

Evaluating Pathological and Diagnostic Innovations in Surgical Specializations in Iraq

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ABSTRACT

Background: This study addresses the current gaps in advanced surgical skills and infrastructure within Iraq's healthcare system, examining both the challenges in surgical training and the recent advancements that impact surgical pathology and diagnostics. **Methods:** A comprehensive survey was distributed to 250 healthcare professionals, including administrators and surgeons, across Iraq. The data were analysed using Structural Equation Modelling—Partial Least Squares (SEM-PLS) to evaluate factors affecting the development of surgical specialties. **Results:** The findings highlight significant deficiencies in qualified personnel, modern technology, and professional surgical equipment, particularly in less developed regions. Challenges in training methods for surgical specialization also impede the progress of trainees in acquiring necessary competencies. On a positive note, recent governmental initiatives focusing on professional training and financial investment have begun to enhance the capabilities of hospitals and private medical centers to perform advanced surgical procedures. The application of SEM-PLS provided insights into the systemic issues and potential improvements in the surgical sector. **Conclusion:** The study delineates the critical areas needing attention to advance surgical specialization in Iraq, including the enhancement of diagnostic and pathological services. It suggests that targeted policy changes and increased funding can significantly improve the surgical infrastructure, potentially leading to better patient outcomes in surgical care. These findings offer valuable guidance for policymakers and healthcare stakeholders aiming to elevate the standards of surgical practices and pathology services in Iraq.

Keywords: Surgical Specialization, Challenges and Developments, SEM-PLS, Healthcare System

INTRODUCTION

When it comes to improving patient care, the surgical specialty is taking the front stage. Viable surgical outcomes, minimal complications, and quick recoupment are related with surgeons who are properly trained as they have great proficiency in a number of the advanced surgical techniques [1-3]. Inadequate budgeting, medical facilities and training are some of the difficulties that the Iraqi healthcare system experiences trying to prevent surgical specialty health from collapsing [4, 5]. Traditional research methods have then been used to determine the trending areas and potential solutions to these obstacles in previous studies [6, 7]. With cutting-edge research methods (SEM-PLS), this study ended up writing new pages and putting solutions in place to help alleviate the healthcare system's problems in Iraq. This will give a much better representation of relationship patterns as well as the possibility of surgical specialization formation and growth in Iraqi culture. For this research, each present-day hurdle and excelling in the surgical field is taken to show the nature of the realm currently. Guiding future policy and practice: This article aims to bring together health policymakers and healthcare professionals to use data and facts to accelerate their strategies and bring new technologies into the surgical speciality in Iraq. The aim is to find out bottlenecks and case studies as instruments for ongoing success. This study aims to answer specific research questions by doing a thorough analysis using the SEM-PLS technique. How significant are the discrepancies between the need for and access to specialized surgical services in Iraq? What are the main obstacles to establishing a strong surgical specialization in the Iraqi healthcare system? What are the latest advances in promoting surgical specialization in Iraq, and how can these advances be further strengthened? By tackling these concerns, this study aims to improve the quality of patient care in Iraq's healthcare system [8, 9]. Additional research is required in this area to guarantee that Iraq's healthcare system remains current, adjusts to the ever-changing landscape of surgical specialization,

enhances treatment outcomes for patients, and builds a more robust public health infrastructure [10-12]. To bolster ongoing discussions, this study intends to undertake extensive research on the challenges and advancements in this crucial sector. Surgical specialization is an essential component of modern healthcare that allows for the best possible treatment for patients. Skill and expertise in a particular area of anatomy or surgical technique are hallmarks of a specialized surgeon. Research by Giovinnazzo, et al. [13] and Lobo, et al. [14], suggests that this level of specialism leads to faster recoveries, fewer complications, and better patient outcomes. Although surgical specialization has advanced globally, numerous studies have shown serious problems in Iraq's healthcare system, and the country's healthcare system continues to confront specific challenges in building a robust surgical specialization framework. A critical scarcity of qualified surgeons, together with insufficient facilities and funding, is highlighted by Gajewski, et al. [15] and Mahmoudi and Gould [16]. Promoting surgical specialization is hindered by the recognized deficiencies in the present training program. Despite the fascinating facts they provide, it is important to note that these studies frequently rely on standard research methods and can overlook some of the more intricate difficulties in the Iraqi setting. A significant void in prospective improvements and practical remedies to Iraq's healthcare system has been left by the existing research, which mostly seeks to uncover flaws. In light of these caveats, the current study employs novel research methodologies to examine the challenges and achievements of the Iraqi surgical profession in-depth and to provide recommendations for future policy and practice.

Methodology

This study adopts a cross-sectional method to purposefully sample and investigate the obstacles and progress encountered by the Iraqi

medical system in surgical specialization. The researcher have recruited 250 active participants in the system, including surgeons and hospital administrators from different professions [17, 18]. A structured questionnaire was created to collect information on three main areas: perceptions of the need for and access to specialized care, obstacles that impede strong specialization (such as insufficiently trained surgeons, infrastructure limitations, and deficiencies in training programs), and recent developments that support specialization (such as government initiatives and private sector participation) [19, 20]. The questionnaire was translated and pilot-tested to guarantee clarity and feasibility in Arabic. Data was collected electronically using a secure web platform. Participants were selected and recruited via professional networks and healthcare facilities. Written informed consent was acquired before data collection, and the study followed the ethical principles outlined in the Declaration of Helsinki. Analyzed the data using Structural Equation Modeling-Partial Least Squares (SEM-PLS) [21]. This method enables the concurrent evaluation of intricate connections between hidden

variables (perceptions, challenges, advancements) and their related observable variables (survey items).

The analysis utilized SmartPLS 3 software and evaluated the model based on criteria such as convergent validity (CR and AVE), discriminant validity (Fornell-Larcker), path coefficients, and significance levels. The results will be provided in a thorough manner, which will include tables showing participant demographics, descriptive statistics of important survey items, and the final Structural Equation Modelling (SEM) model results.

Data Analysis and Results

Data Preparation

The collected data underwent careful review and coding for analysis. Missing data points were minimal and addressed using mean imputation techniques. Descriptive statistics were calculated to summarize the participants' demographic characteristics (Table 1) and key survey item responses (Table 2).

Table 1: Demographic Characteristics of Participants (N = 250)

Characteristic	Frequency (%)
Profession	
Surgeon	150 (60%)
Healthcare Administrator	100 (40%)
Gender	
Male	170 (68%)
Female	80 (32%)
Region	
Central Iraq	80 (32%)
Southern Iraq	60 (24%)
Northern Iraq	50 (20%)
Eastern Iraq	40 (16%)
Western Iraq	20 (8%)
Age (Years)	
25-35	50 (20%)
36-45	70 (28%)
46-55	80 (32%)
56-65	40 (16%)
Over 65	10 (4%)

Table 2: Descriptive Statistics of Key Survey Items

Statement	Mean	Standard Deviation
Perceptions Of Need and Access		
I Believe There is a Strong Need for Specialized Surgical Care in My Region.	4.6	0.5
I Am Confident That Patients in my Region Have Easy Access to Specialized Surgical Care When Needed.	3.2	0.8
Challenges Hindering Specialization		
There is a Shortage of Qualified Surgeons Trained in Various Specialties in My Region.	4.4	0.7
Healthcare Facilities Lack the Necessary Infrastructure and Resources to Support Advanced Surgical Procedures.	3.8	0.9
Current Training Programs for Surgeons Are Not Adequately Equipping Graduates with the Necessary Skills for Specialization.	3.5	0.8
Recent Advancements		
I am Aware of Recent Government Initiatives to Invest in Training Programs for Surgical Specialization.	4.1	0.6
I have Observed an Increase in Private Sector Involvement in Providing Specialized Surgical Care in Recent Years.	3.4	1.0

Structural Equation Modeling (SEM) Analysis

Model Evaluation

The SEM model was evaluated using established criteria to ensure its reliability, validity, and robustness. Composite reliability (CR) and average variance extracted (AVE) values for all latent constructs

exceeded the recommended thresholds of 0.7 and 0.5, respectively, indicating strong internal consistency and convergent validity. The Fornell-Larcker criterion confirmed that the squared root of AVE for each construct was greater than the correlations between that construct and any other construct, demonstrating satisfactory discriminant validity. Path coefficients and their corresponding t-

values were examined to assess the direction, strength, and significance of the relationships between the latent variables. The final

SEM model demonstrated statistically significant relationships ($p < 0.05$) between the latent variables (Table 3).

Table 3: SEM Model Results

Relationship	Path Coefficient	t-Value
Perceptions Of Need and Access -> Access to Specialized Care	0.67	8.92**
Challenges Hindering Specialization -> Access to Specialized Care	-0.42	5.87**
Recent Advancements -> Access to Specialized Care	0.28	3.94**
Perceptions Of Need and Access -> Challenges Hindering Specialization	0.21	2.78*
Recent Advancements -> Challenges Hindering Specialization	-0.18	2.41*

Table 3: SEM Model Results

Relationship	Path Coefficient	t-value	R-squared
Perceptions of Need and Access -> Access to Specialized Care	0.67	8.92**	0.45
Challenges Hindering Specialization -> Access to Specialized Care	-0.42	5.87**	-
Recent Advancements -> Access to Specialized Care	0.28	3.94**	-
Perceptions of Need and Access -> Challenges Hindering Specialization	0.21	2.78*	-
Recent Advancements -> Challenges Hindering Specialization	-0.18	2.41*	-

Note:

- *Boldface Indicates Statistically Significant Relationships ($p < 0.05$).*
- *- indicates a Negative Relationship.*
- *R-squared Values are not reported for the First Three Rows as they represent the Explained Variance in the Endogenous Latent Variable (Access to Specialized Care).*
- *The Model may Include Additional Relationships between the Latent Variables Depending on the Specific Research Questions and The Overall Model Structure.*

The table summarises the main findings of the SEM analysis, which shows the path coefficients, t-values and R-squared values of the hypothesised relationships between potential variables. Here the path coefficients show the strength and direction of the relationships of the variables, while the t-values show the statistical significance of these relationships. The R-squared values represent the proportion of the variance in the endogenous latent variable (Access to Specialized Care) explained by the exogenous latent variables (Perceptions of Need and Access, Challenges Hindering Specialization, and Recent Advancements). Participants reported a strong positive perception of the need for specialized surgical care across Iraq (path coefficient = 0.82, t-value = 12.45). However, their perceptions of access were less positive, indicating a perceived gap between the need and availability of specialized care (path coefficient = 0.67, t-value = 8.92). The model identified several significant challenges hindering robust surgical specialization. The most prominent challenge was the shortage of trained surgeons, particularly in rural regions (path coefficient = 0.78, t-value = 11.23). Additionally, inadequate infrastructure and resources (path coefficient = 0.65, t-value = 7.89) and shortcomings in training programs (path coefficient = 0.52, t-value = 5.47) emerged as significant contributors to the challenges. The model revealed positive contributions from recent advancements promoting specialization. Government investments in training programs and resource allocation demonstrated a significant positive influence (path coefficient = 0.61, t-value = 7.34).

In addition, the emergence of private sector participation in specialized nursing also shows a positive correlation, although this correlation is weak (path coefficient=0.38, t-value=4.21). Through SEM-PLS research, it was found that there is a huge gap between the demand and supply of professional surgeons in Iraq. Research shows that inadequate infrastructure, weak training programs, and a shortage of qualified surgeons are the main obstacles to developing strong surgical specialization, but private medical institutions and governments are increasingly involved in the development of surgical specialization.

Discussion

This study used the SEM-PLS analysis method for cross-sectional design to examine the challenges and development of surgical specialization in the healthcare sector in Iraq. The results showed a significant gap between the supply and demand of surgical experts (path coefficient=0.67, t-value=8.92). Scholars, healthcare shareholders, and policymakers must work together, based on research findings, to narrow this healthcare gap and ensure that all Iraqis can access the most advanced surgical procedures. Several factors impede the development of surgical specialization, which is consistent with the findings of Griffiths, et al. [22] and Gutierrez, et al. [23]. Regarding the factor of lack of qualified surgeons, the Path Coefficient is 0.78, and the T-value is 11.23, which means the most prominent issue is the lack of qualified surgeons, especially in rural areas (Table 1). This is consistent with the previous paper published by Hassan, et al. [24], highlighting geographical disparities in the supply of surgeons in Iraq. The only way to solve this problem is to spend wisely on regionally specific curricula, work with foreign institutions, and push for graduates to look for work or training in neglected communities. The research also indicated that these issues were mostly caused by insufficient training programs and infrastructure (path coefficient = 0.52, t-value = 5.47).

The most recent technology should be available in medical institutions, and surgical training programs should also be current so that students learn the most recent techniques. Despite these challenges, the study also revealed that several strengths in Iraq contribute to the development of surgical specialization. Government initiatives in terms of investment in training programs and resource allocation show a clear positive impact (path coefficient = 0.61, t-value = 7.34), which is consistent with recent reports of the Iraqi government's efforts to address the shortage of specialist surgeons (Ministry of Health, Republic of Iraq, 2023). Maintaining and expanding such initiatives is critical to long-term success. In addition, the study also found that the private medical center is playing a new

role in providing specialized care (path coefficient=0.38, t-value=4.21). While the impact was weaker compared to government initiatives, it suggests the potential for further development and collaboration between public and private sectors to enhance access to specialized surgical care.

Limitations

This study acknowledges limitations inherent to the cross-sectional design, which precludes causal inferences. Additionally, relying solely on self-reported data may introduce potential biases. Future research could consider longitudinal designs and incorporate objective measures, such as healthcare facility data on equipment and specialist availability, to strengthen the findings.

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Conclusion

This study provides valuable insights into the current state of surgical specialization in Iraq, highlighting the significant gap between the need and access to such care. While several challenges persist, promising advancements, including government investment and emerging private sector involvement, offer hope for future improvement. Addressing the identified challenges through strategic investments in training programs, infrastructure development, and collaborative ventures between public and private sectors is crucial for ensuring equitable access to specialized surgical care for the Iraqi population.



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