were an opportunity to implement important changes at DEU Hospital Central Laboratory.
iii.	You participated in the changes that resulted from the accreditation recommendations.
Benefits of Accreditation	
i.	Accreditation increases service quality.
ii.	Accreditation enables DEU Hospital Central Laboratory to respond better to the patients' needs.
iii.	Accreditation increases service reliability (meaning that the service is completed within the promised time with the desired content).
iv.	Accreditation enables the development of values shared by all professionals at DEU Hospital Central Laboratory.
v.	Accreditation enables DEU Hospital Central Laboratory to respond better to its partners (other contracted institutions, clinics, etc.).
vi.	Accreditation enables the improvement of services in DEU Hospital Central Laboratory.
vii.	DEU Hospital Central Laboratory views quality assurance as a continuing search for ways to improve.