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EVALUATING THE INFLUENCE OF PHYSICIAN EXPERTISE AND PROCEDURAL VOLUME ON COMPLICATION RATES AND PATIENT SATISFACTION IN EMERGENCY MEDICINE AND PLASTIC SURGERY

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Abstract

This study investigates the impact of physician expertise and procedural volume on complication rates and patient satisfaction in emergency medicine and plastic surgery. A retrospective analysis of patient records and surveys was conducted at two major hospitals in Saudi Arabia over a five-year period. The study included 500 emergency medicine patients and 500 plastic surgery patients, along with their attending physicians. Physician expertise was determined by years of experience and specialty certification, while procedural volume was measured by the number of procedures performed annually. Complication rates were assessed using ICD-10 codes, and patient satisfaction was evaluated through a validated survey. Logistic regression analysis was used to examine the associations between physician factors and patient outcomes, while controlling for patient demographics and clinical characteristics. The results showed that higher physician expertise and procedural volume were significantly associated with lower complication rates and higher patient satisfaction in both specialties. The findings suggest that investing in physician training and specialization, as well as ensuring adequate exposure to procedures, can improve the quality and safety of patient care in emergency medicine and plastic surgery. The study highlights the importance of continuous professional development and performance monitoring in these critical areas of healthcare.

Introduction

Physician expertise and procedural volume are two key factors that can influence patient outcomes in various medical specialties. Expertise refers to the knowledge, skills, and judgment that physicians acquire through education, training, and experience (Ericsson, 2015). Procedural volume refers to the number of specific procedures that physicians perform over a given period, which can reflect their proficiency and efficiency (Birkmeyer et al., 2013). Previous studies have shown that higher physician expertise and procedural volume are associated with better patient outcomes, such as lower mortality, morbidity, and complication rates, as well as higher patient satisfaction and quality of life (Morche et al., 2016; Weigl et al., 2016).

Emergency medicine and plastic surgery are two specialties where physician expertise and procedural volume can have a significant impact on patient outcomes. Emergency medicine

involves the rapid assessment, diagnosis, and treatment of acute and life-threatening conditions, which requires a broad range of knowledge and skills (Counselman et al., 2017). Plastic surgery involves the repair, reconstruction, or replacement of physical defects or deformities, which requires precise technical skills and aesthetic judgment (Rohrich et al., 2019). Both specialties deal with complex and high-risk procedures, such as trauma resuscitation, wound management, and reconstructive surgeries, which can have significant complications and long-term consequences for patients (Stokes et al., 2017; Farber et al., 2019).

Despite the importance of physician expertise and procedural volume in emergency medicine and plastic surgery, there is limited research on their specific impact on complication rates and patient satisfaction in these specialties, particularly in the context of Saudi Arabian healthcare. This study aims to address this gap in the literature by examining the associations between physician factors and patient outcomes in a large sample of emergency medicine and plastic surgery patients from two major hospitals in Saudi Arabia. The findings of this study can inform the development of strategies and interventions to enhance the quality and safety of patient care in these critical areas of healthcare.

Methods

Study Design and Setting

A retrospective observational study design was used to analyze the patient records and surveys from two major tertiary hospitals in Riyadh, Saudi Arabia: King Saud Medical City and Prince Sultan Military Medical City. These hospitals were selected based on their large volume of emergency medicine and plastic surgery cases, as well as their diverse patient populations and physician workforce. The study period covered five years, from January 2015 to December 2019, to ensure an adequate sample size and temporal trend analysis.

Study Population and Sampling

The study population included all adult patients (aged 18 years and above) who underwent emergency medicine or plastic surgery procedures at the participating hospitals during the study period. Patients were excluded if they had incomplete or missing data, or if they were transferred to another facility before completing their treatment. A stratified random sampling technique was used to select a representative sample of 500 patients from each specialty (emergency medicine and plastic surgery), for a total of 1,000 patients. The sample size was calculated based on a power analysis, assuming a medium effect size (odds ratio of 2.0), a significance level of 0.05, and a power of 0.80 (Cohen, 1992).

Data Collection and Variables

Data were collected from the electronic medical records (EMR) and patient satisfaction surveys of the participating hospitals. The EMR data included patient demographics (age, gender, nationality), clinical characteristics (diagnosis, comorbidities, severity of illness), physician factors (expertise and procedural volume), and outcome measures (complication rates). Physician expertise was determined by two indicators: years of experience since residency completion and specialty certification (board certification or equivalent). Procedural volume was measured by

the average number of procedures performed by each physician per year, categorized into low (<50), medium (50-100), and high (>100) volume.

Complication rates were assessed using the International Classification of Diseases, Tenth Revision (ICD-10) codes for postoperative complications, such as infections, hemorrhage, thromboembolism, and organ failure. Patient satisfaction was evaluated using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, which is a validated and standardized tool for measuring patients' perceptions of their hospital experience (Giordano et al., 2010). The survey included questions on communication, responsiveness, pain management, discharge information, and overall rating of the hospital, scored on a scale of 0-10.

Data Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the characteristics of the study population and the main variables of interest. Bivariate analyses, using chi-square tests and t-tests, were conducted to examine the associations between physician factors (expertise and procedural volume) and patient outcomes (complication rates and satisfaction scores), as well as to identify potential confounders.

Multivariate logistic regression analyses were performed to assess the independent effects of physician expertise and procedural volume on complication rates and patient satisfaction, while controlling for patient demographics and clinical characteristics. The dependent variables were dichotomized into high (above median) and low (below median) categories, based on their distribution in the sample. The independent variables were entered into the models as continuous (years of experience) or categorical (specialty certification and procedural volume) variables. The covariates included age, gender, nationality, diagnosis, comorbidities, and severity of illness. Odds ratios (OR) and 95% confidence intervals (CI) were calculated to estimate the magnitude and precision of the associations.

All statistical tests were two-tailed, and a p-value of <0.05 was considered significant. The goodness-of-fit of the logistic regression models was assessed using the Hosmer-Lemeshow test, and the predictive accuracy was evaluated using the area under the receiver operating characteristic (ROC) curve. Multicollinearity was checked using the variance inflation factor (VIF), and influential cases were identified using Cook's distance and leverage values.

Ethical Considerations

The study protocol was approved by the Institutional Review Boards (IRB) of the participating hospitals and the Saudi Ministry of Health. The need for informed consent was waived due to the retrospective nature of the study and the use of de-identified data. The researchers complied with the ethical principles of the Declaration of Helsinki and the Saudi National Bioethics Committee guidelines. The data were stored securely on encrypted servers and were accessible only to the research team. The results were reported in aggregate form, and no individual patients or physicians were identified.

Results

Sample Characteristics

The final sample included 500 emergency medicine patients and 500 plastic surgery patients, with a mean age of 45.6 years (SD = 16.2) and a male predominance (60%). The majority of patients were Saudi nationals (80%), and the most common diagnoses were trauma (30%), infection (20%), and cancer (15%). The mean number of comorbidities was 2.3 (SD = 1.8), and the mean severity of illness score was 3.2 (SD = 1.5). Table 1 presents the detailed characteristics of the study sample.

Table 1. Patient Characteristics (N = 1,000)

Characteristic	**Emergency Medicine (n = 500)**	**Plastic Surgery (n = 500)**	**Total (N = 1,000)**
Age, mean (SD)	45.6 (18.2)	48.4 (16.5)	47.0 (17.4)
Gender, n (%)			
Male	320 (64.0)	280 (56.0)	600 (60.0)
Female	180 (36.0)	220 (44.0)	400 (40.0)
Nationality, n (%)			
Saudi	410 (82.0)	390 (78.0)	800 (80.0)
Non-Saudi	90 (18.0)	110 (22.0)	200 (20.0)
Diagnosis, n (%)			
Trauma	200 (40.0)	100 (20.0)	300 (30.0)
Infection	120 (24.0)	80 (16.0)	200 (20.0)
Cancer	50 (10.0)	100 (20.0)	150 (15.0)
Other	130 (26.0)	220 (44.0)	350 (35.0)

Characteristic	**Emergency Medicine (n = 500)**	**Plastic Surgery (n = 500)**	**Total (N = 1,000)**
Comorbidities, mean (SD)	2.5 (1.9)	2.1 (1.7)	2.3 (1.8)
Severity of illness, mean (SD)	3.4 (1.6)	3.0 (1.4)	3.2 (1.5)

Physician Expertise and Procedural Volume

The mean years of experience of the attending physicians was 12.5 years (SD = 6.4) in emergency medicine and 14.2 years (SD = 7.1) in plastic surgery. The majority of physicians were board-certified or equivalent in their specialty (80% in emergency medicine and 85% in plastic surgery). The distribution of physicians by procedural volume category was as follows: low (30%), medium (45%), and high (25%) in emergency medicine; and low (25%), medium (50%), and high (25%) in plastic surgery. Table 2 presents the detailed characteristics of the attending physicians.

Table 2. Physician Characteristics (N = 200)

Characteristic	**Emergency Medicine (n = 100)**	**Plastic Surgery (n = 100)**
Years of experience, mean (SD)	12.5 (6.4)	14.2 (7.1)
Specialty certification, n (%)		
Yes	80 (80.0)	85 (85.0)
No	20 (20.0)	15 (15.0)
Procedural volume category, n (%)		
Low (<50 per year)	30 (30.0)	25 (25.0)
Medium (50-100 per year)	45 (45.0)	50 (50.0)

Characteristic	Emergency Medicine (n = 100)	Plastic Surgery (n = 100)
High (>100 per year)	25 (25.0)	25 (25.0)

Complication Rates and Patient Satisfaction

The overall complication rate was 12% in emergency medicine and 18% in plastic surgery. The most common complications were infection (5%), bleeding (3%), and venous thromboembolism (2%). The mean patient satisfaction score was 8.2 (SD = 1.6) in emergency medicine and 7.8 (SD = 1.8) in plastic surgery. Table 3 presents the detailed outcomes of the study sample.

Table 3. Patient Outcomes (N = 1,000)

Outcome	Emergency Medicine (n = 500)	Plastic Surgery (n = 500)	Total (N = 1,000)
Complication rate, n (%)			
Any complication	60 (12.0)	90 (18.0)	150 (15.0)
Infection	25 (5.0)	30 (6.0)	55 (5.5)
Bleeding	15 (3.0)	20 (4.0)	35 (3.5)
Venous thromboembolism	10 (2.0)	15 (3.0)	25 (2.5)
Other	10 (2.0)	25 (5.0)	35 (3.5)
Patient satisfaction, mean (SD)	8.2 (1.6)	7.8 (1.8)	8.0 (1.7)

Bivariate Analyses

The bivariate analyses showed significant associations between physician expertise and procedural volume and patient outcomes. Higher years of experience and specialty certification were associated with lower complication rates and higher patient satisfaction scores in both emergency medicine and plastic surgery ($p < 0.05$). Similarly, higher procedural volume category was associated with lower complication rates and higher patient satisfaction scores in both specialties ($p < 0.01$). Table 4 presents the detailed results of the bivariate analyses.

Table 4. Bivariate Associations between Physician Factors and Patient Outcomes | Physician Factor | Emergency Medicine | Plastic Surgery |

interventions that aim to optimize physician expertise and procedural volume in these specialties. Additionally, more prospective and experimental studies are needed to establish the causal links and long-term effects of physician factors on patient outcomes and satisfaction.

Conclusion

In conclusion, this study demonstrates that physician expertise and procedural volume are significant and independent predictors of complication rates and patient satisfaction in emergency medicine and plastic surgery. Higher years of experience, specialty certification, and procedural volume are associated with lower complication rates and higher patient satisfaction, after adjusting for patient demographics and clinical characteristics. These findings have important implications for healthcare policy and practice, as they suggest that investing in physician training and specialization, as well as concentrating certain procedures in high-volume centers or physicians, may improve the quality and safety of patient care in these critical areas of healthcare. However, more research is needed to confirm these associations in other settings and to evaluate the effectiveness and feasibility of interventions that aim to optimize physician expertise and procedural volume in emergency medicine and plastic surgery.

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