

ORIGINAL ARTICLE

Hospital Stay, Recovery, and Factors Associated with Prolonged Hospitalization Following Orthopedic Surgery

Zainab Mubashir^{1*} | Faiza Kamran²

¹Surgery, Sharif Medical and Dental College, Lahore, Pakistan | ²Surgery, Lahore Medical and Dental College, Lahore, Pakistan

*Correspondence: Zainab Mubashir (dr.zainabawmed@gmail.com)

Citation: Mubashir Z, Kamran F. Hospital Stay, Recovery, and Factors Associated with Prolonged Hospitalization Following Orthopedic Surgery. J Med Multidisc Healthc Res. 2026;1(2):33-37. <https://doi.org/10.68041/jmmhr.v1i2/02>

Acknowledgement: None; **Competing Interests:** The authors declare no competing interests; **Grant Support and Funding Source:** None; **Study Ethical Approval:** The authors declared that approval was obtained from the institute prior to the study (124ADLT/EC/202); **Consent for Participation and Publication:** Written informed consent was obtained from all participants before the conduct of the study; **Availability of Data and Materials:** The data are available from the corresponding author upon reasonable request; **Use of Artificial Intelligence:** The corresponding author declared that no artificial intelligence or AI-assisted tools were used anywhere in this manuscript; **Authors' Contribution:** ZM, FK: Conception, design, literature search, data analysis, data interpretation, drafting, writing, critical revision and final approval as per ICMJE roles.

Received: 24 August, 2026

Revised: 15 September, 2026

Accepted: 25 September, 2026

Published: 30 September, 2026

ABSTRACT

Background: There is variability in postoperative outcomes and hospital resources utilized among orthopedic procedures. This study aimed to evaluate hospital stays and recovery rates following orthopedic surgery and to determine the factors associated with the extended hospital stays. **Methods:** This prospective observational cohort included 120 adult patients who underwent elective or emergency surgery on their upper or lower extremities or spine for six months. Data were collected on a structured data-collection form, including demographic data, comorbidities, procedure type, postoperative complications, length of stay (prolonged hospital stay ≥ 8 days), time to independent ambulation, and recovery status at discharge. Descriptive data analysis, association, and multivariable logistic regression were carried out using SPSS software version 26.0, and $p < 0.05$ was considered significant. **Results:** The mean age was 51.7 ± 16.4 years, and 70 (58.3%) were male. The mean length of hospital stay was 6.8 ± 3.2 days, and the mean time to independent ambulation was 4.9 ± 2.1 days. 85(70.8%) of the patients had good recovery on discharge, while 28(23.3%) stayed in hospital for more than 8 days. Prolonged stay was independently associated with age ≥ 60 years (aOR=2.54; $p=0.022$), diabetes mellitus (aOR=2.31; $p=0.041$), major joint replacement (aOR=2.47; $p=0.028$), postoperative complications (aOR=4.62; $p=0.001$), and delayed ambulation (aOR=3.18; $p=0.006$). **Conclusion:** Complications, delayed ambulation, age, diabetes, and major joint replacement had a significant association with prolonged hospitalization, and recovery was generally favorable. Perioperative care and prevention of complications based on risk could enhance recovery and shorten hospital periods. The results should be confirmed by multicenter studies.

Keywords: Early Ambulation; Length of Stay; Orthopedic Procedures; Postoperative Complications; Risk Factors

INTRODUCTION

Orthopedic surgery plays an important role in the treatment of musculoskeletal trauma, degenerative joint disease, deformity, and spinal disorders, and contributes significantly to disability and health care utilization globally ¹. There is significant variation in postoperative requirements for both the upper and lower extremities and spine ². Therefore, Hospital length of stay (LOS) is an important measure of recovery, utilization of resources, readiness for discharge, and efficiency of services rendered ³. Patient, disease, and procedural factors all play a role in orthopedic surgery recovery ⁴. There are differences between the recovery pattern of the two types of operations: upper-extremity, lower extremity, and spinal procedures, due to the different weight-bearing restrictions, functional demands, complications, and rehabilitation needs that exist between the two types of surgery ⁵.

The aim of enhanced recovery pathways is to encourage patient education, multimodal analgesia, early nutrition, avoiding complications, and early mobilization ⁶. Further, evidence has shown that when this coordinated perioperative care is delivered, it may reduce LOS without increasing the risk of readmission or adversely affecting functional outcomes following orthopaedic surgical procedures ⁷. Early and intensive rehabilitation can also improve mobility and the rate of functional recovery ⁸. Most available evidence is procedure-specific, whereas fewer studies have evaluated LOS and postoperative recovery across mixed orthopedic surgical populations ⁹. Assessment of these outcomes within a single clinical setting may help identify locally relevant patterns and opportunities to improve perioperative care, rehabilitation, and discharge planning.

The goal of this study was to characterize LOS for adult patients who have undergone elective or emergency orthopedic surgery. The secondary objective was to assess early recovery following upper-extremity, lower-extremity, and spine procedures. In addition, the study sought to determine the demographic, clinical, and procedural factors that were associated with prolonged LOS and less favorable recovery outcomes.

METHODOLOGY

A prospective observational cohort study was carried out to assess the trend of hospital stay and recovery after orthopedic interventions. The sample size of 120 participants was calculated using OpenEpi version 3.01 (Emory University, Atlanta, GA, USA) at a 95% confidence level, using the formula $n = Z^2 P(1-P)/e^2$, where n represents the required sample size, Z is the standard normal deviate corresponding to the confidence

level, P is the estimated prevalence, and e is the absolute precision ¹⁰. Patients with elective or emergency orthopedic surgery cases were included over a period of six months. Subjects included patients 18 years or older who had undergone any upper extremity, lower extremity, or spinal orthopedic surgery and who agreed to be studied. Whereas polytrauma (ITU), pathological fractures (malignancy), revision surgery, and incomplete medical records were excluded.

The structured data collection form was used to gather data from patient interviews and review of the hospital's medical records. Demographic data such as age, gender, body mass index (BMI), presence of diabetes mellitus (DM), and hypertension were obtained. Other clinical information, such as nature of orthopedic procedure, postoperative complications, hospital stay, and successful ambulation, was also documented. A good, moderate, or poor recovery at discharge was assessed by the orthopedic care team, based on recovery of pain, wound healing, mobility, and independence in basic activities.

The primary outcome was hospital LOS (≤ 5 days, 6–8 days and > 8 days), with prolonged hospital stay defined as >8 days. Other outcomes included recovery at discharge and time to independent ambulation. Patients were followed prospectively from surgery until hospital discharge.

The Statistical Package for the Social Sciences (SPSS) version 26.0 (Armonk, NY: IBM Corp.) was used to enter and analyze the data. Means $\pm$ SDs were used to display continuous variables, and frequencies and percentages were used for categorical variables. Chi-square test was used for categorical variables to determine the association between hospital stay, recovery outcomes, and clinical variables, while independent t-test or one-way analysis of variance (ANOVA) was used as applicable for continuous variables. Variables showing statistical significance in univariate analysis were considered for inclusion in the multivariable logistic regression model; additionally, clinically important potential confounders, including age and relevant comorbidities, were considered irrespective of their univariate statistical significance. Adjusted Odds ratios (aORs) with 95% confidence intervals (CIs) were calculated, and a p-value <0.05 was regarded as statistically significant. Study approval was obtained from the departments, and informed written consent was obtained from all participants. The participants were kept anonymous, and their confidentiality was maintained throughout this study.

RESULTS

There were 120 patients who had undergone orthopedic procedures and were included in the study. The average age of the study participants was 51.7 years with a standard deviation (SD) of 16.4 years, with 70 (58.3%) being male, with the majority aged 40 years or older. The average BMI was 27.6 ± 4.2 kg/m², and overweight was the most prevalent finding, while hypertension and diabetes were found in 47 (39.2%) and 39 (32.5%) of patients, respectively. The most common procedures were lower-limb fracture fixation 32 (26.7%), total knee replacement 26 (21.7%), upper-limb fracture fixation 20 (16.7%), hip replacement 18 (15.0%), spine surgery 17 (14.2%), and arthroscopy 7 (5.8%), as shown in Table I.

Table I: Baseline Demographic, Clinical, and Procedural Characteristics of the Study Participants (N = 120)

Characteristic	Category	n (%) / Mean $\pm$ SD
Age (years)	Mean age	51.7 $\pm$ 16.4
	18–39	28 (23.3)
	40–59	46 (38.3)
	≥ 60	46 (38.3)
Gender	Male	70 (58.3)
	Female	50 (41.7)
BMI (kg/m ²)	Mean BMI	27.6 $\pm$ 4.2
	Normal	35 (29.2)
	Overweight	51 (42.3)
	Obese	34 (28.3)
Comorbidities	Diabetes mellitus	39 (32.5)
	Hypertension	47 (39.2)
Orthopedic procedure	Total knee replacement	26 (21.7)
	Hip replacement	18 (15.0)
	Lower-limb fracture fixation	32 (26.7)
	Upper-limb fracture fixation	20 (16.7)
	Spine surgery	17 (14.2)
	Arthroscopy	7 (5.8)

Table II demonstrates that the mean hospital stay was 6.8 ± 3.2 days, with 49 (40.8%) of patients staying in hospital for 6–8 days, 43 (35.8%) for ≤ 5 days, and 28 (23.4%) for >8 days. Independent walking was reached by a mean of 4.9 ± 2.1 days, 60 (50.0%) with the majority of participants walking independently in 4–6 days. Of those discharged, 85 (70.8%) of patients recovered well, 26 (21.7%) recovered moderately well, and 9 (7.5%) recovered poorly.

Table II: Hospital Stay and Recovery Outcomes(N=120)

Variable	Frequency (n)	Percentage (%)
Length of Hospital Stay		
≤ 5 days	43	35.8
6–8 days	49	40.8
>8 days	28	23.4
Independent Ambulation		
≤ 3 days	31	25.8
4–6 days	60	50.0
>6 days	29	24.2
Recovery at Discharge		
Good	85	70.8

Moderate	26	21.7
Poor	9	7.5
Mean Hospital Stay (days)	6.8 ± 3.2	
Mean Ambulation Time (days)	4.9 ± 2.1	

Among participants aged ≥60 years, 18 of 46 (39.1%) experienced prolonged hospital stay (>8 days). Prolonged stay occurred in 15 of 39 (38.5%) participants with diabetes mellitus, 13 of 34 (38.2%) participants with obesity, and 16 of 44 (36.4%) participants undergoing major joint replacement. The highest proportion of prolonged hospitalization was observed among participants who developed postoperative complications, of whom 11 of 19 (57.9%) stayed for >8 days ($p<0.001$), as shown in **Table III**.

Table III: Clinical factors were statistically compared between patients with a hospital stay of ≤8 days (n = 92) and those with a prolonged hospital stay of >8 days (n = 28) among the total study population (N = 120).

Variable	≤8 Days (n=92)	>8 Days (n=28)	p-value
Age ≥60 years	28 (30.4%)	18 (64.3%)	0.002
Diabetes Mellitus	24 (26.1%)	15 (53.6%)	0.008
Obesity	21 (22.8%)	13 (46.4%)	0.019
Major Joint Replacement	28 (30.4%)	16 (57.1%)	0.013
Postoperative Complications	8 (8.7%)	11 (39.3%)	<0.001

Early ambulation within 3 days was significantly associated with good recovery (29 (34.1%) vs 2 (5.7%), $p<0.001$). Adverse outcomes 17 (48.6%) (age ≥60 years (54.3%)), (postoperative complications 11 (31.4%)), (hospital duration >8 days 18 (51.4%)), were more common in the diabetes group. All assessed clinical variables showed statistically significant associations with recovery status, as shown in **Table IV**.

Table IV: Clinical variables were statistically compared between patients with good recovery (n = 85) and those with moderate/poor recovery (n = 35) among the total study population (N = 120) and those with moderate/poor recovery (n = 35) among the total study population (N = 120)

Variable	Good Recovery (n=85)	Moderate/Poor Recovery (n=35)	p-value
Early Ambulation (≤3 days)	29 (34.1%)	2 (5.7%)	<0.001
Diabetes Mellitus	22 (25.9%)	17 (48.6%)	0.016
Age ≥60 years	27 (31.8%)	19 (54.3%)	0.023
Postoperative Complications	8 (9.4%)	11 (31.4%)	0.003
Hospital Stay >8 Days	10 (11.8%)	18 (51.4%)	<0.001

Post-op complications (aOR 4.62; $p=0.001$) were the most important predictor of a longer hospital stay after adjustment, followed by delayed ambulation (aOR 3.18; $p=0.006$). The major joint replacement and age ≥ 60 years continued to be important independent risk factors, while obesity did not ($p=0.082$), as shown in **Table V**.

Table V: Multivariable logistic regression analysis was performed to identify independent predictors of prolonged hospital stay (>8 days; n = 28) compared with hospital stay ≤8 days (n = 92) among the total study population (N = 120)

Variable	Adjusted OR	95% CI	p-value
Age ≥60 years	2.54	1.14–5.67	0.022
Diabetes Mellitus	2.31	1.03–5.16	0.041
Obesity	1.98	0.91–4.29	0.082
Major Joint Replacement	2.47	1.10–5.53	0.028
Postoperative Complications	4.62	1.82–11.71	0.001
Delayed Ambulation (>6 days)	3.18	1.39–7.25	0.006

Table VI summarizes the factors associated with prolonged hospital stay and recovery status. Older age, diabetes mellitus, major joint replacement, postoperative complications, and delayed ambulation were significantly associated with prolonged hospital stay, whereas early ambulation, diabetes mellitus, older age, postoperative complications, and prolonged hospital stay were significantly associated with recovery status.

Table VI: Summary of factors associated with prolonged hospital stay (>8 days; n = 28 vs ≤8 days; n = 92) and recovery status (good recovery; n = 85 vs moderate/poor recovery; n = 35) among the total study population (N = 120)

Predictor	Association with Prolonged Hospital Stay (Adjusted p-value)	Predictor	Association with Recovery Status (p-value)
Age ≥60 years	0.022	Early ambulation (≤3 days)	0.001
Diabetes mellitus	0.041	Diabetes mellitus	0.016
Major joint replacement	0.028	Age ≥60 years	0.021
Postoperative complications	0.001	Postoperative complications	0.003
Delayed ambulation (>6 days)	0.006	Hospital stay >8 days	<0.001

Postoperative complications were the strongest independent predictor of prolonged hospital stay, followed by delayed ambulation, as shown in **Figure 1**. Age ≥60 years, diabetes mellitus, and major joint replacement were also significant predictors, whereas obesity was not statistically significant.

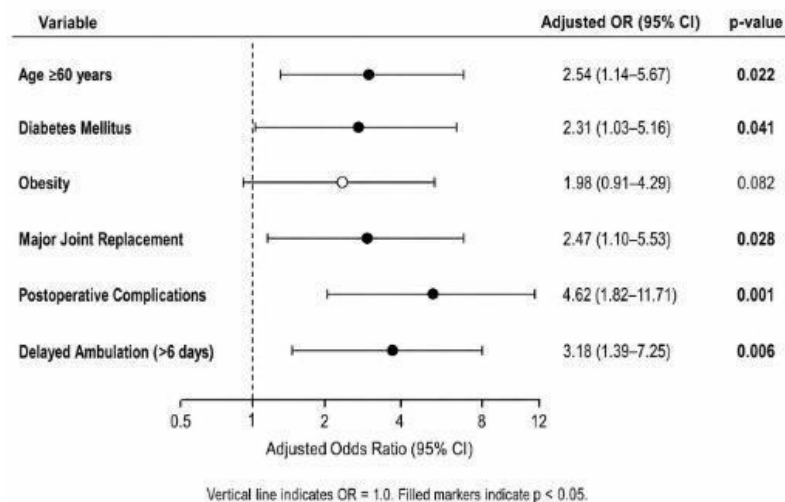


Figure 1: Forest plot showing adjusted odds ratios and 95% confidence intervals for factors associated with prolonged hospital stay

Overall, the findings indicate that postoperative complications, delayed ambulation, older age, diabetes mellitus, and major joint replacement were associated with prolonged hospital stay. Early ambulation was associated with better functional recovery, whereas older age, diabetes mellitus, postoperative complications, and prolonged hospitalization were associated with less favorable recovery outcomes.

DISCUSSION

The current study revealed that the early results after mixed orthopedic procedures were good, with 70.8% of the patients maintaining good recovery at the time of discharge; the mean hospitalization was 6.8 days and independent ambulation was achieved after a mean of 4.9 days. However, approximately 25% of the patients still had to stay in the hospital for over 8 days. Similarly, a study reported that only 15.6% of orthopedic surgical patients experienced poor quality of recovery on the first postoperative day¹¹. Kim et al. also noted good functional recovery following THA, with ambulation with a walker or crutch started after 2.9 days, and a mean hospital stay of 8.2 days¹². In the present study, age ≥60 years, DM, major joint replacement, postoperative complications, and delayed ambulation were independently associated with prolonged hospitalization^{13,14}.

For prolonged hospitalization, the odds were more than doubled at advanced age, so advanced age was associated with a moderate or poor level of recovery¹⁵. Patients over the age of 60 are likely to have lower physiological reserve, sarcopenia, frailty and dependence before surgery, and these factors can slow the recovery post-surgery¹⁶. The same relationships have been found following knee arthroplasty and hip-fracture surgery, with diabetic patients having greater morbidity after surgery, longer hospital stays and inferior functional outcomes following surgery. Obesity was significantly associated with prolonged hospital stay in the univariate analysis; however, this association did not remain statistically significant after multivariable adjustment (aOR 1.98; p=0.082)¹⁷. A significant association was found between BMI > 30 kg/m² and longer hospital stay¹⁸. The loss of statistical significance after adjustment in the present study suggests that the observed relationship with obesity may be influenced by other clinical factors, such as age, diabetes, procedure complexity, or postoperative complications¹⁹.

Good recovery was significantly associated with early ambulation, while ambulation after 6 or more days was independently associated with 3-fold higher odds of prolonged hospital stay. In a similar study, it was found that mobilization on the day of total knee arthroplasty was associated with a reduction in hospital stay and with a greater probability of discharge to the home setting.²⁰ Evidence of hip fracture also has shown that early mobilization is correlated with better functional outcomes at 1-month post-fracture and reduced hospital stay. In addition, delayed ambulation may be a determinant of complications or instability²¹.

The risk of long-term hospitalization was higher in patients undergoing major joint replacement, likely due to the increased surgical exposure, blood loss, pain after surgery, limitations in mobility, and rehabilitation needs associated with this procedure²². Comorbidity, blood loss, pain, and the time to functional milestones were also factors in longer hospital stays identified in arthroplasty studies; the most significant was the risk of postoperative complications, which more than quadrupled the likelihood of extended hospital stay²³. The present result corroborates that of orthopedic-trauma and spinal-surgery populations, which all highlight postoperative complications as significant contributors to prolonged hospitalizations²⁴. Results highlight the importance of optimising perioperative management and care through multimodal analgesia, early nutrition and mobilization within the context of enhanced-recovery pathways, which can reduce the incidence of postoperative complications and hospitalization²⁵.

The limitations of this study were that it was single-center, cross-sectional, and had a small sample size, along with a mixed group of elective and emergency procedures, which makes causal inference and generalizability to specific procedures difficult. The recovery did not include assessment based on a validated functional scale, and not all the parameters were fully evaluated: frailty, ASA status, operative duration, blood loss, pain intensity, and rehabilitation intensity. Standardized recovery instruments and analyses stratified by the procedure should be utilized in future multicenter prospective studies. There is a need to further explore the effect of glycemic optimization, complication prevention bundles, and protocolized early mobilization on reducing hospital stay while maintaining patient safety and reducing readmission rates.

CONCLUSION

The study concluded that the recovery of the majority of patients was satisfactory at the time of discharge; almost a quarter of patients stayed in hospital for more than eight days. The longer hospital stay was independently associated with the presence of older age, diabetes mellitus, major joint replacement, postoperative complication, and delayed ambulation. The results indicate that risk-stratified perioperative management, complication prevention, and early mobilization may help in improving recovery and reducing prolonged hospital stay. Validated recovery measures through multicenter prospective studies need to be assessed in the future.

References

- Agarwal-Harding KJ, von Keudell A, Zirkle LG, Meara JG, Dyer GSM. Understanding and addressing the global need for orthopaedic trauma care. *J Bone Joint Surg Am*. 2016;98(21):1844–1853. <https://doi.org/10.2106/JBJS.16.00323>
- Tao J, Yan Z, Bai G, Zhang H, Li J. Enhanced recovery after surgery rehabilitation protocol in the perioperative period of orthopedics: a systematic review. *J Pers Med*. 2023;13(3):421. <https://doi.org/10.3390/jpm13030421>
- Hirani R, Podder D, Stala O, Mohebbpour R, Tiwari RK, Etienne M. Strategies to reduce hospital length of stay: evidence and challenges. *Medicina (Kaunas)*. 2025;61(5):922. <https://doi.org/10.3390/medicina61050922>
- Chona D, Lakomkin N, Bulka CM, Mousavi I, Kothari P, Dodd AC, et al. Predicting the post-operative length of stay for the orthopaedic trauma patient. *Int Orthop*. 2017;41(5):859–868. <https://doi.org/10.1007/s00264-017-3425-2>
- Barbosa TP, Raposo AR, Cunha PD, Cruz Oliveira N, Lobarinhas A, Varanda P, et al. Rehabilitation after cervical and lumbar spine surgery. *EFORT Open Rev*. 2023;8(8):626–638. <https://doi.org/10.1530/EOR-23-0015>
- Wainwright TW, Gill M, McDonald DA, Middleton RG, Reed M, Sahota O, et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *Acta Orthop*. 2020;91(1):3–19. <https://doi.org/10.1080/17453674.2019.1683790>
- Salamanna F, Contartese D, Brogini S, Visani A, Martikos K, Griffoni C, et al. Key components, current practice and clinical outcomes of ERAS programs in patients undergoing orthopedic surgery: a systematic review. *J Clin Med*. 2022;11(14):4222. <https://doi.org/10.3390/jcm11144222>
- Thompson A. Role of physiotherapy in early recovery after orthopaedic surgeries: an observational overview. *Natl J Clin Orthop*. 2025;9(4):45–48. <https://doi.org/10.33545/orthor.2025.v9.i4.A.500>
- Choi YS, Kim TW, Chang MJ, Kang SB, Chang CB. Enhanced recovery after surgery for major orthopedic surgery: a narrative review. *Knee Surg Relat Res*. 2022;34(1):8. <https://doi.org/10.1186/s43019-022-00137-3>
- Sullivan KM, Dean A, Soe MM. OpenEpi: a web-based epidemiologic and statistical calculator for public health. *Public Health Rep*. 2009;124(3):471–474. <https://doi.org/10.1177/003335490912400320>
- Wessels E, Perrie H, Scribante J, Jooma Z. Quality of recovery following orthopedic surgery in patients at an academic hospital in South Africa. *Anesth Analg*. 2021;133(2):507–514. <https://doi.org/10.1213/ANE.0000000000005594>
- Kim HS, Lee YK, Won SJ, Park SJ, Park JW, Koo KH. Effectiveness of online video instruction on time to start ambulation and duration of hospital stay, satisfaction and functional recovery in patients undergoing total hip arthroplasty. *J Korean Med Sci*. 2022;37(2). <https://doi.org/10.3346/jkms.2022.37.e7>
- Gupta P, Quan T, Patel CJ, Manzi JE, Gu A, Tabaie S, et al. Extended length of stay in diabetic octogenarians following revision total hip arthroplasty. *Eur J Orthop Surg Traumatol*. 2023;33(4):1217–1222. <https://doi.org/10.1007/s00590-022-03277-0>
- Horton I, Bourget-Murray J, Buth O, Backman C, Green M, Papp S, et al. Delayed mobilization following admission for hip fracture is associated with increased morbidity and length of hospital stay. *Can J Surg*. 2023;66(4). <https://doi.org/10.1503/cjs.006822>
- Lo CK, Lee QJ, Wong YC. Predictive factors for length of hospital stay following primary total knee replacement in a total joint replacement centre in Hong Kong. *Hong Kong Med J*. 2017;23(5):435–440. <https://doi.org/10.12809/hkmj166113>
- Wilson JRF, Badhiwala JH, Jiang F, Wilson JR, Kopjar B, Vaccaro AR, et al. The impact of older age on functional recovery and quality of life outcomes after surgical decompression for degenerative cervical myelopathy: results from an ambispective, propensity-matched analysis from the CSM-NA and CSM-I international, multicenter studies. *J Clin Med*. 2019;8(10):1708. <https://doi.org/10.3390/jcm8101708>
- Singh JA, Chandrupatla S, Rumalla K. Association between diabetes mellitus and total hip arthroplasty outcomes: an observational study using the US National Inpatient Sample. *BMJ Open*. 2024;14(7). <https://doi.org/10.1136/bmjopen-2024-085400>
- Kremers HM, Visscher SL, Kremers WK, Naessens JM, Lewallen DG. Obesity increases length of stay and direct medical costs in total hip arthroplasty. *Clin Orthop Relat Res*. 2014;472(4):1232–1239. <https://doi.org/10.1007/s11999-013-3316-9>
- Oliveira FM, Costa LAV, Bastos AMPA, Paião ID, Ferretti M, Lenza M. Assessment of the risk factors related to the length of hospital stay and postoperative complications in patients undergoing primary total knee arthroplasty. *Rev Bras Ortop (Sao Paulo)*. 2023;58(3):435–442. <https://doi.org/10.1055/s-0042-1753534>
- Yakkanti RR, Miller AJ, Smith LS, Feher AW, Mont MA, Malkani AL. Impact of early mobilization on length of stay after primary total knee arthroplasty. *Ann Transl Med*. 2019;7(4):69. <https://doi.org/10.21037/atm.2019.02.02>
- Goubar A, Martin FC, Potter C, Jones GD, Sackley C, Ayis S, et al. The 30-day survival and recovery after hip fracture by timing of mobilization and dementia: a UK database study. *Bone Joint J*. 2021;103-B(7):1317–1324. <https://doi.org/10.1302/0301620X.103B7.BJJ-2020-2349.R1>
- Song X, Xia C, Li Q, Yao C, Yao Y, Chen D, et al. Perioperative predictors of prolonged length of hospital stay following total knee arthroplasty: a retrospective study from a single center in China. *BMC Musculoskelet Disord*. 2020;21(1):62. <https://doi.org/10.1186/s12891-020-3042-x>
- Zhang S, Huang Q, Xie J, Xu B, Cao G, Pei F. Factors influencing postoperative length of stay in an enhanced recovery after surgery program for primary total knee arthroplasty. *J Orthop Surg Res*. 2018;13(1):29. <https://doi.org/10.1186/s13018-018-0729-x>
- Yadla S, Ghobrial GM, Campbell PG, Maltenfort MG, Harrop JS, Ratliff JK, et al. Identification of complications that have a significant effect on length of stay after spine surgery and predictive value of 90-day readmission rate. *J Neurosurg Spine*. 2015;23(6):807–811. <https://doi.org/10.3171/2015.3.SPINE14318>
- Sauro KM, Smith C, Ibadin S, Thomas A, Ganshorn H, Bakunda L, et al. Enhanced Recovery After Surgery guidelines and hospital length of stay, readmission, complications, and mortality: a meta-analysis of randomized clinical trials. *JAMA Netw Open*. 2024;7(6). <https://doi.org/10.1001/jamanetworkopen.2024.17310>

