Research Article

Factors Associated with Waiting Time for Patients Scheduled for Elective Surgical Procedures at the University Teaching Hospital (UTH) in Zambia

Mubanga Musonda[1]*, Jacobs Choolwe[1], Rizk Jean[2], Gajewski Jakub[2], Pittalis Chiara[2] and Mweene Cheelo[1,3]

[1]Department of Epidemiology and Biostatistics, School of Public Health, University of Zambia, Zambia; [2]Royal College of Surgeons, Ireland; [3]Surgical Society of Zambia, Zambia

Corresponding author:
Mubanga Musonda, Department of Epidemiology and Biostatistics, School of Public Health, University of Zambia, Zambia,
E-mail: musondam7@gmail.com

Abstract

Background: Measuring waiting times for elective surgical procedures is vital because it is considered as a proxy for evaluating the quality of surgical care. The aim was to examine waiting time for elective surgery at the University Teaching Hospital (UTH) in Zambia, looking at both patient and facility factors. **Methods:** This was a cross-sectional study utilizing data from medical records of patients who were scheduled for elective surgical procedures at the UTH, between 1st December 2018 and 31st January 2019. The Weibull regression model was used to examine waiting times from admission to surgery using patient profiles and to assess the factors associated with waiting time. **Results:** During the study period, 182 patients underwent elective surgical procedures. The overall median waiting time was 9 days (interquartile range 4 to – 18 days). Significant differences in waiting time were observed by the surgical unit (log-rank test, p=0.01). Lack of blood products from the blood bank and lack of operating theatre time were significant determinants of longer times (p=0.02, event time ratio [ETR] 2.23), and (p=0.01, ETR 1.96) respectively. Patients from the neuro-surgical unit experienced a waiting time that was 2.72 (p=0.04) times more than patients from other surgical units. **Conclusion:** We were able to determine waiting times for elective surgical procedures and this can be used to plan for surgery given patient profiles. Additionally, we found that the unavailability of blood products for transfusion and lack of operating theatre time increase waiting time for elective surgery. Ensuring the availability of blood products may reduce waiting time for surgery.

Keywords: Waiting times; Surgical specialty; Medical records; Elective surgical procedures; Blood transfusion

Abbreviations: UTH: University Teaching Hospital; ETR: Event time ratio; WHO: World Health Organization; SD: Standard deviation; CI: Confidence Interval; IQR: Interquartile range; CDH: Cancer Disease Hospital.

Introduction

Timely access to safe surgical care is lacking in the majority of the world, with low- and middle-income countries (LMICs) being affected the most. [1] There is a high surgical disease burden in Sub-Saharan Africa (SSA) exacerbated by inadequate infrastructure, shortages of the workforce, and medical supplies. [2,3] As a result, patients have to wait for a long time before they can receive surgical treatment leading to poor health outcomes. [4] Delays as a result of waiting for elective surgery have been linked to adverse events [4] and poorer outcomes for certain operations. [5] This also puts unnecessary stress on patients. [6] Waiting times can be examined as one of the parameters to measure the performance of public healthcare systems.

In Zambia, surgical care is provided by a network of government (68%), faith-based (30%), and private facilities (2%). [7] The number of facilities able to provide safe and quality-assured surgical care was reported as inadequate. [8] Most of the health facilities providing surgical care do not meet the World Health Organization (WHO) surgical procedural standards. [9] Shortages of qualified human resources and lack of proper equipment for surgery are not well documented, [5,10,11] but some progress has been made to improve surgical care delivery. [10] This also includes the launch of the National Surgical, Obstetric, and Anaesthesia Plan. [12]

An elective or nonemergency is a surgery that can be scheduled in advance because there is no immediate threat to the patient's life. [13] For this study, waiting time was defined as the time elapsed from the patient's admission date in hospital for surgery to the time of the actual surgical procedure, measured in days. [14] Elective surgeries were divided into two categories, major and

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minor, both considered in the study. Major elective surgeries are associated with an expected blood loss of above 500 ml, significant fluid shifts, and a minimum of one-night stay in hospital and may include cardiac operations, any bowel cavity operations, reconstructive surgery, deep tissue procedures, any transplant procedures, as well as any surgery in the abdomen, chest or cranium, while minor surgeries are associated with an expected blood loss of fewer than 500 ml, minimal fluid shifts, and typically done on an ambulatory basis (day surgery/same-day discharge), [15] which may include biopsies, repairs of cuts or small wounds.

Some studies have reported long waiting times in Zambia for eye surgery and ear, nose, and throat (ENT) surgery, [15,16] but to our best knowledge, no study has investigated the waiting time for other elective surgeries in a tertiary facility. The study aimed to estimate the waiting times for patients scheduled for elective surgery at the University Teaching Hospital (UTH) and to determine factors associated with patient waiting time.

Research Methodology

Study setting

The University teaching hospital (UTH) is located in Zambia's capital city, Lusaka. It has a catchment population of approximately 2 million. UTH serves as the main referral hub for all patients from the country. The facility has five hospitals, namely; Adult hospital, Women and newborn hospital, eye hospital, children hospital, and cancer disease hospital (CDH). For this study, we focused on the Adult hospital. The adult hospital has a surgical department that offers diverse surgical services which include; General surgery, Orthopedic and Trauma, Ophthalmology, Urology, Paediatric Surgery, Ear, Nose, and Throat (ENT), Cardiac, Laparoscopy, Neurosurgery, and Maxillofacial. In this study, we considered seven surgical units/specialties including; Maxillofacial, Ear-Nose, and Throat (ENT), Urology, Ortho-spine, Orthopaedics, General Surgery, Neurology. The Adult hospital has eight operating theaters. Table 1 shows the average number of surgeries that are performed by each surgical unit in a typical week and the number of surgeons in each of the surgical units/specialties considered in this study:

Study design

Cross-sectional study design was used, collecting data from patient medical records.

Data collection

Data were collected between 1st December 2018 and 31st January 2019. Theatre lists and patient medical records were used to identify patients who had presented to UTH needing elective surgical treatment. We reviewed a total of 182 medical records. Data on patient and hospital-related factors were extracted from medical records of patients scheduled for elective surgical procedures. We excluded patients undergoing elective re-operations (second, third, or more), as this would require taking into account different waiting time intervals. Patients with missing files and incomplete information were also excluded.

Data analysis

A descriptive analysis was performed. Frequencies and percentages were presented for all variables as shown in Table 2. The mean and standard deviation were reported for the age of the participants. Kaplan Meier survival curves and the log-rank test were used to check differences in waiting times for the following variables: gender, type of procedure, and surgical unit. A null hypothesis (the survival curves across all groups are equal) was a confirmation that the waiting time distributions do not differ significantly in terms of these variables.

The Weibull model was used to model time to elective surgery using the variables as shown in Tables 3 and 4. All analyses were performed using STATA software, version 15 SE (Stata Corporation, College Station, TX, USA). The statistical significance was set at 5%.

Results

The overall waiting time distribution was skewed as the Shapiro-Wilk test gave a p-value of $p<0.05$, and therefore, the median and interquartile range were used to describe the centrality and the variability of the data, respectively. It also supported the use of the Weibull regression model.

A total of 182 surgeries were completed during the study. The median waiting time for patients was 9 days (Interquartile range 4 to – 18 days). Patient characteristics, along with relevant statistics, are displayed in Table 2. 33.5% (61/182) of patients were females. The mean (Standard deviation) for the age of patients was 35 years (19.5 years). A majority of the patients 40.1% (73/182) underwent orthopedic surgical procedures, with the least number of patients 3.3% (6/182) undergoing

Table 1: Average number of surgeries conducted by each surgical unit in a week (Total number of surgeons=117).

Surgical Unit/specialty	Total Number of surgeries conducted by each surgical unit in a typical week	Average number of surgical procedures conducted in each surgical unit/specialty in a typical week	Number of surgeons per surgical unit/specialty
General Surgery	10	2	39
Urology	13	2.6	19
Neurosurgery	1	0.2	13
Orthopaedics	12	2.4	34
Ortho-spine	4	0.8	3
Ear, Nose and Throat (ENT)	5	1	4
Maxillofacial	2	0.4	5

Table 2: Demographic and hospital characteristics of sample participants (n=182).

Variables	Baseline/Totals	Percentage
Mean Age x̄ (sd)	35.1	19.1
Gender n (%)		
Female	61	33.5%
Male	121	66.5%
Referral Status n (%)		
The patient is not a referral	80	43.6%
The patient is a referral	102	56.4%
Surgical Unit n (%)		
Maxillofacial	6	3.3%
Ear, Nose and Throat	18	9.9%
Urology	31	17%
Ortho-spine	6	3.3%
Orthopaedics	73	40.1%
General Surgery	41	22.5%
Neurology	7	3.8%
Type of Procedure n (%)		
Minor	49	26.9%
Major	133	73.1%

Table 3: Descriptive statistics of median waiting time according to surgical units/specialties.

	Surgical Unit/Specialty						
Admission to surgery interval (days)	**Maxillofacial (n=6)**	**Orthopaedics (n=73)**	**Neurosurgery (n=7)**	**Orthospine (n=6)**	**General Surgery (n=41)**	**Urology (n=31)**	**ENT (n=18)**
Overall	3 (1-13)	10 (7-22)	10 (6-29)	3 (1-13)	5 (2-11)	7 (2-22)	6 (1-16)
Minor surgery	1 (1-5)	7 (6-10)	10 (5-11)	21 (6-36)	6 (5-10)	2 (2-20)	9 (2-16)
Major surgery	13 (1-20)	8 (11-24)	18.5 (7-35.5)	5.5 (4-20)	5 (2-12.5)	14 (2-22)	1 (1-4)

Table 4: Log Rank Test (Comparing group by gender, type of procedure, and surgical unit)

Variables	Chi2	P value
Gender	1.26	0.26
Type of Procedure	3.24	0.07
Surgical unit	17.11	0.01*
	*=Significant at p<0.05	

ortho-spine and 3.3% (6/182) undergoing maxillofacial surgical procedures, while the remaining 46.7% were spread across Urology, general, neurology and ear, nose and throat surgical units. 73% (133/182) of the patients underwent major surgical procedures while the remaining 26.9% (49/182) underwent minor surgeries.

The median (Interquartile range) waiting time in various surgical specialties is described in Table 3 and are divided by major or minor elective surgery.

Waiting time by patient characteristics and hospital characteristics, as shown in Figure 1, the probability of waiting for elective surgery was similar for both males and females. This was also confirmed using the log-rank test shown in Table 3, giving a p-value of 0.26.

Figure 2 show that there was a slight difference, but not significant in the waiting time between patients scheduled for major and minor surgery. This is also shown in the log-rank test in Table 4, where the p-value (0.07) is not significant.

Figure 3 show that there were differences in waiting time for patients from different surgical units/specialties. The log-rank test in Table 4 confirmed that this difference was statistically significant.

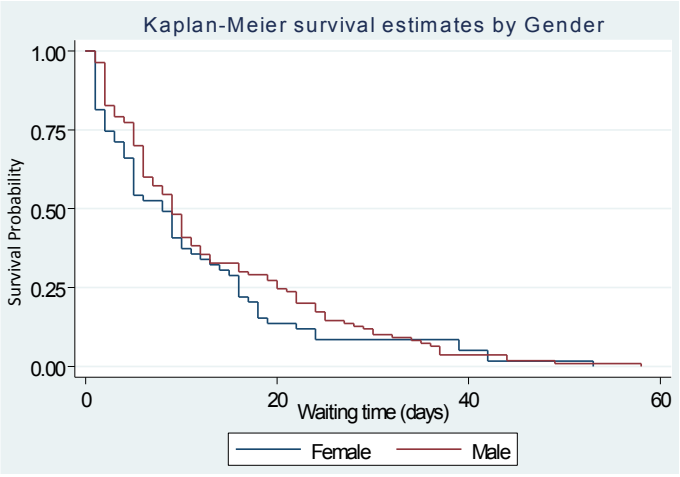

Figure 1: Kaplan-Meier survival estimates by sex.

Factors associated with waiting time for elective surgical procedures, in addition to the log-rank test, the Weibull regression analysis was performed to simultaneously incorporate all the covariates into our regression model. We present the results obtained from the multiple regression model after controlling for the effects of other variables as shown in Table 5. The results show that patients from the orthopedic surgical unit were 2.5 times more likely to experience long waiting times (p = 0.01,

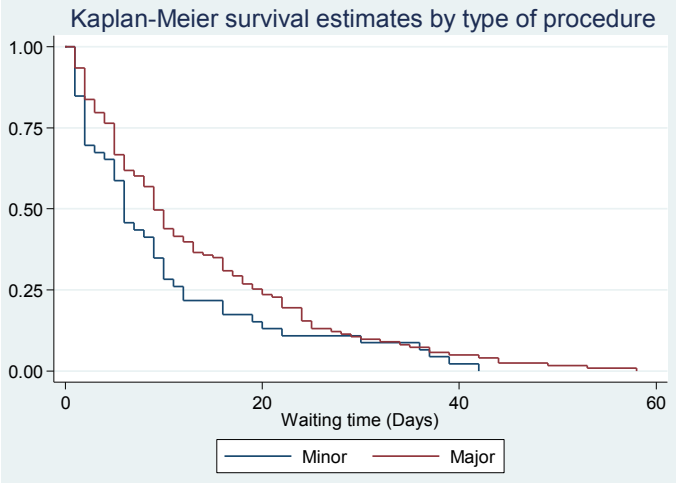

Figure 2: Kaplan- Meier survival estimates by type of procedure.

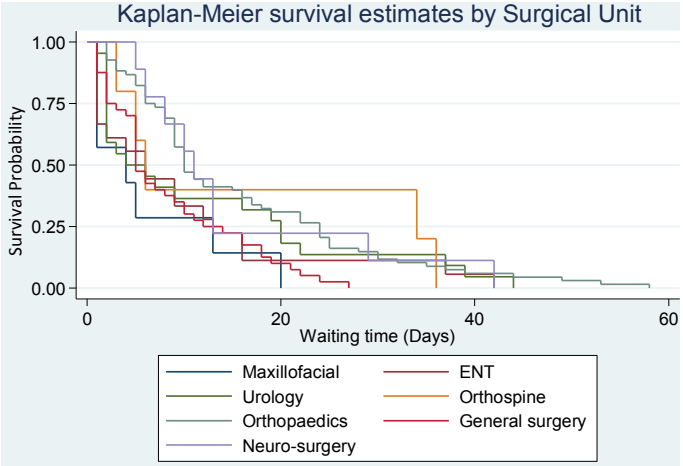

Figure 3: Kaplan-Meier survival estimates by surgical unit.

Table 5: Patient and hospital related factors associated with waiting time for elective surgical procedures.

Variables	Coefficient (SE)	95% CI	p-value	ETR
Age	0.01 (0.01)	-0.01, 0.01	0.36	1.00
Sex: Female	Ref			
Male	-0.09 (0.15)	-0.38, 0.21	0.57	0.92
The Patient is a referral case	Ref			
No	0.22 (0.14)	-0.05, 0.49	0.11	1.25
Yes				
Type of procedure	Ref			
Minor	0.19 (0.17)	-0.14, 0.52	0.26	1.21
Major				
Surgical Unit	Ref		0.06	2.31
Maxillofacial				
ENT	0.84 (0.44)	-0.03, 1.70		
Urology	0.74 (0.39)	-0.02, 1.51	0.06	2.10
Ortho-spine	0.80 (0.50)	-0.18, 1.79	0.11	2.23
Orthopaedics	0.94 (0.38)	0.20, 1.68	0.01*	2.56
General surgery	0.26 (0.39)	-0.50, 1.01	0.50	1.30
Neuro-surgery	1.00 (0.48)	0.06, 0.94	0.04*	2.72
Health System factors	Ref			
Lack of Blood	0.80		0.02*	2.23
No	(0.34)	0.13, 1.48		
Yes				
Lack of operating theatre time	Ref		0.01*	1.96
No	0.67	0.17, 1.17		
Yes	(0.25)			

*= Significant at p<0.05, 95% CI= 95% Confidence Interval, ETR= Event Time Ratio, Ref= Reference Group, SE= Standard Error

ETR = 2.56), compared to patients from the maxillofacial surgical unit. Similarly, patients from the neurosurgical unit were 2.72 times more likely to experience long waiting times (p = 0.04, ETR = 2.72), compared to patients from the maxillofacial surgical unit.

Patients in need of blood transfusion were 2.23 times more likely to experience longer waiting time for their elective surgical procedure compared to patients that did not require blood transfusion (p = 0.02, ETR=2.23). Similarly, lack of operating theatre time was associated with longer waiting time for surgery (p = 0.01, ETR= 1.96).

Discussion

The study aimed to estimate the waiting times for patients scheduled for elective surgery at the University Teaching Hospital (UTH) and to determine whether the following factors are associated with patient waiting time for elective surgery: age, gender, and type of surgical procedure, surgical unit, operating theatre time and availability of blood products.

We found that a lack of blood for blood transfusion contributed to delays in surgery and extended the waiting time for elective procedures. Our findings confirm the well-documented need for improving the availability of essential surgical supplies such as blood products to support more timely surgical care in Zambia and the sub-Saharan African region (SSA). [14,17] As a result of this, patients in need of blood transfusion experienced longer waiting time compared to patients that did not need a blood transfusion. This finding is comparable to a study conducted in India. [18] Although we did not examine the effect of delayed surgery on patient outcomes, in a study done in Kenya, delayed blood transfusion was associated with poor outcomes in surgical patients. [19] Other studies have also demonstrated the importance of similar hospital-related factors with regards to waiting time for elective surgery. [20,21]

In our study, lack of operating theatre time was significantly associated with waiting time for elective surgery and this finding was consistent with other research. One study conducted at a large teaching hospital found that, after the first operation, anesthetists and surgeons had to wait for a considerable amount of time before subsequent patients were brought into the theatre. [22] A randomized control trial that looked at the change-over-time for surgical patients on theatre lists also found significant

delays in waiting time for routine change over approach compared to theatre team-based strategies. [23]

Our study also found that the type of surgical unit was significantly associated with waiting time for elective surgery: patients in the neurology and orthopedic units experienced longer waiting times than patients in the other units. This could be because of the high volume of emergency trauma cases that take priority over the elective ones in the SSA setting. [24,25] According to a study conducted at a tertiary hospital in Ethiopia cases in the orthopedic unit were the most frequently canceled (i.e. not operated on the scheduled day). [26]

We did not find a significant association between waiting time for elective surgery and age or gender, and these results were consistent with findings from at least 3 other studies. [27] A study on waiting time for orthopedic surgery found that hospital-related factors rather than patient-related factors i.e. age and gender played an important role in waiting time. [28] Another study on gender and socioeconomic determinants on waiting time did not find evidence of gender bias in terms of waiting for surgery. [29]

Conclusion

The findings of our study highlight that in a low-resourced environment, it is the hospital-related factors that play a major role in delaying timely surgery rather than the individual patient's characteristics. One would assume that in an efficient environment it is the severity of the disease (major/minor), comorbidities, or patients' age that would determine the time that is needed to prepare the patients for surgery. Yet in this study, none of these factors was statistically significant and an independent predictor of the waiting time. We found that hospital-related factors including lack of theatre operating time, lack of blood, and the surgical unit that operated on the patient affected the waiting time.

Limitations

A major limitation of this study lies in the definition of waiting time, which is not universal and therefore makes it difficult to compare our findings with other studies. Despite this limitation, we feel that our findings make a significant contribution to the existing knowledge, highlighting the importance of addressing the systemic failures that lead to delayed surgical care if access to safe surgery is to be scaled up. Secondly, the cross-sectional study for measuring waiting time has an inherent weakness in that it does not follow up patients or determine causality with regard to patient outcomes. We suggest longitudinal studies that follow up patients from outpatients to theatre and capture overall waiting time, outcomes, and quality of life.

Ethics Approval and Consent to Participate

Ethical approval to undertake the study was obtained from the University of Zambia Biomedical Research Ethics Committee (UNZABREC), reference number: 007-08-18. Written permission was obtained from the Ministry of Health (MOH) and the Senior Medical Superintendent of the Adult Hospital at the UTH.

Consent for Publication

Not Applicable

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' Contributions

JC, GJ, and MC conceptualized the problem, MM developed the theory and the design, collected the data, and performed the data analysis. RJ verified the analytical methods. JC and MC participated in problem and design refinement and supervised data collection, analysis, and write-up of the findings of this work. All authors discussed the results and contributed to the critical review of the final manuscript. All authors read and approved the final manuscript.

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Competing Interests

The authors declare that they have no competing interests.

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