Extended Length of Hospital Stay in Orthopedic Surgery - Frequency, Severity, and Risk Factors Associated with Different Treatment Procedures

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Abstract

Orthopedic surgical procedures are associated with different outcomes that have both physical and psychological implications for patients, thus, the need to understand the risk factors associated with patients' Extended Length of Hospital Stay (ELOHS) after the procedures. This retrospective study identified patients who are treated for Joint replacement (JR), Shoulder Repair (SR), Knee Reconstruction (KR), Fractures(others)(FO), Hip Fracture (HF), Ligament/tendon repair (LR), and Hematoma/abscess (HA) and used Cox proportionality hazard model to determine the risk factors of ELOHS. The result shows that 7.98% of the patients have ELOHS after the procedures and the risk of ELOHS is pronounced with KR {HR: 1.66(1.05-2.63), p: 0.03}, SR {HR: 1.69(1.01-2.84), p: 0.04}, and patients 20-40 years {HR: 1.94(1.15-3.28), p: 0.01}. Proper management of these risk factors through perioperative risk adjustment before the various surgeries will help to reduce complications, improve recovery, minimize ELOHS, and the cost of hospitalization.

1. Introduction

If a patient treated for a given health condition stays more than three times the Average Length of Stay (ALOS) for that Diagnosis Related Group (DRG), the patient has an Extended Length of Hospital Stay (ELOHS). ELOHS has been attributed to more financial burdens on hospitals, health insurance, and the government [2-4, 38] due to the increased utilization of hospital resources. There is also the tendency for more health complications for patients due to nosocomial infections [3] which can arise from a longer stay in the hospital.

To derive value from orthopedic surgical treatment entails having a quality outcome that improves the quality-of-life of the patients without necessarily increasing the cost of care. Unfortunately, orthopedic procedures like other surgical treatments are more than twice as expensive as other medical procedures that are not requiring surgical methods [1]. Coupled with this, when complications ensue during the management of surgical patients, there is always a very high tendency of ELOHS. Since the proposed fixes for the varying quality of healthcare, and the growing dissatisfaction of patients have not been adequately addressed with the rapidly advancing technology [5-6], it became imperative that value-based care will be utilized to bridge this gap [7-8]. Value-based care is ensuring that the delivery of healthcare should be in such a manner that will improve value for the patients by ensuring that healthcare providers deemphasis profitability to achieve the expected health outcomes for patients [7].

Achieving the expected outcomes for orthopedic surgery patients will therefore entail knowing the risk factors of the treatment procedures seeing that such knowledge will make it possible to adopt patients' management practices that will prevent ELOHS while enhancing the outcome of the treatment. Knowing that obtaining the expected quality of patient outcome for any orthopedic surgery may not be feasible without mitigating the associated risk factors of ELOHS, this study will identify the risk factors, frequencies, and severities of the features by analyzing patients' case-mix data.

Orthopedic surgical treatment is one of the surgical procedures that are frequently done in hospitals with procedures such as hip, knee, and shoulder joint procedures ranking very high in comparison to others [1,9-10]. Research has shown that orthopedic surgery can be linked to risk factors such as age, gender, comorbidities, demographic traits, smoking status, Charlson Score Index (CSI), knee injury and osteoarthritis outcome score, hospital site, specialist, time of surgical procedure in the week, implant type, and surgical procedure start time [11-12]. Other factors such as revision of the surgical procedure, length of stay (LOS), and increasing time of average operating room durations are also

URI: https://hdl.handle.net/10125/103021
978-0-9981331-6-4

associated risk factors for patients undergoing elective spine, knee, and hip orthopedic surgery [13]. Voskuijl et al. [14] showed that Charlson Score index (CSI) accounts for the variation in readmission of patients after orthopedic surgery with every increase in the CSI adding a 0.45% risk of readmission for arthroplasty and 0.9% risk of readmission for spine surgery. Similarly, complications and mortalities from orthopedic surgery such as ankle fractures, spinal metastasis surgery, and knee or hip arthroplasty have been linked to comorbidities that have helped infections to arise [13, 15-17].

Even though the information presented so far has clearly shown that limited work has been done on establishing the risk factors for orthopedic surgery considering treatment procedures, it is important to know how the risk factors can be managed to add value to caregiving. Similarly, the impact of hospital-specific characteristics and other patients' case-mix data have rarely been used for determining the risk factors and the severity of ELOHS amongst orthopedic surgery patients, despite the importance of these parameters [1,8]. To this end, the research question that is pertinent to answer is: -

RQ1: How can orthopedic surgery for different treatment procedures be managed to support a fundamental re-orientation of caregiving that will add value to patients and reduce cost via ELOHS minimization?

Considering the need to have value-based health care and solutions that improve outcomes for patients while reducing costs [5,8], this study will design a framework that will help to decrease negative orthopedic surgical outcomes via the identification of the risk factors and their severity. Hence, making it possible (through reflection and learning) to minimize the care disparities and patient outcomes for individuals of different economic status [8,18] treated for orthopedic surgery procedures while minimizing the ELOHS and costs.

To further understand the influence of orthopedic surgery procedures such as JR, SR, KN, FO, HF, LR, and HA on the patients in the acute care setting, the following null hypotheses were tested: -

- H1: The ELOHS for acute care patients undergoing orthopedic surgery procedures is positively associated with the age of patients.
- H2: The ELOHS for acute care patients undergoing orthopedic surgery procedures is positively associated with the CSI of patients.
- H3: The ELOHS for acute care patients undergoing orthopedic surgery procedures is positively associated with the Average Operating Room Time (AORT) of patients.
- H4: The ELOHS for acute care patients undergoing orthopedic surgery procedures is positively associated with the specialist treating them.
- H5: The ELOHS for acute care patients undergoing orthopedic surgery procedures is positively associated with the Socioeconomic Status (SES) of patients.

2. Methods

This retrospective study relied on data from patients that underwent orthopedic surgical treatment procedures for any of the following conditions: JR, SR, KN, FO, HF, LR, and HA. The result obtained from the analysis helps to make the value patients get from orthopedic surgery care better because clinicians can risk-adjust for factors that can negatively influence the surgery [19-20]. This means that there could be no issues with decreased discharge and survival rates, increased number of hospital visits, more time in the Intensive Care Unit (ICU), and increased hospital-acquired complications and infections [21-22]. To this end, can help to maximize the benefits of a cost-effective intervention by facilitating learning into meaningful actions [23] surrounding the surgical process. This can result in an improvement in patients' experience of surgical outcomes seeing that therapeutic misconceptions such as pre-surgical optimism about pain management and functionality after surgery and the length of recovery post-operation [24] can be addressed.

2.1. Data collection and sample processing

De-identified patients' records for orthopedic surgery treatment procedures obtained between 10/2015 and 12/2020 from a private acute teaching hospital in Melbourne Australia are used for the study. Initially, 3048 samples comprising 73 features were extracted from the medical database before using hospital-specific case-mix features that include: - Specialists, Length of Stay (LOS), Patient Age, Patient Gender, ADC, CSI, SES, Distance to Hospital (DTH), Transfusion (TRF), day of surgery patient (DOSP), Intensive Care Unit visit (ICU), treatment procedures (TRT), AORT in minutes, rapid response team calls (RRT), time to surgery (TTS) in minutes and theatre sessions (TS). The CSI is used for assessing the comorbidity burden of the patients [25] while using the postcodes for obtaining the SES and the Distance to Hospital (DTH). The Australian Bureau of Statistics (ABS) socio-economic indexes for areas (SEIFA) [26] is used for classifying the patients into three SES – low (1 – 4 decile), middle (5 – 7 decile), and high (8-10 decile). The DTH also relied on the postcodes for obtaining the longitudes and latitudes of the hospital and patients' locations while using the great circle distance model of the earth [27] for the Global Positioning System (GPS) locations to calculate the distance in kilometers. The features that have missing values are dropped from the sample population leaving 2595 samples for the analysis. The features are grouped as follows: patient age (< 20 years, 20 -40 years, 40-65 years and >65 years), CSI (0-1, 2-4, ≥5), DTH (0-5km, 5-10km, 10-20km, >20km), TRT(JR, SR, KN, FO, HF, LR, HA), AORT (< 1 hour, 1-2 hours, > 2hours), TTS(< 1 hour, > 1 hour), TS (once, 2 or more), DOSP (Yes, No), ICU (yes, no), TRF (Yes, No) and ADC (PL1, EMG, UC1, others).

2.2. Statistical analysis

Descriptive statistics such as counts, percentages, and means were used to characterize the samples. To understand if there exists any difference in the ELOHS of these orthopedic surgery patients treated by different specialists, from different SES, ADC, AORT, and age groups, a single-factor analysis of variance (ANOVA) was used. To establish if any variance exists in the ELOHS of the various categories within the ANOVA tested features, Holm post hoc analysis was carried out while Chi-squared analysis is used to establish the association of ELOHS for the various orthopedic treatment procedures with the features studied. To establish the risk factors and their severities for the ELOHS, the Cox proportionality hazard model was used considering the LOS of the patients on admission while adjusting for the other features used in the study. All the analyses are considered significant at a 95% confidence level and were carried out using Python 3.9.

3. Results

A total of 2595 patients who underwent orthopedic surgery treatment procedures such as JR, SR, FO, LR, KR, HF, and HA are included in the analysis that has Table 1 showing the baseline characteristics of the patients. The proportion of the patients that overstayed on admission (ELOHS) is 7.98% while the mean age of the patients is 59.99±22.03 years. The average TTS is 10.54 ± 29.63 minutes, the average LOS is 4.78 ± 7.4 days whereas the AORT is 86.82 ± 45.58 minutes. There are 1349 (51.98%) patients who are >65 years, and 788 (30.37%) patients who are aged 40-65 years. The average times spent for the various orthopedic surgery procedures in the operating room are: - FO (90.53 minutes), HA (39.74 minutes), HF (83.2 minutes), JR (103.93 minutes), KR (66.53 minutes), LR (70.83 minutes) and SR (74.50 minutes). The average times it took before the patients undergo their procedures (TTS) are as follows: - FO (24.00 minutes), HA (18.77 minutes), HF (25.05 minutes), JR (7.11 minutes), LR (20.50 minutes), and SR (4.62 minutes). On average, the LOS of patients who underwent HA procedures is 12.74 days, which is 167% higher than the time spent by patients who underwent FO procedures. The average LOS of HA patients is 45%, 90%, 452%, 273%, and 572% respectively higher than those treated for HF, JR, KR, LR, and SR. This average LOS translates to 3.98 to 10.90 days more for HA procedures compared to the rest of the procedures.

The variation of ELOHS for the various patients' case-mix characteristics shows that patients treated for HA have a 28.21% rate of ELOHS followed by FO patients that have a 21.43% rate of ELOHS whereas those treated for JR add up to 40.15% of the entire sampled population but has only a 4.13% of ELOHS rate. This rate is only slightly higher than the rate for patients treated for SR which is 4.06% of the ELOHS rate and consists of 28.48% of the sample population. In contrast, HA patients only consist of 1.5% of the study population but contribute the most ELOHS rate whereas FO, HF, and LR have 17.5% - 21.43% of the sampled population, and contribute 4.63 – 9.17% of the ELOHS rates.

The ELOHS rate of the patients associated with the various specialists ranged from 0 – 31.25%. Even though many factors such as treatment procedure complications, comorbidities, and the age of patients can be contributing to this [21-22], specialists' skills can also be a contributing factor. There is no unique trend in the ELOHS rate of patients, and the total number of patients treated by the various specialists. However, for the 8 specialists that have an ELOHS rate of >10%, the average number of patients they treated is 106.88 whereas, for the 22 specialists that have patients ELOHS rate of <10%, the average number of patients they treated is 79.09.

The chi-squared analysis of the patient's case-mix for the various treatment procedures has a p-value of < 0.001 for χ^2(33.3 – 3795.2). This indicates that no significant difference exists in the orthopedic treatment procedures for the patient's case-mix data considered in the study. The ANOVA on the variation of ELOHS for orthopedic surgery patients of different age groups yielded a significant variation (F-stat: 10.56, P < 0.001). The Holm post hoc analysis shows that patients who are ≥ 65 years have ELOHS that differ significantly from patients who are < 20 years (P< 0.001), 20-40 years (P= 0.048), and 40-65 years (P <0.001). Patients who are 40-65 years have no significant difference in their ELOHS with those who are < 20 years (P= 0.25) and 20-40 years (P= 0.82).

Similarly, the ANOVA of the ELOHS variation computed for the patient's CSI showed a significant variation (F-stat = 22.37 and P < 0.001), and Holm's adjustment within the groups also indicated significantly different ELOHS with P <0.001 computed for: - CSI (0-1) & CSI(2-4); CSI(0-1) & CSI(≥), and CSI(≥5) & CSI(2-4). The ELOHS for the various AORT categories also returned a significant variation (F-stat = 8.26 and P < 0.001), however, there is no significant difference in the ELOHS for the patients with AORT(0-1hr) & AORT (1-2 hrs) with P = 0.21. Those with AORT (0-1 hr) & AORT (>2 hrs) and AORT (1-2 hrs) & AORT (>2 hrs) have a significant difference in ELOHS with P = 0.02 and P <0.001 respectively. The computation of ANOVA for the SES of the patients indicated that no significant variation exists in the ELOHS (F-stat=2.61, P = 0.07) with Holm's adjustment showing no significant difference within the patients' SES group. The ANOVA of the ELOHS variation computed for the treating specialists shows there is a significant variation of ELOHS for the patients treated by different specialists (F-stat = 11.17, P < 0.001). The post hoc analysis shows that a significant variation exists amongst the following specialists: - (SPX36 & SPX09, P < 0.001), (SPX36 & SPX32, P<0.001), (SPX36 & SPX06, P<0.001), and 62 more different pairwise combinations of specialists whereas 370 pairwise combinations of specialists from the analyzed 30 specialists have no significant difference in the ELOHS of the patients they treated.

Table 1: Baseline characteristics of Patients' Demographic, Hospital, and Psychosocial features considered in the study.

Population	2595	Age (mean ±std)	59.99 ± 22.03 years
ELOHS(Yes)	207 (7.98%)	TTS (mean ±std)	10.54 ± 29.63 minutes
ELOHS(No)	2388(92.02%)	LOS (mean ±std)	4.78 ± 7.4 days
		AORT (mean ±std)	86.82 ± 45.58 minutes

Categorical variables

Patient Age		Specialists		Gender	
<20 years	246(9.48%)	SPX01	142(5.47%)	Female	1489(57.38%)
20-40 years	212(8.17%)	SPX02	160(6.17%)	Male	1106(42.62%)
40-65 years	788(30.37%)	SPX03	39(1.5%)	Admission Category	
>65 years	1349(51.98%)	SPX04	33(1.27%)	PL1	2206(85.01%)
Time to surgery (TTS)		SPX06	266(10.25%)	EMG	298(11.48%)
< 1 hour	2485(95.76%)	SPX08	84(3.24%)	UC1	76(2.93%)
> 1 hour	110(4.24%)	SPX09	148(5.7%)	others	15(0.58%)
Average Operating Room Time (AORT)		SPX11	35(1.35%)	ICU	
< 1 hour	743(28.63%)	SPX12	43(1.66%)	No	2521(97.15%)
1-2 hours	1383(53.29%)	SPX13	40(1.54%)	Yes	74(2.85%)
> 2 hours	469(18.07%)	SPX14	35(1.35%)	Day of Surgery Patient	
Distance to hospital (km)		SPX15	23(0.89%)	Yes	2167(83.51%)
0-5km	666(25.66%)	SPX17	57(2.2%)	No	428(16.49%)
5-10km	601(23.16%)	SPX19	21(0.81%)	Theatre Sessions	
10-20km	581(22.39%)	SPX20	66(2.54%)	Once	2540(97.88%)
>20km	747(28.79%)	SPX21	84(3.24%)	2 or more	55(2.12%)
Socio-economic Status		SPX22	75(2.89%)	Transfusion	
high	2038(78.54%)	SPX23	34(1.31%)	No	2438 (93.95%)
middle	323(12.45%)	SPX24	22(0.85%)	Yes	157(6.05%)
low	323(12.45%)	SPX25	33(1.27%)	Charlson Score Index (CSI)	
Treatment Procedures		SPX26	39(1.5%)	(0-1)	985(37.96%)
Joint replacement (JR)	1042(40.15%)	SPX28	105(4.05%)	(2-4)	1494(57.57%)
Shoulder Repair (SR)	739(28.48%)	SPX30	35(1.35%)	(≥5)	116(4.47%)
Knee Reconstruction (KR)	252(9.71%)	SPX31	102(3.93%)	Rapid Response Team (RRT) calls	
Fractures(others)(FO)	238(9.17%)	SPX32	336(12.95%)	No	2519(97.07%)
Hip Fracture (HF)	165(6.36%)	SPX33	184(7.09%)	Yes	76(2.93%)
Ligament/tendon repair (LR)	120(4.62%)	SPX34	26(1%)		
Hematoma/abscess (HA)	39(1.5%)	SPX35	175(6.74%)		
		SPX36	105(4.05%)		
		SPX (others)	48(1.85%)		

The Hazard Ratios (HR) and the risk of ELOHS are shown in Table 2 and Figure 1. At a 95% confidence level, the risk factors include TRF, specialists (SPX4, SPX6, SPX19, SPX25, SPX26, SPX30, SPX33, SPX34), Patient age (20-40 years, >65 years), treatment procedure (HA, HF, JR, KR, SR), AORT (<1 hour), RRT calls (Yes), theatre sessions (2 or more), admission category (EMG), CSI (≥5). Hence, for the patients LOS, the pronounced risk factors (the ones that are likely to result in ELOHS of the patients because of their severity: - HR is > 1) include specialist (SPX25- {HR: 1.95(1.26-3.02, P : <0.005}and SPX34- {HR: 5.78(1.47-22.82), P: 0.01}, patient age 20-40 years- {HR: 1.94(1.15-3.28), P: 0.01}, treatment procedures (KR- {HR: 1.66(1.05-2.63), P: 0.03}, SR- {HR: 1.69(1.01-2.84), P: 0.04}), and ADC (EMG)- {HR: 1.7(1.13-2.57), P: 0.01}. Even though the other risk factors have lower chances of resulting in ELOHS, there is a need to monitor them.

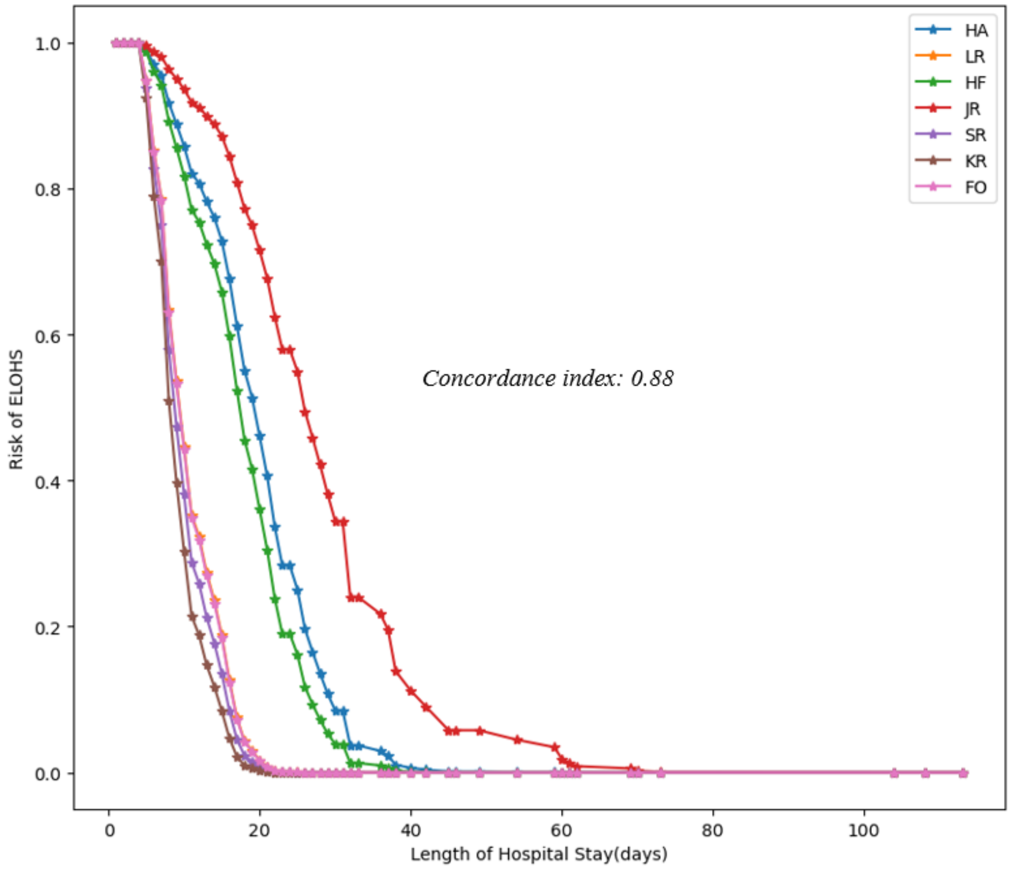

Figure 1: Cox proportionality hazard curve showing the variation of ELOHS risk with patient's LOS for different orthopedic surgery procedures

4. Discussion

Understanding the hospital factors and patient case-mix contributing to the risk of ELOHS amongst orthopedic surgery patients treated for the different procedures considered in this study is important for developing a comprehensive systematic approach to patient safety. Even though the various treatment procedures took different durations in the operating theatre due to their levels of complexity, proper risk adjustments must be done to forestall complications that will warrant more treatments or prolonged patient recovery times.

Since risk factors such as age, gender, and comorbidities are among the well-known risk factors for the surgical process [11-12], adjusting for these risks and others, which have been identified in this study will help to forestall ELOHS since contingency plans are made to accommodate the influence of such risks before medical procedures.

To this end, patients who have transfusion (HR: 0.36(0.23-0.55), P <0.005) are a risk factor of ELOHS, despite their lower likelihood of overstaying considering the small value (<1) of the HR. This outcome will vary for the various treatment procedures seeing that the percentage of orthopedic surgery interventions and blood transfusion rate varies significantly [28]. For instance, whereas 69% of patients who underwent partial hip replacement required blood transfusion, only 41% of those on the revision of knee replacement and 43% of those on total knee replacement require transfusion [28]. The fact that some orthopedic surgery specialists have been identified as risk factors for ELOHS makes it imperative for clinicians to risk adjust for relevant clinical, demographic, and psychosocial conditions influencing ELOHS to prevent patients from overstaying due to the skills of the surgeons. One of the skills, which has been attributed to improved outcomes for patients is communication [29], which helps them to involve patients in the decision-making process. It has been shown that the increase in hospital specialization results in a lower risk of complications after orthopedic surgery for ≥65 years old patients [30].

Table 2: Hazard Ratio (HR) for Extended Length of Hospital Stay (ELOHS) for patients undergoing different orthopedic Surgery treatment procedures (: significant at 95% confidence level)*

Feature	**HR (95% CI)**	**P-value**	**Feature**	**HR (95% CI)**	**P-value**
ICU	1.39(0.74-2.61)	0.31	Distance to hospital		
TRF	0.36(0.23-0.55)	<0.005*	0-5km	Ref	
DOSP	1.01(0.7-1.46)	0.94	5-10km	0.9(0.63-1.28)	0.57
Specialist			10-20km	1.09(0.8-1.50)	0.58
SPX01	Ref		>20km	0.96(0.72-1.28)	0.79
SPX02	1.13(0.65-1.96)	0.68	Treatment procedures		
SPX03	0.68(0.36-1.3)	0.24	FO	Ref	
SPX04	0.54(0.37-0.77)	<0.005*	HA	0.4(0.18-0.9)	0.03*
SPX06	1(1-1)	0.39	HF	0.51(0.34-0.77)	<0.005*
SPX08	1.3(0.4-4.27)	0.66	JR	0.35(0.25-0.47)	<0.005*
SPX09	1.05(0.59-1.87)	0.88	KR	1.66(1.05-2.63)	0.03*
SPX11	1.27(0.19-8.36)	0.8	LR	1.2(0.65-2.23)	0.56
SPX12	2.23(0.88-5.65)	0.09	SR	1.69(1.01-2.84)	0.04*
SPX13	1.27(0.44-3.65)	0.66	Time to surgery (TTS)		
SPX14	0.85(0.44-1.66)	0.63	< 1 hour	Ref	
SPX15	1.4(0.87-2.25)	0.17	>1 hours	1.05(0.71-1.56)	0.8
SPX17	0.84(0.38-1.88)	0.68	Average Operating Theatre Time		
SPX19	0.35(0.22-0.57)	<0.005*	< 1 hours	Ref	
SPX20	0.84(0.47-1.49)	0.55	1-2 hour	0.76(0.55-1.04)	0.09
SPX21	1.04(0.47-2.27)	0.92	>2 hours	0.57(0.40-0.81)	<0.005*
SPX22	0.68(0.33-1.4)	0.3	Rapid Response Team (RRT) Calls		
SPX23	4.33(0.85-22.12)	0.08	No	Ref	
SPX24	1(1-1)	0.49	Yes	0.22(0.08-0.56)	<0.005*
SPX25	1.95(1.26-3.02)	<0.005*	Theatre Sessions		
SPX26	0.48(0.27-0.83)	0.01*	once	Ref	
SPX28	1.15(0.71-1.86)	0.58	2 or more	0.17(0.1-0.28)	<0.005*
SPX30	0.29(0.18-0.48)	<0.005*	Patient Gender		
SPX31	0.96(0.36-2.59)	0.93	Female	Ref	
SPX32	0.75(0.49-1.16)	0.2	Male	1.2(0.91-1.57)	0.19
SPX33	0.47(0.32-0.7)	<0.005*	Admission category		
SPX34	5.78(1.47-22.82)	0.01*	PL1	Ref	
SPX35	0.68(0.35-1.29)	0.24	EMG	1.7(1.13-2.57)	0.01*
SPX36	0.68(0.4-1.13)	0.14	UC1	1.3(0.77-2.2)	0.33
SPX (others)	1.49(0.89-2.5)	0.13	others	1.08(0.4-2.96)	0.87
Patient Age			Socio-economic Status		
(40-65 years)	Ref		High	Ref	
(<20 years)	1.56(0.9-2.72)	0.11	Low	1.03(0.61-1.74)	0.91
(20-40 years)	1.94(1.15-3.28)	0.01*	Middle	0.99(0.67-1.46)	0.97
(>65 years)	0.66(0.49-0.9)	0.01*	Charlson Score Index (CSI)		
			0-1	Ref	
			2-4	0.91(0.68-1.21)	0.51
			≥5	0.52(0.30-0.91)	0.02*

As expected, the more complications patients have during orthopedic surgery procedures the increased likelihood of ELOHS. Furthermore, patients who are >65 years of age {HR: 0.66(0.49-0.90), p: <0.01} are at risk of ELOHS because of the many comorbidities, which contribute to postoperative morbidity and mortality [32]. However, patients that are aged 20-40 years of age {HR: 1.94(1.15-3.28), p: 0.01} are more likely to have ELOHS than those who are >65 years by 1.94 times. This finding is different from what has been shown in previous studies in that the risk of ELOHS increases with the age of the patients [11-12]. Even though a previous study has shown that the delay of surgery for more than 48 hours contributes to ELOHS [33], this study could not establish TTS as a risk factor for ELOHS for orthopedic surgery treatment.

Despite the influence of AORT on ELOHS, it also influences mortality rate with 30 minutes increased duration of a procedure in operating theatre increasing the mortality rate of patients >80 years by 17% [32]. Again, those having one theatre session (HR: 1 because it is the reference) have 5.88 times more risk of ELOHS compared to those who have "2 or more" theatre sessions {HR: 0.17(0.1-0.28), p: <0.005}. This means that enhanced perioperative care will be needed for those with one theatre session to guarantee better patient outcomes and reduced LOS [34]. Imperatively, the use of risk stratification to establish necessary perioperative interventions can better serve the patients through risk adjustment in orthopedic surgery, thus, surgical site infection rates can be reduced [35].

To fully harness the values of orthopedic surgery for patients will entail making treatment decisions in real-time using the patient's clinical, hospital, and psychosocial attributes. This means that the employment of artificial intelligence (AI) for augmenting clinical support cannot be overemphasized if the cost of healthcare is to be minimized and patients will have better experiences of recovery [36-37].

Hypotheses H1, H2, H3, and H4 are not accepted based on the data analyzed. This may be associated with the bias on ELOHS introduced by the patients' discharge policy, which aims at allowing them to recover at home, and free bedspaces for new patients to help reduce the cost of care. Although some of the considerations for early discharge such as function and activity limitations, loss of independence, and the ability to manage pains have been associated with the mental outlook of the patients and rehabilitation [39], many patients have been shown to worry less about early discharge [39-41]. The major concern though is the patient's ability to manage pain and mobility [40]. Nonetheless, with research showing that a 22% decrease in postoperative hospital charges is saved through early patients discharge, the reduced cost of healthcare may be the winner for early discharged patients who have significantly increased pains within the first 4 days of discharge compared to those who were not discharged early [42]. H5 is accepted and may be attributed to the impact of the SES on the patients presenting to the various orthopedic surgical treatment. Even though patients of high SES can afford to stay longer in the hospital because they can easily pay the gap cost through their private health insurance or out-of-pocket, research has shown that low SES patients have significantly longer hospital stays than high SES patients [43-44].

There are some limitations associated with this study like many other studies in this area. The first amongst these limitations is the size of the data used for analysis. It may be necessary to increase the data size to better capture the influence of the used patients' case-mix features on ELOHS. This may help to paint a better picture of the risk factors of ELOHS seeing that the treatment procedures with fewer samples will be bolstered. The chances of having errors in data entry cannot be ruled out seeing that this is a retrospective study that relied on historic records captured in the database of the hospital in focus by numerous individuals. Since some of the treatment procedures may be simple while others may be complex due to several factors that may have not been accounted for, it will suffice to identify the complication of the treatment procedures to make it better to understand the correlation between specialists and ELOHS.

5. Conclusions

To manage ELOHS entails risk adjustment in orthopedic surgery to forestall complications that will leave patients in the hospital more than the expected LOS for different surgical procedures. This study identified the risk factors of ELOHS for orthopedic surgery patients treated for JR, SR, FO, HA, LR, KR, and HF to facilitate enhanced perioperative care that will add value to patients experience of orthopedic surgery and reduce the cost of care. Numerous risk factors such as transfusion AORT (<1 hour), CSI (≥5), patients aged 20-40 years and >65 years as well as some specialists are found to impact the ELOHS of orthopedic surgery patients. Two orthopedic surgery procedures – KR {HR: 1.66(1.05-2.63), p: 0.03} and SR {HR: 1.69(1.01-2.84), p:0.04} pose the most risk of ELOHS on admission. By being able to identify patients at risk of complications early in their treatment course, complications such as infections can be avoided. The importance of adequate perioperative management considering the various risk factors identified in this study cannot be overemphasized. It is also necessary to enhance communication and psychological preparation of the patients about the road to recovery if improved clinical outcomes are expected.

Acknowledgment

The authors wish to thank the Digital Health Cooperative Research Centre (DHCRC) and Cabrini

Health, Melbourne, Australia for their financial support and other contributions to this research.

Conflict of Interest

No conflict of interest to declare

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