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Modifiable Preoperative Physiological Predictors of Length of Stay Following Shoulder Arthroplasty: A Systematic Review

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Modifiable Preoperative Physiological Predictors of Length of Stay Following Shoulder Arthroplasty: A Systematic Review

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Modifiable Preoperative Physiological Predictors of Length of Stay Following Shoulder Arthroplasty: A Systematic Review

Abstract:

Background: Shoulder arthroplasty volumes have increased markedly, intensifying pressure on hospital resources. Prolonged hospital length of stay (LOS) elevates costs, complications, and societal burden. Identifying modifiable preoperative predictors of LOS may enable targeted optimisation to improve outcomes and efficiency.

Methods: A systematic search of PubMed, Embase, Medline, Scopus, and Web of Science was conducted through July 20, 2025, following PRISMA 2020 and SWiM guidelines. Studies including adults undergoing shoulder arthroplasty, reporting patient- or procedure-related factors associated with LOS, were included. Due to heterogeneity, qualitative synthesis was performed.

Results: Sixty-four studies ($n = 2,435,166$) were included. Prolonged LOS was consistently associated with anaemia (7 studies, 1.8-5.0 days depending on severity), malnutrition or nutritional risk (2 studies, 2.2-3.7 days), hypoalbuminemia (3 studies, 2.3-3.5 days), insulin-dependent or complicated diabetes (9 studies, 0.5-0.7-day increase), higher ASA grade (7 studies, 2.6-4.3 days), frailty or functional indices (3 studies, graded increases), cumulative comorbidity burden (≥ 10 studies), and preoperative opioid use (7 studies, 1.4-2.3 days). Dehydration (2 studies), electrolyte disturbances (3 studies), and mental health disorders particularly depression (7 studies, 2.0-3.0 days) were also associated with longer LOS. Morbid obesity ($\text{BMI} \geq 40 \text{ kg/m}^2$) modestly increased LOS (mean difference 0.3-0.4 days), whereas general obesity ($\text{BMI} 30\text{-}40$) showed inconsistent associations across 13 studies. Global physiological measures (ASA grade, frailty, comorbidity burden) outperformed individual comorbidities in predicting LOS.

Conclusions: Physiological reserve, metabolic factors and mental health are key modifiable determinants of LOS after shoulder arthroplasty. Preoperative optimisation targeting anaemia, nutrition, glycaemic control, and mental health may reduce hospital LOS and facilitate short-stay or same-day pathways. These findings provide an evidence-based framework for perioperative planning to improve patient outcomes and resource utilisation.

Keywords: Shoulder Arthroplasty; Hospital Length of Stay; Preoperative Risk Factors; Frailty; Anaemia; Malnutrition; Diabetes Mellitus; Opioid Use

Level of Evidence: Level III; Systematic Review

Shoulder arthroplasty is indicated for glenohumeral pathology and proximal humeral fractures causing pain and functional limitation. In the United States, annual shoulder arthroplasty volume increased from approximately 12,000 procedures in 2000 to over 110,000 by 2019, with continued growth projected¹². International registry data show similar trends, with annual growth rates of 6-15% in Europe and Asia over the last decade (2011-2019)⁷⁶. This increasing procedural volume places substantial pressure on perioperative resources, hospital capacity, and surgeon workload.

Hospital length of stay (LOS) after shoulder arthroplasty is a key determinant of healthcare efficiency, cost, and patient outcomes²⁰. Prolonged LOS is associated with increased complications, delayed access to care, and greater healthcare and societal burden^{20,32,42}. Extended LOS also negatively impacts patient quality of life and recovery trajectories and contributes to societal costs through lost productivity and caregiver burden^{15,34}. Identifying modifiable preoperative predictors of LOS is therefore critical for optimising outcomes and supporting short-stay or same-day arthroplasty pathways.

This systematic review aims to identify and synthesise modifiable preoperative physiological predictors of LOS following shoulder arthroplasty, offering actionable insights to inform clinical optimisation strategies and enhance healthcare efficiency. We hypothesised that modifiable preoperative physiological, metabolic, and psychosocial factors are associated with prolonged LOS following shoulder arthroplasty, and that these factors can be synthesised into clinically actionable domains to inform perioperative optimisation strategies.

Methodology

Adherence to guidelines: The systematic review was conducted in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (10). The completed PRISMA flowchart is shown in Figure 1. Analysis was conducted in line with Synthesis Without Meta-analysis (SWiM) guidelines (11).

PROSPERO registration: CRD420261284138.

Electronic databases: A multi-database search was performed from conception to July 20th, 2025, encompassing PubMed, Embase, Medline, Scopus and Web of Science. Our full search string can be found in Supplementary Table 1.

Eligibility Criteria: Eligible studies included adult patients (≥ 18 years) undergoing shoulder arthroplasty that evaluated patient- or procedure-related factors associated with LOS, prolonged LOS, or risk of extended hospitalisation. Observational studies, including retrospective and prospective cohort studies, case-control studies, and registry/database analyses, were included. Studies were excluded if they involved paediatric populations, non-arthroplasty procedures, interventions unrelated to LOS, or lacked LOS data or a comparator group. Only full-text articles published in English were considered. Supplementary table 2 outlines the Population, Intervention, Comparison, and Outcomes (PICO) criteria.

Screening and Data Extraction: Studies were imported into Covidence, where duplicates were removed, and titles/abstracts screened independently by three reviewers (HS, BC, HC) following

Cochrane recommendations. Full-text articles were reviewed for eligibility based on the PICO framework. Data extraction was performed independently by three reviewers (HS, BC, HC). Discrepancies were resolved by discussion, with final arbitration by the senior author (KS). Data were extracted using an Excel (Microsoft Inc., Washington, USA) spreadsheet including study characteristics, study design, patient demographics, location, publication year, sample size, and outcomes assessed.

Risk of bias: Two independent reviewers (HC and BC) assessed the risk of bias using ROBINS-I for non-randomised studies as shown in figures 2 (14). Disagreements were resolved through consensus, with a third reviewer (HS) providing arbitration when necessary. The assessment focused on confounding, missing data, and selective reporting.

Data Analysis, Qualitative Synthesis and Reporting: Due to substantial heterogeneity across studies in arthroplasty type (anatomic versus reverse), surgical indications, perioperative protocols, and definitions of length of stay (continuous versus dichotomous), quantitative meta-analysis was not feasible. Instead, a qualitative synthesis was conducted as per SWiM guidance (11).

Results

Study Design

A total of 988 articles were initially identified (Figure 1). After removal of duplicates and detailed screening against predefined inclusion and exclusion criteria, 64 studies involving a total of 2,435,166 patients were deemed eligible and included in the final analysis ^{2-5,7,8,10,11,16-19,21-23,25-31,35-41,43-45,47-54,56-67,69,70,72-75,78,79,81-84}.

Study Characteristics

Patient characteristics varied across studies, with mean ages ranging from 60–78 years and sample sizes from 29 to over 422,000 patients (Table 1 and 2). The studies were predominantly conducted in the United States (n = 62), with smaller contributions from the United Kingdom (n = 1) and Spain (n = 1). The majority of studies were retrospective cohort studies.

Indications included osteoarthritis, rotator cuff arthropathy, fractures, inflammatory disease, and revision procedures, with both anatomic and reverse arthroplasty represented.

Risk of Bias

Risk of bias in the 64 non-randomized studies was assessed using ROBINS-I (Figure 2). Overall, 35.9% of studies were rated moderate and 64.1% serious risk of bias, with none rated low. Risk was primarily driven by confounding, missing data, and selective reporting.

Body Mass Index (BMI)

The relationship between BMI and postoperative LOS was evaluated in 13 studies, with mixed findings^{4,7,10,17,28,29,31,37,40,48,62,70,75}. Morbid obesity (BMI ≥ 40 kg/m²) was most consistently associated with modestly increased LOS. Areti et al. reported mean LOS of 2.23 ± 3.25 days in morbidly obese patients versus 1.87 ± 1.89 days in non-morbidly obese patients (mean difference $+0.36$ days; $P < 0.001$)⁴. Griffin et al. found LOS increased from 2.56 ± 2.0 days in non-obese patients to 2.84 ± 1.77 days in morbidly obese patients ($P = 0.003$), and Gruson et al. reported a median LOS of 2 days for BMI < 30 and 2 days (IQR 2-4) for BMI ≥ 40 , with a significant incidence rate ratio for morbid obesity (IRR 1.316; $P = 0.038$)^{28,29}. Pappou et al. also observed higher LOS in BMI ≥ 40 (3.1 ± 2.6 vs 2.6 ± 1.3 days), though this was not statistically significant ($P = 0.823$)⁷⁰.

For patients with a BMI between 30-40 kg/m², any association with LOS was generally weak and often non-significant. Izquierdo-Fernández et al. observed no significant differences for BMI ≥ 30 (5.83 ± 1.42 days) versus < 30 (5.18 ± 1.25 days; $P = 0.222$) or BMI ≥ 35 (6.00 ± 1.69 days) versus < 35 (5.43 ± 1.25 days; $P = 0.327$)³⁷. Burns et al. reported 2.4 ± 2.4 days in obese versus 2.2 ± 1.6 days in non-obese patients ($P = 0.158$), and Khokhar et al. found no difference in matched cohorts (median 2 [IQR 1-3] vs 2 [2-3]; $P = 0.654$)^{10,40}.

Several studies examined BMI as a continuous predictor, with variable results. Menendez et al. reported a higher mean BMI in patients with prolonged LOS (32.6 ± 7.5 vs 30.2 ± 5.8 ; $P = 0.004$), while Lee et al. identified a non-significant effect per kg/m² (OR 1.01, 99% CI 1.00-1.02)^{48,62}. In contrast, Puzzitiello et al. ($\beta = 0.04$; $P = 0.54$), Destine et al. (OR 1.03, 95% CI 0.95-1.12; $P = 0.413$), Biron et al. (31.7 vs 31.2 ; $P = 0.062$), and Hartwell et al. (31.1 vs 31.0 ; $P = 0.29$) observed no significant associations^{7,17,31,75}. Additionally, Kishan et al. examined BMI > 30 as a predictor and found no significant association with LOS (OR 1.3, 95% CI 0.6-2.7)⁴⁴.

Collectively, these findings suggest that morbid obesity (BMI ≥ 40) may modestly prolong LOS, whereas general obesity (BMI 30-40) shows inconsistent effects, and BMI as a continuous variable exerts only a minimal or non-significant influence on postoperative LOS across arthroplasty populations.

Comorbidities

Diabetes

Diabetic status was consistently associated with prolonged hospital LOS in nine studies^{5,7,10,25,48,62,63,74,79}. Burns et al. reported LOS of 2.8 ± 2.8 days in patients with uncontrolled diabetes versus 2.3 ± 1.7 days in non-diabetic controls ($P = 0.019$)¹⁰. Fu et al. demonstrated higher odds of extended LOS in insulin-dependent diabetes (IDDM: OR 1.38, 95% CI 1.04-1.82; $P = 0.025$), while non-insulin-dependent diabetes was not significant (OR 1.13, 95% CI 0.92-1.39; $P = 0.255$)²⁵. Basques et al. reported a more pronounced effect (OR 2.37, 95% CI 1.53-3.66; $P < 0.001$), and Ponce et al. observed longer LOS in complicated versus uncomplicated diabetes (3.4 ± 2.8 vs 2.7 ± 2.2 days; $P < 0.001$)^{5,74}. Kishan et al. further

demonstrated that patients with diabetes undergoing aseptic revision shoulder arthroplasty had longer LOS than non-diabetic patients (1.98 ± 2.20 vs 1.72 ± 1.82 days; $P = 0.03$), with higher odds of prolonged LOS (3.5% vs 1.5%; $P = 0.02$)⁴⁴. Other studies confirmed the association: Menendez et al. (28% vs 9%; $P < 0.001$), Biron et al. (25.8% vs 16.3%; $P < 0.001$), Sivasundaram et al. (OR 1.51, 95% CI 1.29-1.77; $P < 0.001$), Miltenberg et al. (OR 2.85, 95% CI 1.88-3.72; $P < 0.001$), and Lee et al. (OR 1.49, 99% CI 1.28-1.73)^{7,48,62,63,79}.

American Society of Anaesthesiologists grade

American Society of Anaesthesiologists (ASA) grade was also a strong predictor of LOS in seven studies^{7,38,62,63,67,73,75}. Johnson et al. demonstrated mean LOS of 2.6 days for ASA 1–2 versus 3.3 days for ASA 3–4 (effect size 0.46; $P < 0.001$)³⁸. Menendez et al. found 39% of patients with ASA ≥ 3 experienced prolonged LOS versus 17% with ASA ≤ 2 ($P < 0.001$), and Biron et al. reported 77.0% versus 50.1% for long versus short LOS in ASA > 2 patients ($p < 0.001$)^{7,62}. Miltenberg et al. observed 88% increased odds of prolonged LOS with ASA 3–5 (OR 1.88, 95% CI 1.58-2.23; $P < 0.001$)⁶³. Other studies showed trends without reaching significance^{67,73,75}.

Functional and frailty Scores

Functional and frailty constructs were associated with stepwise increases in LOS in three studies^{33,35,36}. Humphries et al. reported mean LOS of 3.2, 3.5, and 4.3 days for Deyo scores 0, 1–4, and 5–36, respectively ($P < 0.001$), with similar adjusted means³⁵. Issa et al. demonstrated large effect sizes for Deyo scores ≥ 1 (2 vs 0: +15.25, 95% CI 13.16-17.39; $P < 0.0001$)³⁶. Frailty, measured by the modified frailty index (mFI), was also predictive: Holzgrefe et al. reported mean LOS of 1.88 ± 2.9 days for mFI 0 versus 2.43 ± 2.1 days for mFI ≥ 2 ($P < 0.001$), with similar trends in patients aged ≥ 70 years³³.

Other Comorbidities

Other comorbidities further influenced LOS mentioned in 10 studies^{11,16,22,41,48,58,59,66,69,78}. Charlson Comorbidity Index (CCI) and comorbidity counts were strong predictors: Schairer et al. observed ORs for prolonged LOS rising from 1.69 for 2 comorbidities to 5.64 for ≥ 4 comorbidities⁷⁸. Kim et al. reported prolonged LOS increased with Elixhauser Comorbidity Measure (ECM) and CCI counts ($P < 0.0001$), with predictive model AUCs of 0.752 and 0.698, respectively⁴¹. Matsen et al. demonstrated CCI > 1 associated with $1.73 \times$ LOS and elevated risk of prolonged LOS in TSA (85.7%) and HA (92.1%)⁵⁹.

Disease-specific comorbidities were also relevant: CKD (Burns et al.: 2.8 ± 1.3 vs 2.3 ± 1.0 days, $P < 0.001$; Dacombe et al.: $P = 0.0008$), dialysis (OR 3.44, 99% CI 1.61-7.35; Lee et al.), COPD (OR 1.49, 99% CI 1.19-1.86; Lee et al.), bleeding disorders (OR 2.58, 99% CI 1.65-4.02; Lee et al.), Parkinson disease (2.9 ± 2.5 vs 2.1 ± 2.3 days; Papalia et al.), cirrhosis (2.6 ± 3.6 vs 1.5 ± 1.1 days; Martino et al.), and metabolic syndrome (adjusted OR 1.13-1.44; Fassler et al.; Murphy et al.)^{11,16,22,48,58,66,69}. Other predictors included functional dependence

(OR 2.73, 99% CI 2.05–3.64; $P < 0.001$; Lee et al.), sepsis (OR 3.34, 99% CI 1.60-6.96; $P < 0.001$; Lee et al.), and dyspnoea (OR 1.37, 99% CI 1.10-1.72; $P < 0.001$; Lee et al.), while smoking was not consistently significant (OR 1.20, 99% CI 0.97-1.48; $P = 0.016$ univariate, no significance in multivariate; Hartwell et al.)^{31,48}.

Physiological and Laboratory Markers

Anaemia/Haemoglobin related markers

Anaemia was consistently associated with prolonged LOS across seven studies^{2,10,19,39,63,72,82}. Polisetty et al. reported a mean LOS of 3.3 days in patients with iron-deficiency anaemia versus 2.4 days in non-anaemic controls ($P < 0.0001$)⁷². Burns et al. observed similar findings (5.0 ± 4.0 vs 2.2 ± 1.6 days; $P < 0.001$), and Doan et al. demonstrated increasing LOS with the degree of anaemia: 1.5 days for normal haematocrit, 2.1 days for mild anaemia, and 3.0 days for moderate-to-severe anaemia ($P < 0.0001$)^{10,19}. Large cohort analyses reinforced this relationship: Wang et al. reported LOS >2 days in 1.4% of non-anaemic patients, 2.9% of mild anaemia (OR 1.67, 95% CI 1.21-2.30; $P = 0.002$), and 12.5% of moderate-to-severe anaemia patients (OR 6.61, 95% CI 4.84-9.04; $P < 0.001$)⁸². Alder et al. similarly observed mean LOS of 1.8 ± 1.3 , 2.3 ± 2.0 , and 3.0 ± 2.6 days for non-anaemic, mild, and moderate-to-severe anaemia, respectively with anaemia severity defined using WHO haemoglobin thresholds (*all* $P < 0.001$)². Blood loss-related anaemia independently predicted prolonged LOS, with Kandil et al. reporting OR 1.65 (95% CI 1.21–2.23; $P < 0.001$) and Miltenberg et al. reporting OR 1.43 (95% CI 1.21–1.69; $P < 0.001$)^{39,63}. Kishan et al. similarly identified preoperative haematocrit $<35\%$ as strongly predictive of prolonged LOS in patients undergoing revision shoulder arthroplasty (OR 4.3, 95% CI 2.1-8.6)⁴⁴.

Malnutrition

Malnutrition similarly predicted prolonged LOS¹⁰. Burns et al. reported LOS of 3.7 ± 2.8 days in malnourished patients versus 2.2 ± 1.5 days in well-nourished controls ($P < 0.001$)¹⁰. Using the Geriatric Nutritional Risk Index (GNRI), Liu et al. demonstrated a dose-response relationship: prolonged LOS (>2 days) occurred in 13.0% of patients with normal nutrition (GNRI >98), 24.7% with moderate malnutrition (GNRI 92-98; OR 1.85, 95% CI 1.63-2.12; $P < 0.001$), and 41.6% with severe malnutrition (GNRI <92 ; OR 3.27, 95% CI 2.73-3.92; $P < 0.001$)⁵⁴.

Hypoalbuminemia

Hypoalbuminemia was independently associated with extended LOS in 3 studies^{23,26,47}. Lee et al. reported mean admission-to-discharge LOS of 3.46 days in hypoalbuminemia patients versus 2.26 days in matched controls ($P < 0.001$), with postoperative LOS similarly increased (2.75 vs 2.20 days; $P < 0.001$)⁴⁸. Garcia et al. found hypoalbuminemia conferred 69% higher adjusted odds of prolonged LOS (OR 1.69, 95% CI 1.02-2.78; $P = 0.041$)²⁶. Flamant et al. demonstrated that low preoperative albumin (<3.5 g/dL) predicted extended LOS (>3 days) in

primary shoulder arthroplasty (26.8% vs 13.6%; multivariable OR 2.11; $P = 0.03$), while in revision shoulder arthroplasty, the association was not significant²³.

Hyponatremia and Alkaline Phosphatase

Electrolyte disturbances were also predictive of increase in LOS in 3 studies^{48,49,53}. Hyponatremia (<135 mEq/L) was associated with increased LOS in both Lee et al. (OR 1.63, 99% CI 1.31-2.03) and Liu et al. (29.4% vs 17.7% prolonged LOS; multivariate OR 1.63, 95% CI 1.09-2.45; $P = 0.017$)^{48,49}. Elevated alkaline phosphatase (ALP) was similarly associated with extended LOS (>2 days) in Liu et al. (40.7% vs 17.7% for normal ALP; OR 2.37, 95% CI 1.31-4.30; $P = 0.004$)⁵³.

Dehydration

Dehydration was independently associated with prolonged LOS in 2 studies^{43,50}. In both, dehydration was defined biochemically using the preoperative blood urea nitrogen (BUN) to creatinine (Cr) ratio. Liu et al. classified patients with $BUN/Cr \geq 25$ as dehydrated, reporting LOS >2 days in 25.8% versus 15.1% in normally hydrated patients (OR 1.50, 95% CI 1.05-2.14; $P = 0.028$)⁵⁰. Kim et al. further stratified severity by BUN/Cr into non-dehydrated (<20), moderately dehydrated (20-25), and severely dehydrated (>25), showing stepwise increases in LOS ≥ 2 days from 34.1% to 35.5% and 38.6%, respectively ($P < 0.001$), with similar trends observed in elderly subgroups⁴³.

Medications

Opioid

Preoperative opioid exposure demonstrated significant associations with postoperative hospital LOS in 7 studies^{8,10,45,60,62,84}. Opioid use was consistently linked with dose-dependent increases in LOS. Mayfield et al. reported mean LOS increasing across opioid exposure quintiles from <22.3 MMEs (1.37 ± 1.72 days) to >83.3 MMEs (2.33 ± 2.24 days; $P < 0.0001$), while Brandner et al. observed longer LOS among opioid-dependent patients compared with non-dependent patients (1.8 ± 1.8 vs 1.6 ± 1.7 days; $P < 0.001$)^{8,60}. In multivariate analysis, Wilson et al. demonstrated a stepwise increase in odds of extended LOS (≥ 3 days) with escalating opioid use, with adjusted ORs of 1.25 for <1 OME/day ($P < 0.001$), 1.29 for 1–5 OME/day ($P = 0.002$), 1.52 for 5–10 OME/day ($P < 0.001$), and 1.98 for >10 OME/day ($P < 0.001$), univariate extended LOS proportions similarly increased from 15.4% in opioid-naïve patients to 25.9% in patients receiving >10 OME/day⁸⁴. Kopriva et al. corroborated these findings, reporting LOS >3 days in 15.5% of opioid-naïve patients, 19.2% with tramadol, 21.8% with traditional opioids, and 20.9% with combined opioids and tramadol (all $P < 0.001$), with adjusted odds ratios demonstrating a 31–51% higher likelihood of extended LOS in opioid-exposed patients compared with opioid-naïve controls⁴⁵. Menendez et al. further reported a higher prevalence of prolonged LOS among preoperative opioid users (24% vs 14%; $P = 0.013$)⁶². Burns et al. found no significant difference in LOS

between opioid-affected and unaffected patients (2.3 ± 1.7 vs 2.2 ± 1.7 days; $P = 0.407$), highlighting variability across cohorts ¹⁰.

Tranexamic acid

Tranexamic acid (TXA) demonstrated mixed effects on LOS in the two included studies ^{3,61}. Mayfield et al. reported no difference in propensity-matched cohorts (1.5 ± 1.0 days for both TXA and non-TXA patients; $P = 0.629$), although patients at high risk for venous thromboembolism experienced significantly shorter LOS with TXA (1.7 vs 1.9 days; $P = 0.0001$) ⁶¹. Anthony et al. similarly observed reduced LOS among TXA users (1.8 ± 1.2 vs 2.1 ± 1.9 days; $P < 0.0001$), corresponding to a 6.2% shorter adjusted LOS (95% CI -8.0% to -4.4%; $P < 0.05$) ³.

Steroid

Steroid administration demonstrated mixed effects on LOS in two studies ^{7,31}. Biron et al. found no significant association between perioperative steroid use and LOS (short LOS: 4.48%; long LOS: 5.77%), whereas Hartwell et al. reported a higher proportion of patients with LOS >24 hours among steroid recipients (59.7% vs 40.3%; $P = 0.0059$) ^{7,31}.

Mental Health Conditions

Preoperative mental health disorders were evaluated in seven studies, particularly depression, were consistently associated with prolonged hospital LOS following arthroplasty ^{18,56,57,62,64,75,81}. Diamond et al. reported a median LOS of 3 days in patients with a diagnosis of depression versus 2 days in patients without a diagnosis of depression ($P = 0.0007$) ¹⁸. Mollon et al. similarly observed a longer mean LOS among depressed patients (2.5 ± 1.6 days vs 2.2 ± 1.6 days; $P < 0.001$), while Lunati et al. demonstrated that 22.9% of patients with preoperative depression experienced extended LOS compared with 20.0% of non-depressed patients ($P < 0.001$), with depression independently predicting LOS ≥ 3 days (OR 1.23, 95% CI 1.12-1.36; $P < 0.001$) ^{57,64}. Regression analyses further confirmed this relationship, with Puzzitiello et al. identifying depressive status as an independent predictor of longer LOS ($\beta = 0.15$, 95% CI 0.04-0.45; $P = 0.022$) ⁷⁵. Menendez et al. reported that 39% of patients with depression had prolonged LOS compared with 21% of non-depressed patients ($P < 0.001$) ⁶². Vanderham et al. extended these findings to mental health disorders more broadly, showing that patients with preoperative mental health diagnosis (depression, anxiety, or psychosis) were more likely to have LOS > 2 days compared with those without mental health disorders (20% vs 14%), with similar rates observed for anxiety (20%), depression (20%), and psychotic disorders (23%) (all $P < 0.001$) ⁸¹. In contrast, Lonergan et al. found no significant difference in LOS between patients with mood disorders and those without (1.3 vs 1.1 days; $P = 0.11$) ⁵⁶.

Discussion

Principal Findings

In this systematic review of 64 studies involving 2,435,166 patients, modifiable preoperative factors associated with prolonged LOS following shoulder arthroplasty were identified across physiological, metabolic, and psychosocial domains. Anaemia, malnutrition, hypoalbuminemia, diabetes, frailty, higher ASA grade, comorbidity burden, opioid exposure, and depression were consistently associated with longer admissions. In contrast, general obesity showed limited association, with only morbid obesity demonstrating a modest effect. These findings highlight physiological reserve, systemic disease optimisation, and mental health as key targets for reducing LOS.

Comparison with Prior Evidence

Berman et al. (2019) performed the only previous systematic review on this topic, including 22 studies⁶. They identified age >65 years, female sex, obesity (BMI ≥ 40 kg/m²), reverse arthroplasty, and lower hospital/surgeon volume as the main correlates of prolonged LOS and non-home discharge⁶. Diabetes was noted but not examined in depth; laboratory markers, nutritional indices, opioid dose–response, dehydration, and mental-health diagnoses were not synthesised⁶.

The present review expands the evidence base to 64 studies (>2.4 million patients), restricts the scope exclusively to modifiable physiological, metabolic, and psychosocial predictors, incorporates the substantial post-2019 literature on these factors, and organises the findings into clinically actionable domains. This shifts the contribution from a descriptive summary of risk factors to an integrated optimisation framework that directly supports short-stay and same-day pathways.

Clinical Significance

The modifiable predictors identified offer clear targets for preoperative optimisation to reduce LOS and support short-stay shoulder arthroplasty. Anaemia correction, nutritional supplementation (including protein and vitamin D), glycaemic control, prehabilitation to improve functional reserve, structured opioid tapering, and mental health management have all been shown to enhance recovery, reduce complications, and shorten hospitalisation^{1,9,13,14,68,71,77}. Integrating these interventions into an evidence-based preoperative optimisation bundle or enhanced recovery protocol addresses physiological, metabolic, and psychosocial factors simultaneously. Such structured pathways provide a practical framework to improve perioperative efficiency, facilitate early mobilisation, and enable safe implementation of short-stay or same-day discharge models in contemporary shoulder arthroplasty.

Key Observations and Mechanistic Insights

Several modifiable preoperative factors identified in this review are supported by meta-analyses showing clear impacts on postoperative outcomes. Hypoalbuminemia (<3.5 g/dL) prolongs hospital stay, with Llombart et al. reporting a mean difference of 1.59 days (95% CI 0.86-2.32) in TSA patients, and Tischler et al. showing higher odds of extended LOS (>3 days, OR 2.24), readmission (OR 1.88-2.92), reoperation (OR 2.20-3.60), and mortality (OR 3.93-14.57), likely reflecting impaired wound healing and systemic vulnerability, highlighting nutritional optimisation as a modifiable strategy to improve outcomes^{55,80}. In 1.46 million total hip and knee arthroplasty patients, anaemia increased LOS (+1.3-1.6 days), sepsis risk (OR 3.93), cardiopulmonary events (OR 2.4), and readmission (OR 1.58) (82), likely delaying recovery by impairing oxygen delivery, increasing transfusion requirements, and limiting mobilisation^{24,46,85}.

Psychosocial factors also affect LOS. Kremic et al. found preoperative depression increased LOS by 0.98 days (95% CI 0.35-1.62) and raised odds of extended LOS by 1.27 (95% CI 1.11-1.46) in over 27 million surgical patients⁴⁶. Depression may impair pain tolerance, reduce rehabilitation engagement, and trigger stress responses, which, combined with metabolic deficits, further delays recovery⁴⁶. These findings support a biopsychosocial optimisation strategy incorporating mental health screening, nutritional and haematologic optimisation, and functional prehabilitation to shorten LOS and improve recovery efficiency in shoulder arthroplasty.

Limitations

All included studies were observational, with many at serious risk of bias due to confounding, missing data, and selective reporting, limiting causal inference. Preoperative predictors, such as anaemia, malnutrition, and hypoalbuminemia, may be highly confounded by baseline patient health, frailty, or comorbidity burden; therefore, our synthesis is exploratory rather than confirmatory. Substantial heterogeneity in arthroplasty type, LOS definitions, and perioperative protocols precluded meta-analysis. Most studies were US-based, limiting generalisability. A further methodological consideration is the potential for overlapping patient populations across studies using the same large administrative databases. Exact double-counting cannot be quantified due to the absence of unique identifiers. However, studies differed in year ranges, inclusion criteria, and outcome definitions. Partial cohort overlap remains a limitation that may amplify database-specific biases. Finally, mental health data were inconsistently reported, potentially underestimating their impact.

Future Directions

Prospective, multicentre studies are needed to evaluate preoperative optimisation strategies targeting anaemia, nutrition, glycaemic control, opioid use, and mental health. These studies should adjust for baseline demographics, comorbidities, and medication use to identify independent predictors of LOS and determine the most effective protocols. Future work should also stratify analyses by arthroplasty type and indication to determine whether the identified predictors differ across these clinically distinct populations. Additionally,

interventional trials testing structured preoperative regimens could establish evidence-based pathways for short-stay or same-day shoulder arthroplasty across diverse healthcare settings.

Conclusion

Modifiable preoperative physiological factors, comorbidity burden, and mental health are key predictors of hospital LOS after shoulder arthroplasty. Anaemia, malnutrition, hypoalbuminemia, insulin-dependent or complicated diabetes, frailty, and depression consistently prolong LOS, while general obesity (BMI 30-40) has minimal impact. Targeted preoperative optimisation, including mental health assessment, can safely reduce LOS, improve efficiency, and support short-stay or same-day pathways, providing an evidence-based framework to enhance outcomes and resource utilisation.

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Figures

Figure 1. PRISMA flow diagram

Figure 2. ROBINS-I risk of bias assessment

Author (Year)	Title	Journal	Study design	Country or region	Data Source	Sample size (Total and for each subgroup (if applicable))	Age (Mean $\pm$ SD Or median (IQR))	% male	BMI (mean $\pm$ SD)	Comorbidity indices	Indication for TSA	Type of TSA performed
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Liu et al. 2025 ⁵⁰	Dehydration independently predicts prolonged hospital stay following aseptic revision total shoulder arthroplasty.	European Journal of Orthopaedic Surgery and Traumatology	Retrospective cohort study	USA	American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database (2015–2022)	1,372	Age reported categorically - overall cohort: 0.8 % of normally hydrated and 0.4 % of dehydrated patients were 18–39 yrs; 16.5 % vs 8.0 % were 40–59 yrs; 72.5 % vs 72.9 % were 60–79 yrs; and 10.2 % vs 18.7 % were	Over all cohort: 62.9 % male. In the normal hydration group 65.6 % were male vs 49.3 % in the dehydration group	Mean BMI not reported but BMI presented categorically - <18.5 kg/m ² (0.1 % normal vs 0 % dehydrated), 18.5–24.9 kg/m ² (14.1 % vs 16.4 %), 25–29.9 kg/m ² (30.9 % vs 32.4 %), and ≥30 kg/m ² (54.9 % vs 51.1 %)	ASA classification ≤2 in 34.7 % of normal hydration and 27.1 % of dehydrated patients; ASA ≥3 in 65.3 % vs 72.9 % Comorbidities: CHF 1.9 % vs 3.6 %, hypertension 70.3 % vs 76.9 %, COPD 6.6 % vs 10.7 %, bleeding disorder 3.7 % vs 4.4 %, disseminated cancer 0.3 % vs 0 % Functional	Aseptic (non-infectious) revision TSA; cases performed for infection were excluded	Revision total shoulder arthroplasty
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							≥80 y rs			status was indepe ndent in 96.7 % vs 97. 8 %		
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Nazzal et al. 2025 ⁶⁷	Predictors of failing same-day discharge after shoulder arthroplasty : developing a model to improve outcomes and reduce health care cost.	Journal of Shoulder and Elbow Surgery	Retrospective case-control study	USA	Single-centre institutional database (consecutive shoulder arthroplasty cohort)	333	69.9 ± 7.9 years overall. achieved SDD had a mean age of 69.5 ± 7.7 vs 71.1 ± 8.2 years in patients who failed SDD.	46.9 % male overall; 50.2 % male in the SDD group vs 38.0 % male in the failure group.	Mean BMI 30.9 ± 6.4 kg/m ² ; SDD group 30.5 ± 6.4 vs failure group 32.0 ± 6.3.	Mean Charlson Comorbidity Index (CCI) 3.4 ± 1.6 overall (3.33 ± 1.6 for SDD vs 3.67 ± 1.7 for failure)	Primary glenohumeral osteoarthritis or rotator cuff arthropathy. Patients with fractures, revision arthroplasty, or age < 45 yrs were excluded.	Anatomic TSA, reverse TSA,
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Areti et al. 2025 ⁴	Impact of morbid obesity on postoperative outcomes in reverse total shoulder arthroplasty : A national inpatient sample analysis.	Journal of Orthopaedics	Retrospective cohort study	USA	National Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP)	59,925	Mean age at admission : morbidly obese 67.74 ± 7.674 years vs 71.67 ± 8.642 years in the control group (difference – 3.93 years, p < 0.001). Age categories showed a greater proportion of younger patients in the morbidly obese	28.40 % in morbidly obese vs 40.44 % male control group.	Diabetes and tobacco-related disorders. Diabetes without complications occurred in 22.04 % of morbidly obese vs 13.78 % controls; diabetes with complications occurred in 0.39 % vs 0.18 % . Tobacco-related diagnoses were less common in the morbidly obese	Rotator Cuff Arthropathy, fractures, osteoarthritis and revision arthroplasty	Reverse Total Shoulder Arthroplasty only
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							cohort (<60 yrs: 1 4.15 % vs 8.32 % control; 60– 69 yr s: 42. 55 % vs 29.8 4 %; $p < 0.001$).			group (11.26 % vs 16.51 %, $p < 0.001$).		
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Mayfield et al. 2025 ⁶⁰	Perioperative opioid use in total shoulder arthroplasty is associated with dose-dependent risk of major surgical and medical complications.	Journal of Shoulder and Elbow Surgery	Retrospective cohort study	USA	Premier Healthcare Database (PHD)	140,251	1.70 ± 8.51 yrs in the lowest quintile, 70.66 ± 8.59 yrs, 70.00 ± 8.85 yrs, 69.02 ± 9.02 yrs and 67.24 ± 9.48 yrs in the highest quintile.	45.06 % in the lowest quintile vs 40.62 % in the highest quintile	Congestive Heart Failure, Chronic pulmonary disease, complicated diabetes, obesity, fluid electrolyte imbalance and depression	Primary elective anatomic or reverse total shoulder arthroplasty	Anatomic TSA, reverse TSA,
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Liu et al. 2024 ⁵⁴	Severe malnutrition predicts early postoperative complications in aseptic revision total shoulder arthroplasty.	Shoulder and Elbow	Retrospective cohort study	USA	ACS - NS QIP database	678	Age reported by categories: 65–74 yrs (67.6 % normal, 60.0 % moderate, 52.3 % severe); 75–84 yrs (29.5 % normal, 32.6 % moderate, 36.9 % severe); ≥85 yrs (2.9 % normal, 7.4 % moderate, 10.8 %)	Based on Geriatric Nutritional Risk Index (GNRI): normal GNRI 45.6 % male, moderate malnutrition 47.4 % male, severe malnutrition 40.0 % male	ASA classification ≥3: 68.3 % normal nutrition, 78.9 % moderate malnutrition and 83.1 % severe malnutrition, Comorbidities recorded included congestive heart failure (CHF), diabetes, hypertension, chronic obstructive pulmonary disease (COPD), bleeding disorders and	Revision total shoulder arthroplasty for non-infectious etiologies	Revision Total Shoulder Arthroplasty
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							severe)			disseminated cancer ; COPD was more prevalent in the moderate malnutrition group (13.7 % vs 7.1 % normally)		
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Mayfield et al. 2025 ⁶¹	Tranexamic acid use in total shoulder arthroplasty continues to increase and is safe in high-risk patients.	Journal of Shoulder and Elbow Surgery	Retrospective cohort study	USA	Premier Healthcare Database (PHD)	86,356	mean age was 70.3 $\pm$ 8.4 years (TXA ⁺) vs 70.5 $\pm$ 8.6 years (TXA ⁻). High-risk cohorts had similar mean ages (71.5 vs 71.6 years).	45.3 % of the TXA ⁺ group and 44.9 % of the TXA ⁻ group were male. In the high-risk subgroup, 39.7 % (TXA ⁺) and 38.9 % (TXA ⁻) were male.	In the unmatched cohorts, TXA ⁺ patients had lower rates of congestive heart failure (4.9 % vs 6.1 %), pulmonary circulation disorders (0.9 % vs 1.1 %), peripheral vascular disease (3.1 % vs 3.8 %), complicated hypertension (10.8 % vs 11.8 %), renal failure (8.4 % vs	Primary elective Total shoulder arthroplasty	Anatomic and Reverse total shoulder arthroplasty
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									9.4 %) and history of VTE (4.5 % vs 6.5 %). Rates of chronic pulmonary disease, diabetes, hypothyroidism, obesity, depression and other comorbidities were similar between groups. After matching, comorbidity differences were eliminated, with similar prevalence of congestive heart		
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									failure (~5.1 %), hypertension (~60 %), chronic pulmonary disease (~19.5 %) and obesity (~21.7 %) in both cohorts.		
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Liu et al. 2024 ⁴⁹	The association of hyponatremia and early postoperative complications in aseptic revision total shoulder arthroplasty.	European Journal of Orthopaedic Surgery and Traumatology	retrospective cohort study	USA	ACS - NS QIP database	1,927	Age was categorized; 60–79 yrs accounted for 71.7% of eunatremic and 71.3% of hyponatremic patients. Younger (<60 yrs) and ≥80 yrs groups comprised the remainder	Sex distribution was similar: eunatremia 47.7% male vs hyponatremia 46.3% male	BMI categories: eunatremia — 53.9% obese (≥30 kg/m ²), 30.6% overweight (25–29.9 kg/m ²), 15.1% normal weight (18.5–24.9 kg/m ²) and 0.4% underweight; hyponatremia — 46.3% obese, 26.5% overweight,	Functional status prior to surgery (dependent vs independent), ASA classification, smoking, steroid use and comorbidities such as congestive heart failure, hypertension, COPD, bleeding disorders and disseminated cancer were recorded	Revision total shoulder arthroplasty for aseptic indications	Anatomic and Reverse total shoulder arthroplasty
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									26.5 % norm al weig ht and 0.7 % unde rweig ht. Hypo natre mia was signif icantl y asso ciate d with BMI <24.9 kg/m ² (P = 0 .004)			
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Liu et al. 2024 ⁵¹	Hypoalbuminemia predicts early postoperative complications following noninfectious revision total shoulder arthroplasty.	European Journal of Orthopaedic Surgery and Traumatology	Retrospective cohort study	USA	ACS-NSQIP database	839	normal-albumin group, 48.3% were male (362/750); in the hypoalbuminemia group 37.1% were male (33/89)	BMI was categorized: in the normal-albumin cohort, 16.9% were normal weight (18.5 – 24.9 kg/m ²), 29.3% overweight (25–29.9 kg/m ²) and 53.3% obese (≥30 kg/m ²); in the hypoalbuminemia group 13.5% were normal	ASA class and comorbidities were recorded. Hypoalbuminemia was associated with dependent functional status (10.1% vs 2.7%; P<0.001) and ASA class ≥ 3 (78.7% vs 63.5%; P=0.005). Diabetes was more common in the normal-albumin group (19.1% vs 5.6%; P=0.007)	Aseptic revision total shoulder arthroplasty	Revision Total Shoulder arthroplasty
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									al weig ht, 73.0 % over weig ht and 13.5 % obes e			
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Liu et al. 2024 ⁵³	Elevated alkaline phosphatase independently predicts early postoperative complications in noninfectious revision total shoulder arthroplasty.	European Journal of Orthopaedic Surgery and Traumatology	Retrospective cohort study	USA	ACS - NS QIP database	936	<40 yrs 1.0 % vs 3.7 % (normal vs elevated); 40–59 yrs 18.0 % vs 20.4 %; 60–79 yrs 71.1 % vs 64.8 %; ≥80 yrs 9.9 % vs 11.1 %.	Normal group: 49.4 % male elevated group: 35.2 % male.	Normal Group vs Elevated group: ASA class ≥3 in 65.1% vs 88.9 % dependent functional status: (11.1 % vs 3.3 %) diabetes (31.5 % vs 19.8 %) and bleeding disorders (9.3 % vs 3.1 %)	Revision total shoulder arthroplasty	Revision for aseptic etiologies
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Liu et al. 2024 ⁵²	The geriatric nutritional risk index as a strong predictor of adverse outcomes following total shoulder arthroplasty.	European Journal of Orthopaedic Surgery and Traumatology	retrospective cohort study	USA	ACS - NSQIP database	11,411	65–74 yrs (29.1 % of normal, 23.4 % moderate, 21.9 % severe) 75–84 yrs (54.1 % normal, 52.8 % moderate, 48.1 % severe) ≥ 85 yrs (16.9 % normal, 23.9 % moderate, 30.0 % severe)	normal GNRI 42.0 % male, moderate 36.6 % male, severe 28.3 % male	BMI not provided as a continuous measure	Functional status: 2.3 % of the normal, 3.4 % of the moderate and 10.4 % of the severe malnutrition group ASA classification ≥ 3 occurred in 61.6 %, 73.1 % and 80.7 % of normal, moderate and severe group	Anatomic and reverse TSA
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Fassler et al. 2024 ²²	Components of metabolic syndrome as significant risk factors for postoperative complications following total shoulder arthroplasty : hypertension, diabetes, and obesity.	Journal of Shoulder and Elbow Surgery	Retrospective cohort study	USA	ACS - NS QIP database	26,613	< 65 yrs 27.7 % of no-MetS vs 25.7 % of MetS; 65–74 yrs 40.9 % vs 49.0 % ≥ 75 yrs 30.8 % vs 25.1 %.	Patients with MetS were more likely to be aged 65–74 and less likely to be ≥ 75 yrs	males 44.6 % vs 42.2 % no-MetS vs MetS	MetS vs Control ASA ≥ 3 was present in 85.5 % vs 54.2 % dependent functional status (3.4 % vs 1.9 %) dyspnea on exertion or at rest, COPD (8.5 % vs 6.4 %) congestive heart failure (1.4 % vs 0.6 %) open wound /wound infection (0.6 % vs 0.3 %) bleeding disorders (3.3 %	Primary total shoulder arthroplasty for non-trauma indications	Anatomic and reverse TSA
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Burns et al. 2024 ¹¹	Chronic kidney disease increases cost of care and readmission risk after shoulder arthroplasty.	journal shoulder elbow surgery	retrospective cohort study	USA	Regional health system electronic medical record database (Epic; 7-hospital system)	514	CKD: 73.2 ± 8.9 yrs Non-CKD: 68.1 ± 9.4 yrs (p<0.001)	CKD: 32% male Non-CKD: 53.5% male	CKD: 31.5 ± 7.2 Non-CKD: 31.7 ± 6.5 (NS)	Number of comorbidities: CKD 5.9 ± 2.9 vs Non-CKD 5.0 ± 3.1 (p<0.001) Specific comorbidities: CKD patients more likely to have diabetes (36.8% vs 20.1%, p<0.001), cardiac disease (40.8% vs 30.3%, p=0.03), anemia (41.9% vs 18.5%, p<0.001), dialysis	Elective primary TSA	Anatomic and Reverse TSA
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										s (5.6% vs 0, p<0.0 01).		
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Branner et al. 2024 ⁸	Impact of opioid dependence on outcomes following total shoulder arthroplasty	Journal of Shoulder and Elbow Surgery	Retrospective cohort study	USA	National Readmissions Database (NRD), HCUP	58,975					Primary anatomic and reverse TSA	Anatomic and Reverse TSA
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Gruson et al. 2023 ²⁹	Does Morbid Obesity (BMI ≥ 40 kg/m ²) Impact Operative Time, Blood Loss, Length of Stay, or Complications Following Anatomic Total Shoulder Arthroplasty?	Archives of bone and joint surgery	Retrospective cohort study	USA	Single-institution retrospective cohort	130	Median ages: non-obese 64.0 yrs (IQR 56–71), obese 61.5 yrs (IQR 55–69), morbidly obese 62.0 yrs (IQR 56–67)	42 % (55/130)	Median BMI: non-obese 26.8 kg/m ² (IQR 24.9–28.2), obese 33.9 kg/m ² (IQR 32.4–36.5), morbidly obese 42.7 kg/m ² (IQR 41.3–45.4) Over all mean BMI 33.2 $\pm$ 6.8 kg/m ²	Age-adjusted Charlson Comorbidity Index (ACCI); medians: 3.0 (IQR 2.0–4.0) non-obese, 2.5 (IQR 1.5–4.0) obese, 2.0 (IQR 2.0–3.0) morbidly obese	Elective primary aTSA for primary osteoarthritis	Anatomic total shoulder arthroplasty
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Pap alia et al. 202 3 ⁶⁹	Inpati ent charg es, compl ication, and revisi on rates for shoul der arthro plasty in Parkin son disea se: a region al datab ase study.	JSES Intern ationa l	Ret ros pec tive coh ort stu dy	US A	Stat ewi de all- pay er adm inist rative data bas e	39, 011	non- PD 68.6 ± 10. 4 yr vs PD 72.3 ± 8.0 yr	43%	Elixha user Comor bidity Index	Indica tion by ICD-9 /10 codes	Anat omic TSA, rever se TSA, and hemi arthr opla sty
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Diamond et al. 2023 ¹⁸	How does depressive disorder impact outcomes in patients with glenohumeral osteoarthritis undergoing primary reverse shoulder arthroplasty?	JSES International	retrospective case-control study	USA	National claims database	24,326	47.38 % males DD vs 47.36 % no DD	chronic obstructive pulmonary disease, congestive heart failure, diabetes, hyperlipidemia, hypertension, obesity.	glenohumeral osteoarthritis or rotator cuff tear	reverse shoulder arthroplasty
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Polis etty et al. 202 3 ⁷²	Iron defici ency anemi a is assoc iated with increa sed medic al and impla nt- relate d compl ication s and length of stay for patien ts under going total shoul der arthro plasty	JSES Intern ationa l	Ret ros pec tive coh ort stu dy	usa	Med icar e data bas e	106 ,13 4	73 yr for both coho rts (age categ ories: <64 y r 10.2 5 %, 65– 69 yr 22.0 4 %, 70– 74 yr 24.8 5 %, 75– 79 yr 23.2 8 %, 80– 84 yr 14.3 3 %, ≥85 y r 5.26 %)	34.7 4% male	Elixha user Comor biditie s Index used. Matchi ng variabl es includ ed diabet es mellit us, hyperli pidemi a, hypert ension , obesit y and tobacc o use	prima ry total shoul der athro plasty	prim ary total shoul der athro plast y
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Puzzitiello et al. 2022 ⁷⁵	Patients with limited health literacy have worse preoperative function and pain control and experience prolonged hospitalizations following shoulder arthroplasty.	Journal of shoulder and elbow surgery	Retrospective cohort study	USA	Prospectively maintained institutional registry (OBERD database)	230	Mean age: HHL 67.9 ± 7.7 yr vs LHL 69.0 ± 9.6 yr (P = .36).	HHL 50 % vs LHL 51.7 % (P = .82)	HHL 30.8 ± 6.4 kg/m ² vs LHL 31.6 ± 6.9 kg/m ² (P = .42)	ASA physical-status classification (ASA > 2) and Area Deprivation Index (ADI)	osteoarthritis or rotator cuff arthropathy	reverse TSA and anatomic TSA
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Burns et al. 2022 ¹⁰	Modifiable risk factors increase length of stay and 90-day cost of care after shoulder arthroplasty.	jses	Retrospective cohort study	USA	Regional health system electronic medical record database (Epic; 7-hospital system)	1,317				modifiable risk factors (MRFs) defined as anemia (hemoglobin < 10 g/dL), malnutrition (albumin < 3.4 g/dL), obesity (BMI > 40 kg/m ²), uncontrolled diabetes (random glucose > 180 mg/dL or HbA1c > 8 %), tobacco use, and opioid use.	Acute fracture	
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Doan et al. 2021 ¹⁹	Increasing severity of anemia is associated with poorer 30-day outcomes for total shoulder arthroplasty.	JSES International	retrospective cohort study	USA	ACS-NSQIP database	15,185	Normal HCT: 68.6 ± 9.4 yrs; Mild anemia: 71.4 ± 9.1 yrs; Moderate/severe anemia: 72.5 ± 10.3 yrs.	50.8%, 23.1% and 22.6% respectively.	No anemia: 31.4 ± 6.7 kg/m ² ; Mild anemia: 31.1 ± 7.3 kg/m ² ; Moderate/severe anemia: 29.8 ± 7.3 kg/m ² .	ASA physical-status classification. CHF, COPD, cancer, diabetes, dialysis, dyspnea, hypertension, renal failure, sepsis, smoking, steroid use, weight loss	various diagnoses	anatomic and reverse TSA
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Fla man t et al. 202 1 ²³	Malnu trition in electi ve shoul der arthro plasty : a multi- institu tional retros pectiv e study of preop erativ e album in and adver se outco mes.	JSES	retr osp ecti ve coh ort stu dy	US A	Two terti ary insti tutio nal cent res (mul ti- insti tutio nal retr osp ecti ve coh ort)	492	65.7 yr for those with albu min <3.5 g/dL vs 66.8 yr for those with albu min ≥3.5 g/dL	42.5 % of patie nts with low albu min were male vs 49.6 % with norm al albu min	mean BMI 31.3 kg/m ² in maln ouris hed patie nts vs 30.4 kg/m ² in norm oalbu mine mic patie nts	Ameri can Societ y of Anest hesiol ogists (ASA) physic al-stat us classif ication and select ed Elixha user comor biditie s (conge stive heart failure , pulmo nary diseas e, diabet es, renal failure , liver diseas e, smoki ng)	Electi ve prima ry or revisi on total shoul der arthro plasty	anat omic total shoul der arthro plasty (TSA) and rever se TSA (rTSA)
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Wanget al. 2021 ⁸²	Increased severity of anemia is associated with postoperative complications following primary total shoulder arthroplasty.	JSES	Retrospective cohort study	USA	ACS - NSQIP database	13,921	Non-anemic: 69.12 ± 9.38 yr; mild anemia: 71.51 ± 9.31 yr; moderate/severe anemia: 72.98 ± 9.98 yr.	43.6% in non-anemic, 49.3% in mild anemia and 24.0% in moderate/severe anemia.	Non-anemic: 31.51 ± 6.84 kg/m ² ; mild anemia: 30.78 ± 6.87 kg/m ² ; moderate/severe anemia: 30.02 ± 6.92 kg/m ² .	ASA physical-status classification (grades I-IV) and individual comorbidities (COPD, CHF, hypertension, dialysis, renal failure, weight loss, steroid use, bleeding disorder, diabetes, dyspnea)	Primary TSA for Osteoarthritis	anatomic TSA, reverse TSA and total shoulder resurfacing
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Luna ti et al. 202 1 ⁵⁷	Preop erativ e depre ssion is a risk factor for compl ication and increa sed health care utiliza tion follow ing total shoul der arthro plasty .	JSES	Ret ros pec tive coh ort stu dy	US A	Truv en Mar ketScan Comm erci al Claims and Enc ounters Data base	22, 623	Over all ≈49 % male (52.1 % male in non- depre ssed vs 32 .4 % in de pre ssed coho rt)	Elixha user metho d: obesit y, chroni c kidney diseas e, alcohol use, tobacco use, hypert ension , coron ary ar tery diseas e, anxiet y, conge stive heart failure , rheum atic diseas e and diabet es	prima ry TSA for gleno hum eral disea se	anat omic (TSA) and rever se (RSA)
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Wils on et al. 2021 ⁸⁴	Preop erativ e opioid use is an indep enden t risk factor for compl icatio n, revisi on, and increa sed health care utiliza tion follow ing prima ry total shoul der arthro plasty .	JSES		US A	Adm inist rative clai ms data bas e	29, 454				Elixha user comor bidity catego ries		
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Dacomb et al. 2020 ¹⁶	Predictors of length of stay following shoulder arthroplasty in a high-volume UK centre	Annals of the royal college of Surgeons England	Retrospective consecutive cohort study	UK	Single high-volume UK institutional database (electronic patient records/case records)	640	Overall mean age 72 ± 10 years	29.50%	Charlson Comorbidity Index, ASA Distribution	Osteoarthritis (297 cases), cuff-tear arthropathy (160), rheumatoid arthritis (36), avascular necrosis (18), trauma (22), traumatic sequelae (49), infection (3), revision (55)	Anatomic total shoulder replacement (262), reverse shoulder arthroplasty (287), hemiarthroplasty (36), revision arthroplasty (55)
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Men end ez et al. 201 9 ⁶²	Delay ed hospit al disch arge after total shoul der arthro plasty : why, and who is at risk?	JSES Open Acces s	retr osp ecti ve coh ort stu dy	US A	Pros pect ively coll ecte d insti tutio nal regi stry with man ual char t revi ew	415	68.8 ± 8.4 yr	39%	30.8 ± 6.3 kg/m ²	ASA class distrib ution, Depre ssion, diabet es	Electi ve prima ry anato mic or revers e TSA for degen erativ e shoul der condit ions	anat omic (TSA) and rever se (RSA)
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Biron et al. 2020 ⁷	A Novel Machine Learning Model Developed to Assist in Patient Selection for Outpatient Total Shoulder Arthroplasty	J Am Acad Orthop Surg	retrospective cross sectional analysis	USA	ACS - NS QIP database	4,500	67.8 yr in short-stay vs 72.8 yr in long-stay	51.1% male (1,084/2,122); long-stay: 31.9% male (321/1,006)	BMI 31.2 kg/m ² in short-stay vs 31.7 kg/m ² long stay	ASA Class, Diabetes, CHF, COPD, Hypertension, Dyspnea, Obesity	elective total-shoulder arthroplasty	anatomic and reverse TSA
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Anthony et al. 2019 ³	Utilization and Real-world Effectiveness of Transcatheter Aortic Valve Replacement in the United States: A Population-based Study.	Journal of the American Academy of Orthopaedic Surgeons	retrospective cohort study	USA	National claims database	82,512				Charlson-Deeyo Comorbidity Index		
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Lee et al. 2019 ⁴⁷	Low Serum Albumin Levels are Associated with Increased 30-Day Cardiomortality Complications, Reoperation, and Readmission Rates Following Total Shoulder Arthroplasty	IOWA Orthopaedic Journal	retrospective cohort study	USA	ACS - NSQIP database	14,494	Normal cohort: 68.86 ± 9.82 yr; matched control: 70.26 ± 9.44 yr; hypoalbuminemia: 71.24 ± 10.39 yr	Normal cohort: 45.00 % male; matched control: 34.43 % male; hypoalbuminemia: 26.19 % male	COPD 14.43 % vs 7.84 %; CHF 2.27 % vs 0.62 %; hypertension 72.99 % vs 69.07 %; functional dependence 9.69 % vs 2.89 %	primary total shoulder arthroplasty	anatomic and reverse TSA
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Kim et al. 2018 ⁴¹	Predicting adverse events, length of stay, and discharge disposition following shoulder arthroplasty: a comparison of the Elixhauser Comorbidity Measure and Charlson Comorbidity Index.	Seminars in Arthroplasty : JSES	Retrospective cohort study	USA	National Inpatient Sample (NIS), HCUP	90,491	69.2 ± 9.6 yrs	41.80%	31.1 ± 6.6	Charlson Comorbidity Index (CCI) and Elixhauser Comorbidity Measure (ECM)	Elective primary TSA	Anatomic TSA and reverse TSA
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Izquierdo - Fernández et al. 2018 ³⁷	Reverse shoulder arthroplasty in obese patients: analysis of functionality in the medium-term.	Archives of Orthopaedic and Trauma Surgery	retrospective cohort study	Spain	Single-centre institutional database (University Hospital Reina Sofía, Spain)	29	78.1 years	20.70%	31.85		cuff-tear arthropathy and fractures/dislocations	reverse shoulder arthroplasty
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Fu et al. 2017 ²⁵	The impact of insulin dependence on short-term postoperative complications in diabetic patients undergoing total shoulder arthroplasty.	JSES	Retrospective cohort study	USA	ACS-NSQIP database	5,918	≤65 years : Non-DM 28.6 %, NIDDM 22.4 %, IDDM 26.8 % 66–75 years : Non-DM 38.5 %, NIDDM 45.7 %, IDDM 42.0 % >75 years : Non-DM 32.9 %, NIDDM 31.9 %, IDDM 31.2 % p values:	Female proportion: Non-DM 56.6 %, NIDDM 53.8 %, IDDM 56.3 % p values: Non-DM vs NIDDM 0.178; Non-DM vs IDDM 0.926; NIDDM vs IDDM 0.482	Nonobese (≤29.9 kg/m²): Non-DM 54.7 %, NIDDM 32.3 %, IDDM 26.4 % Obese I (30–34.9) : Non-DM 25.3 %, NIDDM 30.7 %, IDDM 27.1 % Obese II (35–39.9) : Non-DM 11.9 %, NIDDM 20.7 %, IDDM 22.7 %	Modified CCI: 0–2: Non-DM 16.8%, NIDDM 1.6%, IDDM 3.1% 3: Non-DM 32.8%, NIDDM 8.0%, IDDM 11.9% 4: Non-DM 33.5%, NIDDM 37.3%, IDDM 29.5% ≥5: Non-DM 16.7%, NIDDM 52.8%, IDDM 55.6% p values : Non-		
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							Non-DM vs NIDDM		Obese III (≥40)	DM vs NIDDM		
							M		:	M		
							<.001;		Non-DM	<.001;		
							Non-DM vs IDDM		8.1%,	<.001;		
									NIDDM	NIDDM		
							vs IDDM		M	M vs IDDM		
							0.478;		16.4%,	0.034		
							NIDDM vs IDDM		IDDM			
							M vs IDDM		23.7%	Functional status:		
							0.305		p value			
									s:	Independent:		
									Non-DM vs NIDDM	Non-DM		
									<.001	96.4%		
									; Non-DM vs IDDM	, NIDDM		
									<.001	M		
									; NIDDM vs IDDM	94.6%		
									0.022	, IDDM		
										93.6%		
										Non-independent:		
										Non-DM		
										3.6%,		
										NIDDM		
										M		
										5.4%,		
										IDDM		
										6.4%		
										p values		
										: Non-DM vs NIDDM		
										M		
										0.025;		
										Non-DM vs IDDM		

									0.013; NIDD M vs IDDM 0.500		
									Individ ual comor biditie s:		
									Hypert ension : Non- DM 63.0%		
									, NIDD M 87.3%		
									, IDDM 84.8%		
									(p<.00 1, <.001, 0.705)		
									Cardia c history : 2.1%, 4.6%, 6.8%		
									(p<.00 1, <.001, 0.167)		
									COPD: 5.9%, 9.4%, 10.2%		
									(p<.00 1, 0.003, 0.710)		
									Curren t smoke		

										r (within 1 year): 10.3% , 7.8%, 10.9% (p=0.0 41, 0.764, 0.122)		
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Issa et al. 2016 ³⁶	Total Shoulder Arthroplasty Demographics, Incidence, and Complications—A Nationwide Inpatient Sample Database Study.	Surgical Technology International	Retrospective cohort study	USA	National Inpatient Sample (NIS), HCUP	226,227	68.9 (95% CI 68.7-68.96)	Male: 43.6%	0: 135,918 (60.01%) 1: 63,332 (27.96%) 2: 19,171 (8.46%) ≥3: 8,074 (3.56%)		
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Wei nreb et al. 201 6 ⁸³	Shoul der Arthro plasty : Dispo sition and Periop erativ e Outco mes in Patien ts With and Witho ut Rheu matoi d Arthrit is.	The Ameri can Journa l of Ortho pedic s	Ret ros pec tive coh ort stu dy	US A	Nati onal Inpa tient Sam ple (NIS , HC UP	34, 970	RA: 66.3 9 ± 11.3 9 years ; Medi an 68 (IQR 60– 75) Non- RA: 69.0 7 ± 9.99 years ; Medi an 70 (IQR 63– 76) p < .001	RA: 24.4 9% Non- RA: 45.5 9% p < .001			Rheu matoi d arthrit is Non- RA indica tions not broke n down	Reve rse and tradi tiona l
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Mollon et al. 2016 ⁶⁴	The influence of a history of clinical depression on peri-operative outcomes in elective total shoulder arthroplasty : a ten-year national analysis.	The Bone & Joint Journal	Retrospective cohort study	US A	National Inpatient Sample (NIS), HCUP	224,060	With depression: n: 67.3 ± 9.6 years	With depression: n: 8,037 (28.7%)	Gender Male With depression: 8,037 (8.0%) Without depression: 92,117 (92.0%) p < 0.001
							Without depression: n: 69.5 ± 10.0 years (p < 0.001) [Student's t-test]	Without depression: n: 92,117 (47.0%) P<0.001 (Fisher's exact test)	Female With depression: 19,925 (16.0%) Without depression: 103,979 (84.0%) Income quartile < \$39,000:

[illegible]

									are: 18,54 1 (12.0 %) vs 135,6 68 (88.0 %)		
									Medic aid: 758 (18.9 %) vs 3,252 (81.1 %)		
									Private : 7,493 (13.1 %) vs 49,87 2 (86.9 %)		
									Other: 1,172 (13.8 %) vs 7,304 (86.2 %)		
									p < 0.001		
									Ethnici ty		
									Cauca sian: 25,47 5 (12.6 %) vs 176,2 09 (87.4		

[illegible]

Kandil et al. 2016 ³⁹	Blood transfusion after total shoulder arthroplasty : Which patients are at high risk?	International Journal of Shoulder Surgery	Retrospective cohort study	USA	National Inpatient Sample (NIS), HCUP	51,191	Any transfusion: 72.92 ± 10.33 years No transfusion: 68.30 ± 11.31 years Overall: 68.58 ± 11.31 years	Any transfusion: 26.2% No transfusion: 45.6% Overall: 44.4%	Charlson-Deyo score: Transfusion: 0.57 ± 1.08 No transfusion: 0.28 ± 0.67 Overall: 0.03 ± 0.70 Individual comorbidities: Obesity: 8.9% vs 9.8% (overall 9.7%) Smoking: 4.4% vs 6.4% (overall 6.2%) Diabetes: 18.9% vs 14.5% (overall 16.7%)
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[illegible]

									ension (unco mplica ted): 60.1% vs 58.9% (overal l 59.0%)		
									Hemat ologic risk factor s:		
									Alcoh ol abuse: 1.0% vs 0.7% (overal l 0.8%)		
									Liver diseas e: 3.5% vs 0.9% (overal l 1.1%)		
									Coagu lation disord ers: 3.5% vs 0.9% (overal l 1.1%)		
									Blood loss		

[illegible]

Murphy et al. 2016 ⁶⁶	Metabolic syndrome and shoulder arthroplasty : epidemiology and peri-operative outcomes.	International Orthopaedics	Retrospective cohort study	USA	National Inpatient Sample (NIS), HCUP	422,371	With metabolic syndrome: 68.7 ± 11.7 years	With metabolic syndrome: 37.4 %	Without metabolic syndrome: 40.0 %	Without metabolic syndrome: 40.0 %	Metabolic vs no metabolic syndrome	Metabolic vs no metabolic syndrome	
											Congestive heart failure : 7.1% vs 3.6%	Osteoarthritis: 61.9% vs 61.3%	
											Chronic lung disease: 20.1% vs 16.2%	Proximal humerus fracture: 19.1% vs 16.3%	Total : 61.4 vs 59.1 — 112
											Liver disease: 1.0% vs 1.0%	Avascular necrosis: 1.8% vs 3.6%	Partial: 38.6 vs 40.9 — 103
											Renal failure : 8.0% vs 2.8%	Rheumatoid arthritis: 0.5% vs 1.5%	
											Peripheral vascular disease: 4.5% vs 4.0%	Non-union of humerus fracture: 2.5% vs	
											Ischemic heart disease		

										e: 7.2% vs 4.2%	2.2% Rotat or cuff arthro pathy: 9.9% vs 9.9% Other: 4.2% vs 5.2%	
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Siva sun dara m et al. 201 6 ⁷⁹	Preop erativ e risk factor s for disch arge to a postac ute care facilit y after shoul der arthro plasty	JSES	Ret ros pec tive coh ort stu dy	US A	Nati onal Inpa tient Sam ple (NIS , HC UP	103 ,79 8	Over all: 69.7 ± 9.8 years	Over all: 43.4 %	Num ber of comor biditie s: ≤3: 31.3% overall ; 35.1% routin e; 19.0% PAC 4-6: 44.1% overall ; 43.9% routin e; 42.8% PAC 7-9: 18.9% overall ; 16.7% routin e; 26.4% PAC ≥9: 5.8% overall ; 4.3% routin e; 11.9% PAC (p < .001) Individ ual comor biditie	Osteo arthrit is: 60.3% Rotat or cuff arthro pathy: 25.1% Hume ral fractu res: 11.7% Revisi on arthro plasti es: 1.76% (1827 patien ts)	TSA: 56.8 % over all; 62.9 % routi ne; 36.6 % PAC RTSA : 43.2 % over all; 37.1 % routi ne; 63.4 % PAC (p < .001)
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									s (multi variabl e analys is, ORs for PAC discha rge): Hypert ension : OR 0.95 (95% CI 0.84– 1.08, p = .656) CHF: OR 2.00 (95% CI 1.44– 2.77, p < .001) Diabet es: OR 1.51 (95% CI 1.29– 1.77, p < .001) Periph eral vascul ar diseas e: OR 1.05 (95%		
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										CI 0.72– 1.52, p = .240)		
										CKD: OR 1.14 (95% CI 0.92– 1.41, p = .238)		

Garcia et al. 2016 ²⁶	Malnutrition : a marker for increased complications, mortality, and length of stay after total shoulder arthroplasty .	JSES	Retrospective cohort study	US A	National surgical quality database (AC S- NS QIP)	4,655	Normal albumin: 69.7 ± 10.3 years	Normal albumin: 42.9 % male	Normal albumin: 30.7 ± 6.7	Modified CCI ≥5
							Hypoalbuminemic: 73.0 ± 10.7 years (p = .001)	Hypoalbuminemic: 24.2 % male (p < .001)	Hypoalbuminemic: 31.2 ± 8.4 (p = .390)	Normal: 24.8% Hypoalbuminemic: 50.0% (p < .001) ASA ≥3 Normal: 52.2% Hypoalbuminemic: 74.2% (p < .001) Individual comorbidities Hypertension Normal: 68.3% Hypoalbuminemic: 75.8% (p = .077) Cardiac

									comor bidity		
									Norma l: 4.8%		
									Hypoa lbumi nemic: 10.2% (p = .008)		
									Pulmo nary comor bidity		
									Norma l: 12.6%		
									Hypoa lbumi nemic: 28.9% (p < .001)		
									Diabet es		
									Norma l: 17.3%		
									Hypoa lbumi nemic: 29.7% (p < .001)		
									Smoki ng		
									Norma l: 9.7%		
									Hypoa lbumi		

										nemic: 11.7% (p = .452)		
										Periph eral vascul ar diseas e		
										Norma l: 0.2%		
										Hypoa lbumi nemic: 0.8% (p = .190)		
										TIA/CV A		
										Norma l: 2.7%		
										Hypoa lbumi nemic: 6.3% (p = .023)		
										Chroni c steroi d use		
										Norma l: 5.6%		
										Hypoa lbumi nemic: 15.6% (p < .001)		

Basques et al. 2015 ⁵	Length of Stay and Readmission After Total Shoulder Arthroplasty : An Analysis of 1505 Cases	The American Journal of Orthopedics	Retrospective cohort study	USA	Institutional database (Rush University Medical Center)	1,505	60–69 years : 558 (37.1 %) 70–79 years : 625 (41.5 %) ≥80 years : 322 (21.4 %)	Male sex: 41.1 %	ASA class 3–4: 802 (53.3 %) Individual comorbidities: Diabetes: 266 (17.7 %) Smoking: 93 (6.2%) Pulmonary disease: 176 (11.7 %) Heart disease: 122 (8.1%) Hypertension : 1,092 (72.6 %) Steroid use: 80 (5.3%) Dependent functional status:	Nonfracture : 1,445 (96.0 %) Fracture-associated: 60 (4.0%)	Primary TSA only + reverse TSA (but wasn't separated)
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										48 (3.2%)		
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Matsen et al. 2015 ⁵⁹	Factors Affecting Length of Stay, Readmission, and Revision After Shoulder Arthroplasty: A Population-Based Study.	The Journal of Bone & Joint Surgery	Retrospective cohort study	USA	Washington State Comprehensive Hospital Abstract Reporting System (CHARS)	17,311	Not given in mean or median	TSA: 43% HA: 30%	Charlson Comorbidity Index: 0: TSA 8,519; HA 7,542 1: TSA 262; HA 212 >1: TSA 42; HA 140 Specific comorbidities (TSA vs HA): Hypertension: 5 vs 4 Infection: 0 vs 1 CNS: 211 vs 294 Malignancy: 114 vs 196 Endocrine: 1,238 vs 1,114	Fracture, inflammatory, osteoarthritis, trauma, cuff tear, osteonecrosis, miscellaneous	Primary TSA and HA
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										Rheu matol ogic: 416 vs 224		
										Overw eight: 249 vs 115		
										Subst ance abuse: 47 vs 79		
										Pulmo nary: 123 vs 91		
										Cardia c: 951 vs 802		
										GI: 202 vs 152		
										Liver/k idney: 128 vs 123		

Papou et al. 2014 ⁷⁰	Outcomes and Costs of Reverse Shoulder Arthroplasty in the Morbidly Obese: A Case Control Study.	The Journal of Bone & Joint Surgery	Retrospective cohort study	USA	Single-institution joint registry cohort	84	Morbidly obese: 69 ± 7 years Controls: 71 ± 6 years P = 0.152	Morbidly obese: 19% (4/21) Controls: 21% (13/63)	Morbidly obese: 43.2 ± 3.1 Controls: 27.1 ± 7.6 (p < 0.0001)	Charlson-Deyo Index (CDI): Morbidly obese: 2 ± 1 Controls: 1 ± 1 (p = 0.025) Total comorbidities (excluding obesity): Morbidly obese: 6 ± 2 Controls: 4 ± 2 (p = 0.001) Specific comorbidities: Obstructive sleep apnea (Yes vs No): 10 vs 2 (OR 27.7; 95%	Cuff tear arthropathy (CTA): 17 vs 51 Massive rotator cuff tear (MRTC): 2 vs 6 Rheumatoid arthritis (RA): 2 vs 6 P = 1.0 (Fisher test)	Primary reverse shoulder arthroplasty
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										CI 5.3–144.1; p = 0.0001)		
										Recent corticosteroid use: 4 vs 5 (OR 2.73; 95% CI 0.7–11.3; p = 0.17)		

Pon ce et al. 201 4 ⁷⁴	Diabe tes as a risk factor for poore r early postope rative outco mes after shoul der arthro plasty	JSES	Ret ros pec tive dat aba se stu dy	US A	Nati onal Inpa tient Sam ple (NIS , HC UP	66, 485	Over all: 69 ± 13 Diab etes: 70 ± 9.4 Non- diabe tes: 69 ± 13 Unco mplic ated diabe tes: 70 ± 9.4 Comp licat ed diabe tes: 71 ± 9.4 Type 1 diabe tes: 64 ± 12 Type 2 diabe tes: 70 ± 9.3 p < .001 acros s	Over all: 43% Diab etes: 41% Non- diabe tes: 43% Unco mpli cate d diabe tes: 42% Comp lica ted diabe tes: 40% Type 1: 55% Type 2: 41% p = .004 (over all com paris on)	Hypert ension Overall: 67% Diabet es: 85% Nondi abetes : 63% P- value: <.001 Diabet es subgro ups: Unco mplica ted: 84% Comp licated: 89% P- value: <.001 Type 1: 71% Type 2: 85% P- value: <.001 Conge stive heart failure	TSA, RTSA
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							groups			Overall: 3.8%		
										Diabetes: 7.1%		
										Nondiabetes: 2.9%		
										P-value: <.001		
										Diabetes subgroups:		
										Uncomplicated: 6.4%		
										Complicated: 14%		
										P-value: <.001		
										Type 1: 7.2%		
										Type 2: 7.1%		
										P-value: .95		
										Peripheral vascular disorders		

										Overall: 2.6%		
										Diabetes: 3.7%		
										Nondiabetes: 2.3%		
										P-value: <.001		
										Diabetes subgroups:		
										Uncomplicated: 3.0%		
										Complicated: 11%		
										P-value: <.001		
										Type 1: 3.6%		
										Type 2: 3.7%		
										P-value: .94		
										Chronic pulmonary diseases		

									e		
									Overall:	17%	
									Diabetes:	20%	
									Nondiabetes:	16%	
									P-value:	<.001	
									Diabetes subgroups:		
									Uncomplicated:	19%	
									Complicated:	24%	
									P-value:	<.001	
									Type 1:	17%	
									Type 2:	20%	
									P-value:	.45	
									Obesity		
									Overall:	14%	

									Diabetes: 25%		
									Nondiabetes : 11%		
									P-value: <.001		
									Diabetes subgroups:		
									Uncomplicated: 23%		
									Complicated: 38%		
									P-value: <.001		
									Type 1: 25%		
									Type 2: 25%		
									P-value: .98		
									Hypothyroidism		
									Overall: 15%		
									Diabetes: 17%		

	Nondiabetes : 14%
	P-value: <.001
	Diabetes subgroups:
	Uncomplicated: 16%
	Complicated: 20%
	P-value: <.001
	Type 1: 27%
	Type 2: 17%
	P-value: .001
	Liver disease
	Overall: 1.1%
	Diabetes: 1.5%
	Nondiabetes : 1.0%

	P-value: <.001
	Diabetes subgroups:
	Uncomplicated: 1.6%
	Complicated: 0.7%
	P-value: .021
	Type 1: 3.6%
	Type 2: 1.5%
	P-value: .043
	Renal failure
	Overall: 5.5%
	Diabetes: 11%
	Nondiabetes: 4.2%
	P-value: <.001

[illegible]

										Uncomplicated: 16%		
										Complicated: 19%		
										P-value: .005		
										Type 1: 27%		
										Type 2: 16%		
										P-value: <.001		
										Deficiency anemias		
										Overall: 10%		
										Diabetes: 12%		
										Nondiabetes: 9.7%		
										P-value: <.001		
										Diabetes subgroups:		
										Uncomplicated:		

										ted: 11%		
										Compl icated: 20%		
										P- value: <.001		
										Type 1: 6.5%		
										Type 2: 12%		
										P- value: .049		
										Solid tumor withou t metas tasis		
										Overal l: 0.6%		
										Diabet es: 0.8%		
										Nondi abetes : 0.5%		
										P- value: <.001		
										Diabet es subgro ups:		
										Unco mplica		

										ted: 0.8%		
										Compl icated: 0.8%		
										P- value: .92		
										Type 1: 0%		
										Type 2: 0.8%		
										P- value: .29		
										Metast atic cancer		
										Overal l: 0.2%		
										Diabet es: 0.2%		
										Nondi abetes : 0.2%		
										P- value: .85		
										Diabet es subgro ups:		
										Unco mplica ted: 0.2%		

[illegible]

Griffin et al. 2014 ²⁸	Morbid obesity in total shoulder arthroplasty : risk, outcomes, and cost analysis.	JSES	Retrospective cohort study	USA	National Inpatient Sample (NIS), HCUP	31,924	Non-obese: 68.3 ± 10.9 years	Non-obese: 44.5 % male	Deyo score:
							Obese: 66.8 ± 9.2 years	Obese: 35.2 % male	Non-obese: 0.28 ± 0.69
							Morbidly obese: 64.9 ± 9.1 years	Morbidity obese: 31.6 % male	Obese : 0.28 ± 0.69
							Total: 68.7 ± 10.8 years	Total : 43.7 % male	Morbidly obese: 0.38 ± 0.75
							p < 0.001	p < 0.001	Total: 0.28 ± 0.69
									p = 0.004
									Number of diagnoses:
									Non-obese: 5.31 ± 3.06
									Obese : 7.78 ± 3.17
									Morbidly obese: 8.26 ± 3.36
		Total: 5.51 ± 3.15							
		p < 0.001							

[illegible]

	Total:	
	5.1%	
	p <	
	0.001	

Johnson et al. 2014 ³⁸	Does preoperative American Society of Anesthesiologists score relate to complications after total shoulder arthroplasty?	Clinical Orthopaedics and Related Research	Retrospective single-surgeon cohort study	USA	Single-institution retrospective cohort	452	TSA: 63.9 ± 10.4 years RTSA: 67.3 ± 12.2 years Revision: 63.9 ± 10.7 years p = 0.008 across groups	TSA: 55.8% male RTSA: 36.7% male Revision: 36.0% male p < 0.001	TSA: 1.3 ± 2.0 RTSA: 1.3 ± 1.7 Revision: 1.2 ± 1.5 p = 0.900 ASA score distribution: TSA: ASA I 5 (2.2%) ASA II 155 (69.2%) ASA III 64 (28.6%) ASA IV 0 RTSA: ASA I 4 (2.4%) ASA II 80 (47.6%) ASA III 82 (48.8%)	Diagnosis – P < 0.001 Osteoarthritis TSA: 206 (91.6%) RTSA: 75 (42.6%) Failed arthroplasty TSA: 0 RTSA: 5 (2.8%) Cuff arthropathy TSA: 0 RTSA: 50 (28.2%) Infection TSA: 0 RTSA: 7 (4.0%)	Total shoulder arthroplasty and RTSA
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									ASA IV 2 (1.2%)	Instability
									Revision:	TSA: 1 (0.4%)
									ASA I 0	
									ASA II 33 (64.7%)	RTSA: 5 (2.8%)
									ASA III 18 (35.3%)	Rheumatoid arthritis
									ASA IV 0	
									p = 0.001	TSA: 3 (1.3%)
									Allergies (median, IQR):	RTSA: 12 (6.8%)
									TSA: 0 (0–1)	Osteonecrosis
									RTSA: 0 (0–1)	TSA: 11 (4.9%)
									Revision: 0.5 (0–1)	
									p = 0.736	RTSA: 3 (1.7%)
									Medications (median, IQR):	Fracture
									TSA: 5 (3–8)	TSA: 1 (0.4%)
									RTSA: 7 (4–	RTSA: 6 (3.4%)

									10)	)	
									Revisi on: 5 (2–7)	Cuff tear with pseud oparal ysis	
									p < 0.001		
										TSA: 1 (0.4%)	
										RTSA: 5 (2.8%)	
										Traum atic arthrit is / arthrit is of disloc ation	
										TSA: 0	
										RTSA: 8 (4.5%)	

Griffin et al. 2013 ²⁷	Obstructive sleep apnea as a risk factor after shoulder arthroplasty	JSES	Retrospective cohort study	USA	National Inpatient Sample (NIS), HCUP	22,988	Overall: 68.81 ± 11.59 years No OSA: 68.99 ± 11.7 years OSA: 66.06 ± 9.48 years (p = .000)	39.70%	Deyo score: Overall: 0.35 ± 0.84 No OSA: 0.35 ± 0.04 OSA: 0.44 ± 0.03 (p = .000) Distribution: 0 = 76.2% 1 = 17.0% 2 = 4.7% ≥3 = 1.0%	TSA and hemiarthroplasty
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Humphries et al. 2008 ³⁵	Effect of the Deyo score on outcomes and costs in shoulder arthroplasty patients.	Journal of Orthopaedic Surgery	Retrospective database cohort	USA	National Inpatient Sample (NIS), HCUP	28,434	No mean given (only age groups)	33.50%		Deyo index (0, 1-4, 5-36)		
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Elsabbagh et al. 2025 ²¹	Does use of glucagon-like peptide-1 agonists increase perioperative complications in patients undergoing shoulder arthroplasty?	JSES	Retrospective Cohort Study	USA	National database (exact database not specified in provided information)	64,567	90-day matched: GLP-1 = 68.2 ± 6.8; Non-GLP-1 = 68.3 ± 6.7; P = 0.269	90-day matched: GLP-1 = 45.1%; Non-GLP-1 = 45.0%	90-day matched: GLP-1 = 2.7 ± 1.9; Non-GLP-1 = 2.6 ± 1.8 (p = .006)	Osteoarthritis	Primary TSA (no differentiation between anatomic and reverse TSA)
							2-year matched: GLP-1 = 67.8 ± 6.5; Non-GLP-1 = 67.9 ± 6.5; P = 0.302	2-year matched: GLP-1 = 45.0%; Non-GLP-1 = 44.7%	Congestive heart failure: 1845 (9.9%) vs 460 (9.2%); P = 0.154		
									Arrhythmias: 4154 (22.2%) vs 1090 (21.8%); P = 0.502		
									Valvular disease: 3620 (19.4%) vs 966 (19.3%); P = 0.920		
									Pulmonary circulatory		

									disorders: 1224 (6.5%) vs 357 (7.1%) ; P = 0.152		
									Peripheral vascular disease: 4005 (21.4 %) vs 1015 (20.3 %); P = 0.078		
									Hypertension : 16,521 (88.3 %) vs 4511 (90.0 %); P < 0.001		
									Paralysis: 302 (1.6%) vs 77 (1.5%) ; P = 0.743		
									Other neurodisorders: 1064 (5.7%) vs 235		

									(4.7%) ; P = 0.006		
									Chronic pulmonary diseases: 6300 (33.7%) vs 1671 (33.4%); P = 0.668		
									Hypothyroidism: 5162 (27.6%) vs 1371 (27.4%); P = 0.752		
									Chronic kidney diseases: 3120 (16.7%) vs 916 (18.3%); P = 0.008		
									Liver diseases: 2632 (14.1%) vs 742 (14.8%); P =		

									0.193		
									Peptic ulcer disease: 909 (4.9%) vs 229 (4.6%) ; P = 0.415		
									Lymph oma: 198 (1.1%) vs 54 (1.1%) ; P = 0.969		
									Metast atic cancer : 185 (1.0%) vs 51 (1.0%) ; P = 0.919		
									Nonm etasta tic cancer : 2265 (12.1 %) vs 619 (12.4 %); P = 0.657		
									Rheu matoi d arthriti s: 1218 (6.5%) vs 293		

	(5.8%) ; P = 0.093
	Coagulopathy: 1268 (6.8%) vs 308 (6.1%) ; P = 0.118
	Fluid and electrolyte disorders: 4951 (26.5%) vs 1227 (24.5%); P = 0.005
	Blood loss anemia: 677 (3.6%) vs 163 (3.3%) ; P = 0.229
	Deficiency anemia: 2993 (16.0%) vs 742 (14.8%); P = 0.041
	Alcohol

									ol abuse: 634 (3.4%) vs 110 (2.2%) ; P < 0.001		
									Drug abuse: 1202 (6.4%) vs 236 (4.7%) ; P < 0.001		
									Psych oses: 540 (2.9%) vs 107 (2.1%) ; P = 0.004		
									Depre ssion: 6255 (33.4 %) vs 1738 (34.7 %); P = 0.102		
									Smoki ng: 4613 (24.7 %) vs 1289 (25.7 %); P = 0.127		
									Obesit y: 8165 (43.7		

										% vs 2613 (52.2 %); P < 0.001		
										Metfor min use: 12,88 0 (68.9 %) vs 3471 (69.3 %); P = 0.591		
										Insulin use: 2859 (15.3 %) vs 899 (17.9 %); P < 0.001		
										Compl icated diabet es: 8983 (48.0 %) vs 2487 (49.6 %); P = 0.045		
										Osteo porosi s: 2421 (12.9 %) vs 561 (11.2 %); P = 0.001		

										Chronic steroid use: 552 (3.0%) vs 119 (2.4%) ; P = 0.033		
										Steroid- induced diabetes: 48 (0.3%) vs 10 (0.2%) ; P = 0.572		
										2-year matched		
										GLP-1 = 2.6 ± 1.8; Non- GLP-1 = 2.5 ± 1.7 (p = .004)		
										Congestive heart failure : 1122 (8.8%) vs 292 (8.5%) ; P = 0.528		
										Arrhythmias: 2422		

									(19.1 %) vs 642 (18.6 %); P = 0.574		
									Valvul ar diseas e: 2119 (16.7 %) vs 570 (16.6 %); P = 0.860		
									Pulmo nary circula tory disord ers: 676 (5.3%) vs 198 (5.7%) ; P = 0.352		
									Periph eral vascul ar diseas e: 2358 (18.6 %) vs 633 (18.4 %); P = 0.809		
									Hypert ension : 10,95 9		

									(86.3 %) vs 3031 (88.0 %); P = 0.012		
									Paraly sis: 184 (1.4%) vs 46 (1.3%) ; P = 0.675		
									Other neuro disord ers: 614 (4.8%) vs 135 (3.9%) ; P = 0.026		
									Chroni c pulmo nary diseas e: 3967 (31.3 %) vs 1066 (31.0 %); P = 0.749		
									Hypot hyroidi sm: 3237 (25.5 %) vs 901 (26.2 %); P = 0.447		

										Chronic kidney disease: 1705 (13.4 %) vs 528 (15.3 %); P = 0.005		
										Liver disease: 1465 (11.5 %) vs 440 (12.8 %); P = 0.050		
										Peptic ulcer disease: 523 (4.1%) vs 124 (3.6%) ; P = 0.183		
										Lymph oma: 114 (0.9%) vs 28 (0.8%) ; P = 0.710		
										Metastatic cancer : 99 (0.8%) vs 24 (0.7%)		

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									anemi a: 382 (3.0%) vs 102 (3.0%) ; P = 0.928		
									Defici ency anemi a: 1776 (14.0 %) vs 411 (11.9 %); P = 0.002		
									Alcoh ol abuse: 314 (2.5%) vs 71 (2.1%) ; P = 0.179		
									Drug abuse: 622 (4.9%) vs 125 (3.6%) ; P = 0.002		
									Psych oses: 318 (2.5%) vs 59 (1.7%) ; P = 0.008		
									Depre ssion: 3796		

									(29.9 %) vs 1057 (30.7 %); P = 0.386		
									Smoki ng: 2428 (19.1 %) vs 704 (20.4 %); P = 0.089		
									Obesit y: 4822 (38.0 %) vs 1593 (46.3 %); P < 0.001		
									Metfor min use: 8122 (64.0 %) vs 2224 (64.6 %); P = 0.540		
									Insulin use: 1512 (11.9 %) vs 508 (14.8 %); P < 0.001		
									Compl icated diabet		

									es: 4924 (38.8 %) vs 1409 (40.9 %); P = 0.025		
									Osteo porosi s: 1534 (12.1 %) vs 363 (10.5 %); P = 0.014		
									Chroni c steroi d use: 292 (2.3%) vs 57 (1.7%) ; P = 0.025		
									Steroi d- induce d diabet es: 20 (0.2%) vs 5 (0.1%) ; P = 1.000		

Alde r et al. 202 4 ²	Increa sing severi ty of preop erativ e anemi a is assoc iated with higher postop erative medic al and surgic al compl ications after prima ry shoul der arthro plasty	JSES	Ret ros pec tive Co hor t Stu dy	US A	Sing le- insti tutio n shoul der arth ropl asty regi stry	5,2 31	No anem ia: 68.8 ± 10.8 years Mild anem ia: 72.0 ± 10.4 years Mode rate- to- sever e anem ia: 70.9 ± 13.0 years P(no anem ia vs. mild anem ia) <0.0 01 P(no anem ia vs. mod erate -to- sever e anem ia) = 0.00 3 P(mil	No anae mia: 48.2 % male Mild anae mia: 48.9 % male Mode rate- to- sever e anae mia: 28.8 % male P(no ane mia vs. mild ane mia) = 0.71 2 P(no ane mia vs. mod erate -to- sever e ane mia) <0.0 01 P(mil	No anem ia: 31.0 ± 9.3 Mild anem ia: 30.2 ± 6.8 Mode rate- to- sever e anem ia: 29.9 ± 7.2 P(no anem ia vs. mild anem ia) = 0.092 P(mil d anem ia vs. mode rate- to- sever e anem ia) = 0.117 P(mil d anem ia vs. mode rate- to- sever	P(no anemi a vs. mild anemi a)/P(m ild anemi a vs. moder ate-to- severe anemi a)/P(m ild anemi a vs. moder ate-to- severe anemi a) Tobac co use No anemi a: 339 (8.1%) Mild anemi a: 46 (6.2%) Moder ate-to- severe anemi a: 20 (6.8%) P values : 0.290 / 0.303 / 0.328	All p value s <0.00 1 Osteo arthrit is: No anemi a 50.9% ; Mild anemi a 42.0% ; Moder ate-to- sever e anemi a 32.9% Rotat or cuff tear arthro pathy: No anemi a 31.6% ; Mild anemi a 35.3% ; Moder ate-to- sever e anemi a 26.4% PTOA: No	All p valu es <0.0 01 Hem iarth ropla sty: No ane mia 9.5% ; Mild ane mia 15.1 %; Mod erate -to- seve re ane mia 21.4 % aTSA : No ane mia 46.2 %; Mild ane mia 48.2 %; Mod erate -to- seve re ane mia 53.9 %
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									a: 28 (9.5%)	anemia 5.4%
									P values : <0.001 / <0.001 / 0.301	Acute fracture: No anemia 1.8%; Mild anemia 5.0%; Moderate- to-severe anemia 22.7%
									Peripheral vascular disease (PVD)	Other: No anemia 1.0%; Mild anemia 1.8%; Moderate- to-severe anemia 1.7%
									No anemia: 216 (5.2%)	
									Mild anemia: 54 (7.3%)	
									Moderate-to-severe anemia: 27 (9.2%)	
									P values : 0.019 / 0.003 / 0.310	
									Cerebrovascular accident (CVA)	

										No anemi a: 99 (2.4%)		
										Mild anemi a: 28 (3.8%)		
										Moder ate-to- severe anemi a: 11 (3.7%)		
										P values : 0.025 / 0.142 / 0.973		
										Deme ntia		
										No anemi a: 30 (0.7%)		
										Mild anemi a: 5 (0.7%)		
										Moder ate-to- severe anemi a: 0 (0.0%)		
										P values : 0.901 / 0.145		

	/	0.158	
	Chronic obstructive pulmonary disease (COPD)	No anemia: 310 (7.4%) Mild anemia: 69 (9.3%) Moderate-to-severe anemia: 43 (14.6%) P values : 0.072 / <0.001 / 0.014	
	Diabetes mellitus	No anemia: 389 (9.3%) Mild	

									anemia: 107 (14.4%)		
									Moderate-to-severe anemia: 47 (15.9%)		
									P values:		
									<0.001 /		
									<0.001 /		
									0.537		
									Chronic kidney disease (CKD)		
									No anemia: 148 (3.5%)		
									Mild anemia: 57 (7.7%)		
									Moderate-to-severe anemia: 43 (14.6%)		
									P values:		
									<0.001		

									1 / <0.00		
									1 / <0.00		
									1		
									ASA score (mean ± SD)		
									No anemi a: 2.3 ± 0.6		
									Mild anemi a: 2.5 ± 0.6		
									Moder ate-to- severe anemi a: 2.6 ± 0.7		
									P values :		
									<0.00		
									1 / <0.00		
									1 / 0.852		
									ASA class ≤2 / ≥3		
									≤2: 2581 / 341 / 124		
									≥3: 1613 / 401 / 171		

	P values : <0.001 / <0.001 / 0.252
	Charlson Comorbidity Index (CCI), mean ± SD
No anemia:	3.1 ± 1.8
Mild anemia:	3.8 ± 2.2
Moderate-to-severe anemia:	4.1 ± 2.6
P values : <0.001 / <0.001 / 0.052	
CCI >2	
No anemia:	2613 (62.3

	%)
	Mild anemia: 554 (74.7 %)
	Moderate-to-severe anemia: 226 (76.6 %)
	P values : <0.001 / <0.001 / 0.512
	CCI class 0 / 1–3 / 4–5 / ≥6
	0: 164 / 16 / 12
	1–3: 2680 / 360 / 129
	4–5: 1021 / 244 / 87
	≥6: 329 / 122 / 67
	P

[illegible]

		Mild anemia: 35.8 $\pm$ 1.7
		Moderate-to-severe anemia: 30.1 $\pm$ 2.7
	P values:	<0.001 / <0.001

Kho khar et al. 202 4 ⁴⁰	Does morbid obesity negatively impact perioperative outcomes following elective reverse shoulder arthroplasty?: a propensity-matched comparative study.	Journal of Shoulder and Elbow Surgery International	Retrospective Cohort Comparison	US A	Single-institution retrospective propensity-matched cohort	175	Overall: 71 (66, 76)	Morbidly obese: 68 (64, 73)	Morbidly obese: 42.4 (41.0, 45.1)	Morbidly obese: 16%	Morbidly obese: 30.3 (27.2, 33.1)	Morbidly obese: 30.6 (26.4, 32.7)	Overall cohort (n = 175)	mFI-5 Score 0–1	BMI ≥ 40: 8 (42%)	BMI < 40: 76 (49%)	p = .59	Score ≥ 2	BMI ≥ 40: 11 (58%)	BMI < 40: 80 (51%)	Smoking status	Never	BMI ≥ 40: 6 (32%)	BMI < 40: 87 (56%)	p = .10	Former	RTC-deficient arthritis, GH OA, Chronic RTC tear, Other (this is what the table says)	Primary rTSA
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									BMI ≥ 40: 11 (58%)		
									BMI < 40: 53 (34%)		
									Curren t		
									BMI ≥ 40: 2 (10%)		
									BMI < 40: 16 (10%)		
									Prior ipsilat eral surger y		
									None		
									BMI ≥ 40: 16 (84%)		
									BMI < 40: 112 (72%)		
									p = .85		
									Arthro scopy		
									BMI ≥ 40: 3 (16%)		
									BMI < 40: 35 (22%)		
									Open surger		

									y		
									BMI $\geq$ 40: 0 (0%)		
									BMI < 40: 5 (3%)		
									Open surger y/arthr oscop y		
									BMI $\geq$ 40: 0 (0%)		
									BMI < 40: 4 (3%)		
									Age- adjust ed Charls on comor bidity index (ACCI)		
									BMI $\geq$ 40: 4 (IQR 3–5)		
									BMI < 40: 4 (IQR 3–5)		
									p = .88		
									Prope nsity match ed cohort		

									(n = 60)		
									mFI-5		
									Score 0-1		
									BMI ≥ 40: 8 (42%)		
									BMI < 40: 14 (34%)		
									p = .55		
									Score ≥ 2		
									BMI ≥ 40: 11 (58%)		
									BMI < 40: 27 (56%)		
									Smoking status		
									Never		
									BMI ≥ 40: 6 (32%)		
									BMI < 40: 23 (56%)		
									p = .19		
									Former		
									BMI ≥ 40: 11 (58%)		

										BMI < 40: 14 (34%)		
										Current		
										BMI ≥ 40: 2 (10%)		
										BMI < 40: 4 (10%)		
										Prior ipsilat eral surger y		
										None		
										BMI ≥ 40: 16 (84%)		
										BMI < 40: 24 (59%)		
										p = .25		
										Arthro scopy		
										BMI ≥ 40: 3 (16%)		
										BMI < 40: 12 (29%)		
										Open surger y		
										BMI ≥ 40: 0		

									(0%)		
									BMI < 40: 3 (7%)		
									Open surgery/arthroscopy		
									BMI ≥ 40: 0 (0%)		
									BMI < 40: 2 (5%)		
									Age-adjusted Charlson comorbidity index (ACCI)		
									BMI ≥ 40: 4 (IQR 3–5)		
									BMI < 40: 4 (IQR 3–6)		
									p = .75		

Destine et al. 2024 ¹⁷	Effect of hospital length of stay on functional outcomes and readmission after total shoulder arthroplasty.	JSES	Retrospective Cohort Study	USA	Sing le-institution retrospective cohort (Thomas Jefferson University Hospital)	217	Overall: 67.5 ± 8.85 years >24 h: 70.1 ± 10.4 years <24 h: 66.7 ± 8.10 years (p = .030)	Overall: 98 (45.2 %) >24 h: 24 (42.9 %) <24 h: 74 (46.0 %) (p = .805)	Overall: 30.4 ± 5.00 >24 h: 31.1 ± 3.83 <24 h: 30.2 ± 5.33 (p = .108)	Charls on comor bidity index (CCI) - group charac teristic s by LOS Overall: 3.10 ± 1.64 >24 h: 4.02 ± 2.07 <24 h: 2.78 ± 1.33 (p = .001) Group charac teristic by CCI thresh olds CCI <3 - 1.62 ± 0.58 CCI ≥ 3 - 4.08 ± 1.36 P<0.0 01 CCI < 4 - 2.19 ± 0.81 CCI ≥	rTSA and aTSA
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										4 - 5.04 ± 1.23 P<0.0 01		
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Moore et al. 2024 ⁶⁵	Fibromyalgia syndrome is an independent predictor of increased complications, revision, and cost of admission within 180 days of total shoulder arthroplasty.	JSES	Retrospective matched cohort study	USA	National readmission database	11,012	FMS: 68 ± 8.2 years No FMS: 67 ± 8.0 years (p = .506)	6% in both groups	Charlson-Deyo Comorbidity Index (CCI): FMS 1.4 ± 1.6 vs No FMS 1.4 ± 1.6 (p = .875) Hypertension requiring medication FMS: 72% No FMS: 70% p = .022 † Depression FMS: 37% No FMS: 22% p < .001 * Diabetes mellitus	Primary anatomy and reverse TSA
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									(DM)		
									FMS: 15%		
									No FMS: 22%		
									p < .001 *		
									Conge stive heart failure (CHF)		
									FMS: 5.7%		
									No FMS: 4.5%		
									p = .005 †		
									Periph eral vascul ar diseas e (PVD)		
									FMS: 3.7%		
									No FMS: 3.1%		
									p = .102		
									Chroni c kidney diseas e		

									(CKD)		
									FMS: 12%		
									No FMS: 9.8%		
									p = .002 *		
									Chronic lung disease		
									FMS: 34%		
									No FMS: 33%		
									p = .048 †		
									Chronic liver disease		
									FMS: 2.9%		
									No FMS: 3.6%		
									p = .024 †		
									☒		
									Key:		
									*		
									Statistically significant		

										† Not signifi cant followi ng Bonfer roni correc tion		
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Miltenberger et al. 2024 ⁶³	Prediction of overnight stay following shoulder arthroplasty utilizing machine learning.	Journal of Shoulder and Elbow Surgery	Retrospective cohort study	USA	ACS - NSQIP database	5,811	18-60 years : OHS 9.72 % vs SHS 15.6 6%	61-75 years : OHS 51.3 0% vs SHS 59.8 0%	76+ years : OHS 39.9 8% vs SHS 24.5 4%	OHS: 30.6 7% SHS: 47.8 2% P <0.001 Same value for multivariable P	<25: OHS 21.17 %, SHS 16.85 % 25-30: OHS 32.61 %, SHS 38.89 % 31-35: OHS 21.38 %, SHS 24.34 % 36+: OHS 24.84 %, SHS 19.92 % P<0.0001 Multivariable P = 0.004	OHS vs SHS Anemia: 32.94 % vs 24.46 %, p < .0001, multivariable p < .0001, OR 1.43 (2.21-1.69), +43% risk ASA grade 3-5: 72.25 % vs 54.86 %, p < .0001, multivariable p < .0001, OR 1.88 (1.58-2.23), +88% risk CHF: 5.40% vs 2.99%, p = .0002 COPD: 10.69 % vs 5.08%	Primary elective TSA
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[illegible]

	Hypertension	: 68.47% vs 63.95%, p = .008
	Smoking history	: 9.29% vs 9.09%, p = .848

Kopriva et al. 2024 ⁴⁵	Tramadol use before total shoulder arthroplasty : patients have lower risk of complications and resource utilization than those using traditional opioids.	Journal of Shoulder and Elbow Surgery International	Retrospective cohort study	US A	National claims database	29,454	Age Distribution by Opioid Cohort (p < .001)	<55 years Opioid naïve : 1317 (8.8 %) Tramadol: 155 (7.0 %) Traditional opioids: 1082 (10.3 %) Opioids + tramadol: 202 (11.1 %)	Opioid naïve : 53.4 % Tramadol: 39.2 % Traditional opioids: 47.0 % Opioids and tramadol: 40.6 %	Obesity (p = .002) Opioid naïve: 1651 (11.0 %) Tramadol: 275 (12.4 %) Traditional opioids: 1283 (12.3 %) Opioids + tramadol: 241 (13.2 %) Chronic kidney disease (p < .001) Opioid naïve: 672 (4.5%) Tramadol: 138 (6.2%) Traditional
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						: 5230 (35.0%)			opioid s: 646 (6.2%)	
						Tramadol: 770 (34.8%)			Opioids + tramadol: 109 (6.0%)	
						Traditional opioids: 3983 (38.1%)			Alcohol use disorders (p < .001)	
						Opioids + tramadol: 729 (39.9%)			Opioid naïve: 105 (0.7%)	
						65–74 years			Tramadol: 23 (1.0%)	
						Opioid naïve :			Traditional opioids: 124 (1.2%)	
						4431 (29.6%)			Opioids + tramadol: 20 (1.1%)	
						Tramadol: 656 (29.6%)			Tobacco use (p < .001)	
						Traditional opioids:			Opioid naïve: 453 (3.0%)	
						2942 (28.1%)			Tramadol: 75	

						(3.4%)		
					Opioi ds + tram adol: 477 (26.1 %)	Traditi onal opioid s: 500 (4.8%)		
					75– 84 years	Opioid s + trama dol: 90 (4.9%)		
					Opioi d naïve : 4431 (23.3 %)	Hyper tensio n (p < .001)		
					Tram adol: 548 (24.8 %)	Opioid naïve: 8719 (58.3 %)		
					Tradit ional opioi ds: 2151 (20.6 %)	Trama dol: 1411 (63.4 %)		
					Opioi ds + tram adol: 361 (19.8 %)	Traditi onal opioid s: 6526 (62.3 %)		
					85+ years	Opioid s + trama dol: 1180 (64.7 %)		
					Opioi d naïve : 495	Coron ary artery diseas		

						(3.3 %)		e (p < .001)		
						Tramadol: 85 (3.8 %)		Opioid naïve: 2411 (16.1 %)		
						Traditional opioids: 304 (2.9 %)		Tramadol: 397 (17.9 %)		
						Opioids + tramadol: 56 (3.1 %)		Traditional opioids: 1846 (17.6 %)		
								Opioids + tramadol: 328 (18.0 %)		
								Congestive heart failure (p < .001)		
								Opioid naïve: 557 (3.7%)		
								Tramadol: 95 (4.3%)		
								Traditional opioids: 585		

									(5.6%)		
									Opioid s + trama dol: 84 (4.6%)		
									Rheu matic diseas e (p < .001)		
									Opioid naïve: 612 (4.1%)		
									Trama dol: 158 (7.1%)		
									Traditi onal opiod s: 696 (6.7%)		
									Opioid s + trama dol: 130 (7.1%)		
									Diabet es (p < .001)		
									Opioid naïve: 2870 (19.2 %)		
									Trama dol: 446 (20.1		

									%)
									Traditi onal opioid s: 2355 (22.5 %)
									Opioid s + trama dol: 391 (21.4 %)
									Depre ssion (p < .001)
									Opioid naïve: 1188 (7.9%)
									Trama dol: 203 (9.2%)
									Traditi onal opioid s: 1461 (13.9 %)
									Opioid s + trama dol: 302 (16.6 %)

[illegible]

									Outpa tient/i npatie nt (p = .632)		
									Outpa tient: 791 (9.31 %)		
									Inpatie nt: 7707 (90.69 %)		
									Diabet es		
									No: 7078 (83.29 %) (p = .012)		
									Non- insulin : 1047 (12.32 %) (p = .028)		
									Insulin : 373 (4.39 %) (p = .021)		
									Dyspn ea		
									No: 7942 (93.46 %) (p =		

									.206)
								Moderate exertion: 529 (6.22%) (p = .354)	
								At rest: 27 (0.32%) (p = .652)	
								COPD (p = .004)	
								No: 7858 (92.47%)	
								Yes: 640 (7.53%)	
								Ascites (p = .154)	
								No: 8498 (100.00%)	
								Yes: 0 (0.00%)	
								Congestive heart failure (p =	

		.010)
	No:	
	8464	
	(99.60	
	%)	
	Yes:	
	34	
	(0.40	
	%)	
	Hypertension	
	(p <	
	.001)	
	No:	
	2926	
	(34.43	
	%)	
	Yes:	
	5572	
	(65.57	
	%)	
	Disseminated cancer	
	(p =	
	.649)	
	No:	
	8480	
	(99.79	
	%)	
	Yes:	
	18	
	(0.21	
	%)	
	Chronic steroid use	
	(p =	
	.007)	

									No: 8128 (95.65 %)		
									Yes: 370 (4.35 %)		
									Bleedi ng disord ers (p = .632)		
									No: 8286 (97.51 %)		
									Yes: 212 (2.49 %)		
									Elderly Cohort		
									Func tional status (p = .034)		
									Indepe ndent: 4594 (97.97 %)		
									Depen dent: 95 (2.03 %)		
									Smoki ng (p < .001)		

	No: 4352 (92.81 %)	
	Yes: 337 (7.19 %)	
	Outpa- tient/i- npatient (p = .357)	
	Outpa- tient: 366 (7.81 %)	
	Inpatie- nt: 4323 (92.19 %)	
	Diabet- es	
	No: 3851 (82.13 %) (p = .009)	
	Non- insulin : 622 (13.27 %) (p = .137)	
	Insulin : 216 (4.61 %) (p	

	=	.012)
	Dyspn ea	
	No:	
	4351	(92.79
	(%) (p	=
	.	.119)
	Moder	
	ate	
	exertio	n: 321
	n: 321	(6.85
	(%) (p	=
	.	.193)
	At	
	rest:	17
	17	(0.36
	(%) (p	=
	.	.913)
	COPD	
	(p =	.030)
	No:	
	4321	(92.15
	(%)	)
	Yes:	
	368	(7.85
	(%)	)
	Ascite	s (p = --
	s (p = --	)
	No:	
	4689	(100.0

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										10 (0.21 %)		
										Chronic steroid use (p = .437)		
										No: 4480 (95.54 %)		
										Yes: 209 (4.46 %)		
										Bleeding disorders (p = .312)		
										No: 4555 (97.14 %)		
										Yes: 134 (2.86 %)		

Hartwell et al. 2019 ³¹	Total shoulder arthroplasty : Risk factors for a prolonged length of stay. A retrospective cohort study.	Current Orthopaedic Practice	Retrospective database study	USA	ACS - NSQIP database	14,339	Age (mean $\pm$ SD): Over all: 69.0 $\pm$ 9.7 years LOS $\leq$ 24 hr: 67.4 $\pm$ 9.7 LOS > 24 hr: 70.3 $\pm$ 9.7 p<0.0001	% male : Over all: 44.0 % LOS $\leq$ 24 hr: 54.7 % LOS > 24 hr: 45.3 %	Over all: 31.1 $\pm$ 6.9 LOS $\leq$ 24 hr: 31.0 $\pm$ 6.5 LOS > 24 hr: 31.1 $\pm$ 7.1	Body Mass Index (BMI): LOS $\leq$ 24hr: 31.0 $\pm$ 6.5 LOS > 24hr: 31.1 $\pm$ 7.1, P = 0.29 Diabetes: LOS $\leq$ 24hr: 233 (29.1 %) LOS > 24hr: 568 (70.9 %), P < 0.0001 Smoking: LOS $\leq$ 24hr: 730 (48.3 %) LOS > 24hr: 781 (51.7 %), P = 0.016 Chronic Obstructive Pulmonary
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	Disease e (COPD)): LOS ≤ 24hr: 299 (32.5%)
	LOS > 24hr: 620 (67.5%), P < 0.0001
	Congestive Heart Failure (CHF): LOS ≤ 24hr: 10 (14.7%)
	LOS > 24hr: 58 (85.3%), P < 0.0001
	Hypertension : LOS ≤ 24hr: 4097 (42.7%)
	LOS > 24hr: 5489 (57.3%), P < 0.0001

		-
	Dialysis:	
	LOS ≤ 24hr:	12 (19.7%)
	LOS > 24hr:	49 (80.3%), P < 0.0001
	Steroids:	
	LOS ≤ 24hr:	284 (40.3%)
	LOS > 24hr:	421 (59.7%), P = 0.0059
	Bleeding disorders:	
	LOS ≤ 24hr:	127 (33.0%)
	LOS > 24hr:	258 (67.0%), P < 0.0001
	American Society	

										y of Anest hesiol ogists (ASA classif ication , mean $\pm$ SD): LOS $\leq$ 24hr: 2.4 $\pm$ 0.6 LOS > 24hr: 2.6 $\pm$ 0.6, P < 0.000 1		
Lone rgan et al. 201 9 ⁵⁶	Mood disorders do not predic t a more difficu lt course after prima ry anatomic total shoul der arthroplasty .	Curre nt Orthopaedi c Practi ce	Ret ros pec tive coh ort stu dy	US A	Pros pect ively coll ecte d insti tutio nal coh ort	133	Mood disorder: mean 60.8 years (rang e 30–70). No mood disorder: mean 62.9 years (rang e 27–83)	Moo d disorder: 8/29 (28%). No mood disorder: 60/9 7 (62%)	Mood disorder: 35.1 (no SD repor ted) No mood disorder: 33.0 (no SD repor ted)	Pre-op narcot ic use	Prima ry osteo arthrit is, inflam mator y arthrit is, osteo necro sis, capsu lorrh aphy, arthro pathy, posttraumat ic	Prim ary anat omic TSA

											arthrit is of shoul der	
Ham mon d et al. 200 3 ³⁰	Surge on Experi ence and Clinic al and Econo mic Outco mes for Shoul der Arthro plasty .	The Journa l of Bone & Joint Surger y	Ret ros pec tive coh ort stu dy	US A	New York Stat e SPA RCS data bas e	1,8 68	Mean -68.1	31.8		CCI	Pertin ent diagn oses asses sed were OA, RA, and fractu res of the hume rus	

Lee et al. 2020 ⁴⁸	Preoperative hyponatremia is associated with postoperative major morbidity, prolonged length of stay, non-home discharge, and readmission in total shoulder arthroplasty.	Journal of Shoulder and Elbow Surgery	Retrospective cohort study	United States	ACS - NS QIP database	12,437	Age: Overall: 69.4 ± 9.6 years Hypонатremia: 71.4 ± 9.6 years Normonatremia: 69.3 ± 9.6 years p < 0.001	% male: Overall: 43.6%. Hypонатremia: 33.3%. Normonatremia: 44.4%. p < 0.001	BMI (mean ± SD): Overall: 31.2 ± 6.9. Hypонатremia: 29.6 ± 6.5. Normonatremia: 31.3 ± 6.9. p < 0.001	ASA	Anatomic TSA and reverse TSA
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Martino et al. 2024 ⁵⁸	Cirrhosis associated with increased complications and health care utilization following total shoulder arthroplasty.	Shoulder & Elbow	Retrospective cohort study	United States	Nationalwide administrative database (exact database not specified in provided information)	1,254	Age: Mean 68 ± 8.4 years for both groups P = 0.884	39% male both groups	Charlson-Deyo Comorbidity Index (CCI) Cirrhosis: Mean 6.1 ± 1.8 No cirrhosis: Mean 1.0 ± 1.2	Both anatomic and reverse TSA
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Van derham et al. 2024 ⁸¹	Psychiatric comorbidities are an independent risk factor for perioperative and postoperative complications in patients undergoing primary total shoulder arthroplasty.	Journal of Shoulder and Elbow Surgery	Retrospective database analysis	United States	National administrative database	128,382	MHD: 68 ± 8.9 years No MHD: 71 ± 8.9 years P <.001 for both	MHD : 30% No MHD : 49% P <.001 for both	Charlson-Deyo Index	Primary TSA - both anatomic and reverse
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Sch airer et al. 201 5 ⁷⁸	Natio nal utiliza tion of revers e total shoul der arthro plasty in the Unite d States	Journa l of Shoul der and Elbow Surger y	Ret ros pec tive natio nal dat aba se ana lysi s	Un ite d St at es	Nati onal Inpa tient Sam ple (NIS , HC UP	66, 485	RSA: 72.7 ± 16.1 TSA: 67.4 ± 15.1 Hemi : 66.8 ± 28.1	RSA: 36.4 %; TSA: 49.6 %; Hemi : 37.0 %	Numb er of comor biditie s - Mean: RSA: 2.18; TSA: 1.86; Hemi: 2.21	Osteo arthrit is 93.4% (n = 27,42 0) Avasc ular necro sis 2.0% (n = 594) Inflam mator y arthrit is 1.2% (n = 356) Proxi mal hume rus fractur e 1.2% (n = 349) Rotat or cuff tear 1.0% (n = 306) Revisi on arthro plasty 0.5% (n = 155) Malun ion/no nunion 0.4% (n = 116)	Anat omic TSA
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Polis etty et al. 202 1 ⁷³	Deter minin g the validit y of the Outpa tient Arthro plasty Risk Asses sment (OAR A) tool for identif ying patien ts for safe same- day disch arge after prima ry shoul der arthro plasty	JSES	retr osp ecti ve revi ew	US A	Sing le- surg eon insti tutio nal shoul der/elb ow regi stry	422	71.6 ± 8.3 years	48.3 0%	28.5 ± 6.0 kg/m ²	OARA score	Prima ry electi ve shoul der arthro plast	anat omic and rever se TSA
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Kishan et al. 2025 ⁴⁴	Perioperative complications and length of stay in patients with diabetes mellitus after aseptic revision total shoulder arthroplasty.	Journal of Orthopaedic Reports	Retrospective cohort study	USA	ACS - NSQIP database	1,979	Age: Median 69 years (IQR 62–75) overall	% male : Overall: 45.7%	BMI (mean $\pm$ SD): Overall: 31 $\pm$ 6.8	Comorbidity indices: ASA I: 1.2% ASA II: 36.0% ASA III: 58.8% ASA IV: 4.04% p = 0.22 (Pearson's chi-square d test) Hypertension : Overall: 1,310 (66.2%) No DM: 958 (60.8%) DM: 352 (87.1%) p < 0.001 (Fisher	Aseptic revision TSA	Revision total shoulder arthroplasty
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	's exact test)
	Curren t smoke r:
	Overal l: 235 (11.9 %)
	No DM: 189 (12.0 %)
	DM: 46 (11.4 %)
	p = 0.80 (Fisher's exact test)
	Histor y of severe COPD:
	Overal l: 155 (7.8%)
	No DM: 114 (7.2%)
	DM: 41 (10.2 %)

		p = 0.06 (Fisher's exact test)	
		Congestive heart failure :	
		Overall: 22 (1.1%)	
	No DM:	15 (1.0%)	
	DM:	7 (1.7%)	
		p = 0.19 (Fisher's exact test)	
	Bleeding disorder:		
	Overall:	61 (3.1%)	
	No DM:	41 (2.6%)	
	DM:	20 (4.95 %)	

									p = 0.02 (Fisher's exact test) Hematocrit <35%: Overall: 269 (13.6%) No DM: 190 (12.1%) DM: 79 (19.6%) p < 0.001 (Fisher's exact test) Total operation time (minutes, mean ± SD): Overall: 126.1 ± 62.4 No DM: 126.1		
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Table 1 – Patient Demographics

Author (Year)	Title	Aims/Methods	Conclusion
Liu et al. 2025 ⁵⁰	Dehydration independently predicts prolonged hospital stay following aseptic revision total shoulder arthroplasty.	Retrospective review of a national surgical database assessing whether preoperative dehydration, defined by elevated BUN/creatinine ratio, independently predicts early postoperative complications after aseptic revision total shoulder arthroplasty, using multivariable logistic regression for risk adjustment.	Preoperative dehydration was associated with increased early postoperative morbidity and independently predicted prolonged hospitalization, indicating that hydration status may serve as a practical marker for perioperative risk stratification in revision shoulder arthroplasty.
Nazzal et al. 2025 ⁶⁷	Predictors of failing same-day discharge after shoulder arthroplasty: developing a model to improve outcomes and reduce health care cost.	Retrospective cohort study of consecutive shoulder arthroplasty cases intended for same-day discharge, evaluating demographic, clinical, and perioperative factors associated with failure of same-day discharge through multivariable logistic regression to develop a predictive model for postoperative hospital admission.	Older age, rotator cuff arthropathy, female sex, preoperative opioid use, and prolonged anesthesia duration significantly increased the likelihood of failing same-day discharge. These findings support risk-stratified selection of candidates for outpatient arthroplasty and highlight the importance of coordinated perioperative planning to optimize resource utilization.
Areti et al. 2025 ⁴	Impact of morbid obesity on postoperative outcomes in reverse total shoulder arthroplasty: A national inpatient sample analysis.	Retrospective cohort analysis of a national inpatient database evaluating whether morbid obesity is associated with adverse perioperative outcomes following reverse total shoulder arthroplasty, using comparative statistics and multivariate logistic regression to assess	Morbid obesity was associated with higher complication rates, prolonged hospitalization, and increased likelihood of non-routine discharge after reverse total shoulder arthroplasty, highlighting the need

		differences in complications, discharge status, and length of stay.	for tailored perioperative optimization and postoperative management in this high-risk population.
Mayfield et al. 2025 ⁶⁰	Perioperative opioid use in total shoulder arthroplasty is associated with dose-dependent risk of major surgical and medical complications.	Retrospective analysis of a large national hospital database assessing whether perioperative opioid consumption, quantified in morphine milligram equivalents and stratified by quintiles, is associated with early surgical and medical complications after primary total shoulder arthroplasty.	Higher perioperative opioid exposure demonstrated a dose-dependent increase in postoperative complications, including infection, mechanical failure, and serious medical events, indicating that opioid requirements may serve as a meaningful predictor for risk stratification and perioperative optimization in total shoulder arthroplasty.
Liu et al. 2024 ⁵⁴	Severe malnutrition predicts early postoperative complications in aseptic revision total shoulder arthroplasty.	Retrospective national database study assessing whether preoperative nutritional risk, quantified by the Geriatric Nutritional Risk Index and stratified by severity, independently predicts 30-day complications after revision total shoulder arthroplasty using multivariable logistic regression.	Severe malnutrition according to the GNRI significantly increased the risk of early postoperative complications, whereas moderate malnutrition did not, highlighting the GNRI as a practical tool for perioperative risk stratification in revision shoulder arthroplasty.
Mayfield et al. 2025 ⁶¹	Tranexamic acid use in total shoulder arthroplasty continues to increase and is safe in high-risk patients.	Retrospective analysis of a national hospital database evaluating temporal trends in tranexamic acid use during primary total shoulder arthroplasty and assessing its association with transfusion requirements and thromboembolic complications, including a propensity-matched comparison and a	Expanded use of tranexamic acid was associated with reduced transfusion rates without increasing thromboembolic risk, even in patients with a history of venous thromboembolism, supporting its safety for broader

		subanalysis of high-risk patients with prior venous thromboembolism.	perioperative use in shoulder arthroplasty
Liu et al. 2024 ⁴⁹	The association of hyponatremia and early postoperative complications in aseptic revision total shoulder arthroplasty.	Retrospective review of a national surgical database assessing whether preoperative hyponatremia independently predicts 30-day complications after aseptic revision total shoulder arthroplasty, using multivariable logistic regression to compare outcomes with patients presenting normal sodium levels.	Hyponatremia was associated with increased early complications, including transfusion, reoperation, and prolonged hospitalization, supporting serum sodium as a practical marker for perioperative risk stratification in revision shoulder arthroplasty
Liu et al. 2024 ⁵¹	Hypoalbuminemia predicts early postoperative complications following noninfectious revision total shoulder arthroplasty.	Retrospective national database review evaluating whether preoperative hypoalbuminemia independently predicts 30-day complications after noninfectious revision total shoulder arthroplasty, using multivariable logistic regression to compare outcomes between patients with normal and reduced albumin levels	Hypoalbuminemia significantly increased the risk of early postoperative morbidity, including infection, transfusion, readmission, and prolonged hospitalization, highlighting serum albumin as a useful marker for perioperative risk stratification in revision shoulder arthroplasty
Liu et al. 2024 ⁵³	Elevated alkaline phosphatase independently predicts early postoperative complications in noninfectious revision total shoulder arthroplasty.	Retrospective national database analysis evaluating whether elevated preoperative alkaline phosphatase predicts 30-day complications after noninfectious revision total shoulder arthroplasty, using multivariable logistic regression to compare outcomes with patients who had normal levels	Elevated alkaline phosphatase significantly increased the risk of early postoperative morbidity, including infection, transfusion, readmission, and prolonged hospitalization, indicating its value as a potential marker for perioperative risk

			stratification in revision shoulder arthroplasty
Liu et al. 2024 ⁵²	The geriatric nutritional risk index as a strong predictor of adverse outcomes following total shoulder arthroplasty.	Retrospective national database study evaluating whether malnutrition severity, quantified by the Geriatric Nutritional Risk Index and stratified into normal, moderate, and severe risk categories, independently predicts 30-day complications after total shoulder arthroplasty using multivariable logistic regression	Malnutrition identified by the Geriatric Nutritional Risk Index was a strong independent predictor of postoperative morbidity and mortality, with complication risk increasing proportionally with nutritional deficit, supporting preoperative nutritional assessment for risk stratification in total shoulder arthroplasty.
Fassler et al. 2024 ²²	Components of metabolic syndrome as significant risk factors for postoperative complications following total shoulder arthroplasty: hypertension, diabetes, and obesity.	Retrospective national database study assessing whether metabolic syndrome independently predicts 30-day complications after total shoulder arthroplasty, with multivariable logistic regression used to adjust for demographic and comorbidity differences between metabolic syndrome and control cohorts.	Metabolic syndrome significantly increased the risk of cardiopulmonary and renal complications, non-home discharge, and prolonged hospitalization, underscoring the importance of preoperative medical optimization in this patient population undergoing total shoulder arthroplasty.
Burns et al. 2024 ¹¹	Chronic kidney disease increases cost of care and readmission risk after shoulder arthroplasty.	Retrospective single-surgeon cohort study comparing health care utilization and 90-day encounter charges after primary shoulder arthroplasty in patients with and without chronic kidney disease, using univariate and multivariable regression to evaluate length of stay,	Chronic kidney disease was associated with greater resource utilization, including increased transfusion risk, longer hospitalization, higher rates of emergency visits and readmissions, and

		transfusion, emergency utilization, readmission, and total postoperative costs.	elevated postoperative charges, emphasizing the importance of preoperative optimization in this high-risk population.
Brandner et al. 2024 ⁸	Impact of opioid dependence on outcomes following total shoulder arthroplasty.	Retrospective national readmissions database analysis comparing outcomes of primary total shoulder arthroplasty in patients with and without opioid dependence, using multivariate regression to assess 180-day complications, revision, readmission, length of stay, discharge disposition, and hospitalization costs.	Preoperative opioid dependence was associated with significantly increased postoperative complications, greater revision and readmission risk, and higher resource utilization, supporting targeted strategies to reduce opioid dependence prior to shoulder arthroplasty to improve outcomes and decrease costs
Gruson et al. 2023 ²⁹	Does Morbid Obesity (BMI ≥ 40 kg/m ²) Impact Operative Time, Blood Loss, Length of Stay, or Complications Following Anatomic Total Shoulder Arthroplasty?	Retrospective review of consecutive anatomic total shoulder arthroplasty cases assessing the impact of obesity classification on operative time, blood loss, perioperative complications, and hospital length of stay, using correlation analyses and regression modeling to identify predictors of prolonged hospitalization.	Morbid obesity did not increase operative time, blood loss, or complication rates but independently predicted longer length of stay, indicating that elevated BMI primarily affects postoperative resource utilization rather than surgical complexity in anatomic shoulder arthroplasty.
Papalia et al. 2023 ⁶⁹	Inpatient charges, complication, and revision rates for shoulder arthroplasty in Parkinson disease: a regional database study.	Retrospective analysis of a statewide all-payer database comparing primary shoulder arthroplasty outcomes in patients with and without Parkinson disease, evaluating inpatient charges, complication and revision rates, and readmissions, with regression modeling to	Parkinson disease was associated with higher postoperative complications, increased revision risk, and greater inpatient resource utilization, indicating the need for careful risk counseling and perioperative planning for patients undergoing shoulder

		control for demographic and comorbidity differences	arthroplasty with this condition
Diamond et al. 2023 ¹⁸	How does depressive disorder impact outcomes in patients with glenohumeral osteoarthritis undergoing primary reverse shoulder arthroplasty?	Retrospective national claims database study comparing outcomes of primary reverse shoulder arthroplasty in patients with and without depressive disorders, evaluating length of stay, 90-day medical complications, emergency department utilization, and episode-of-care costs, with subgroup analysis accounting for preoperative emergency utilization	Depressive disorders were associated with longer hospitalization, higher medical complication rates, increased emergency department use, and greater care costs, indicating that mental health status influences postoperative outcomes and resource utilization after reverse shoulder arthroplasty.
Polisetty et al. 2023 ⁷²	Iron deficiency anemia is associated with increased medical and implant-related complications and length of stay for patients undergoing total shoulder arthroplasty.	Retrospective Medicare database review comparing outcomes of primary total shoulder arthroplasty in patients with and without iron deficiency anemia, using matched cohorts and multivariate logistic regression to evaluate effects on length of stay and 90-day medical and implant-related complications	Iron deficiency anemia was associated with longer hospitalization and substantially higher risks of medical and implant-related complications, including markedly increased transfusion and infection rates, underscoring the importance of preoperative evaluation and optimization in this population
Puzzitiello et al. 2022 ⁷⁵	Patients with limited health literacy have worse preoperative function and pain control and experience prolonged hospitalizations following shoulder arthroplasty.	Retrospective single-surgeon cohort study evaluating whether limited health literacy, identified preoperatively using a validated screening tool, influences preoperative symptom burden and perioperative outcomes after elective shoulder arthroplasty, with	Limited health literacy was common and associated with worse preoperative symptom severity and independently predicted longer hospitalization, indicating its relevance in perioperative planning

		multivariable regression used to assess its effect on length of stay.	and postoperative disposition after shoulder arthroplasty
Burns et al. 2022 ¹⁰	Modifiable risk factors increase length of stay and 90-day cost of care after shoulder arthroplasty.	Retrospective review across a regional health system assessing the impact of predefined modifiable risk factors—including anemia, malnutrition, obesity, uncontrolled diabetes, tobacco use, and opioid use—on 90-day encounter charges, hospital length of stay, emergency department utilization, and readmissions following shoulder arthroplasty, using multivariable modeling to evaluate cost and resource use.	Malnutrition, obesity, and anemia significantly increased postoperative costs and resource utilization, particularly length of stay and readmissions, supporting targeted preoperative optimization programs to reduce financial burden and improve outcomes in shoulder arthroplasty.
Doan et al. 2021 ¹⁹	Increasing severity of anemia is associated with poorer 30-day outcomes for total shoulder arthroplasty.	Retrospective national surgical database analysis evaluating whether increasing preoperative anemia severity, stratified by hematocrit levels, independently influences postoperative outcomes after primary total shoulder arthroplasty, using multivariable logistic regression to assess complications, readmissions, reoperations, and length of stay.	Greater anemia severity was progressively associated with higher complication, readmission, reoperation, and prolonged hospitalization rates, indicating hematocrit as a practical tool for preoperative risk stratification and optimization in total shoulder arthroplasty.
Flamant et al. 2021 ²³	Malnutrition in elective shoulder arthroplasty: a multi-institutional retrospective study of preoperative albumin and adverse outcomes.	Retrospective review of primary and revision shoulder arthroplasty at two tertiary centers assessing whether low preoperative albumin levels predict extended hospitalization, 90-day readmission, and discharge to postacute care facilities, using multivariable analysis to adjust for demographic and clinical risk factors.	Malnutrition, identified by low albumin, was more common in revision cases and independently increased the risk of prolonged hospitalization, with a possible greater need for postacute care, supporting albumin assessment for

			perioperative risk stratification in shoulder arthroplasty.
Wang et al. 2021 ⁸²	Increased severity of anemia is associated with postoperative complications following primary total shoulder arthroplasty.	Retrospective national surgical database study evaluating whether the severity of preoperative anemia, stratified by WHO hematocrit thresholds, independently predicts 30-day complications after primary total shoulder arthroplasty using multivariable logistic regression.	Increasing anemia severity was associated with a stepwise rise in postoperative morbidity, including transfusion, cardiopulmonary events, reoperation, prolonged hospitalization, and mortality, supporting medical optimization of patients with moderate to severe anemia prior to shoulder arthroplasty.
Lunati et al. 2021 ⁵⁷	Preoperative depression is a risk factor for complication and increased health care utilization following total shoulder arthroplasty.	Retrospective administrative database analysis comparing outcomes of primary total shoulder arthroplasty in patients with and without preoperative depression, using multivariate adjustment to evaluate postoperative complications, prosthetic failures, and healthcare utilization within one year.	Preoperative depression was common and independently associated with higher complication rates, increased prosthetic and wound-related failures, and greater healthcare utilization, indicating that mental health status may influence postoperative risk and warrants consideration during preoperative planning.
Wilson et al. 2021 ⁸⁴	Preoperative opioid use is an independent risk factor for complication, revision, and increased health care utilization following primary total shoulder arthroplasty.	Retrospective administrative claims analysis evaluating the dose-dependent relationship between preoperative opioid use and postoperative outcomes after primary total shoulder arthroplasty, stratifying patients by average daily	Higher preoperative opioid exposure was common and demonstrated a dose-dependent increase in complications, health care utilization, revision risk, and costs, supporting opioid reduction prior

		morphine equivalents over the 6 months prior to surgery and using multivariate regression to assess complications, resource utilization, and revisions.	to shoulder arthroplasty as a modifiable target for optimization
Dacombe et al. 2020 ¹⁶	Predictors of length of stay following shoulder arthroplasty in a high-volume UK centre.	Retrospective review of shoulder arthroplasty cases at a high-volume UK centre evaluating patient, comorbidity, and perioperative factors associated with inpatient length of stay, with multivariable linear regression used to identify independent predictors of prolonged hospitalization.	Advanced age, female sex, cardiac and renal comorbidities, intraoperative complications, and transfusion independently increased length of stay, supporting targeted optimization and reduction of perioperative complications to improve inpatient efficiency following shoulder arthroplasty.
Menendez et al. 2019 ⁶²	Delayed hospital discharge after total shoulder arthroplasty: why, and who is at risk?	Retrospective review of elective primary total shoulder arthroplasty assessing reasons for extended hospitalization and identifying preoperative factors associated with prolonged length of stay, using manual chart review to classify causes and multivariable logistic regression to determine independent predictors	Most extended hospitalizations were due to pain, minor medical issues, or limited social support rather than surgical complications, with sociodemographic and psychological factors emerging as key predictors, supporting comprehensive perioperative management beyond technical care alone.
Biron et al. 2020 ⁷	A Novel Machine Learning Model Developed to Assist in Patient Selection for Outpatient Total Shoulder Arthroplasty.	Retrospective analysis of a national surgical database using a random forest machine learning model to predict short-stay outpatient candidacy after elective total shoulder arthroplasty, followed by multivariable logistic regression to identify demographic and comorbidity factors	Machine learning accurately identified patients likely to achieve short stays, with younger age and male sex favoring outpatient eligibility, while cardiopulmonary comorbidities and higher ASA classification

		associated with length of stay.	predicted longer hospitalization, supporting its potential role in outpatient candidate selection.
Anthony et al. 2019 ³	Utilization and Real-world Effectiveness of Tranexamic Use in Shoulder Arthroplasty: A Population-based Study.	Retrospective national claims analysis evaluating trends in tranexamic acid use during shoulder arthroplasty and its association with transfusion risk, postoperative complications, and hospital resource utilization, using multilevel multivariable regression to control for patient and hospital factors.	Tranexamic acid use was low but increased over time and was associated with markedly reduced transfusion risk and lower complication rates without added cost or safety concerns, supporting its broader adoption in shoulder arthroplasty
Lee et al. 2019 ⁴⁷	Low Serum Albumin Levels are Associated with Increased 30-Day Cardiopulmonary Complications, Reoperation, and Readmission Rates Following Total Shoulder Arthroplasty.	Propensity-matched NSQIP analysis evaluating hypoalbuminemia as a predictor of 30-day morbidity after primary TSA. Patients with low preoperative serum albumin were compared with matched controls for acute postoperative complications using multivariate logistic regression.	Hypoalbuminemia was strongly associated with higher pulmonary, cardiac, thromboembolic, infectious, and hematologic complications, along with greater reoperation, readmission, and prolonged hospitalization. Low albumin independently increased risk for pulmonary events, transfusion, reoperation, and readmission, supporting its value in preoperative risk stratification and optimization before TSA.

Kim et al. 2018 ⁴¹	Predicting adverse events, length of stay, and discharge disposition following shoulder arthroplasty: a comparison of the Elixhauser Comorbidity Measure and Charlson Comorbidity Index.	Queried a national inpatient database to evaluate whether the Elixhauser Comorbidity Measure provides superior predictive accuracy to the Charlson Comorbidity Index for forecasting adverse events, resource utilization, and discharge disposition following total shoulder and reverse total shoulder arthroplasty using logistic regression models and concordance statistics.	A model incorporating the Elixhauser Comorbidity Measure demonstrated superior discrimination for mortality, complications, extended hospitalization, and nonroutine discharge, indicating its value as a more reliable tool for guiding perioperative care pathways and supporting value-based reimbursement strategies in shoulder arthroplasty.
Izquierdo-Fernández et al. 2018 ³⁷	Reverse shoulder arthroplasty in obese patients: analysis of functionality in the medium-term.	Evaluated functional and radiographic outcomes of reverse shoulder arthroplasty in patients stratified by body mass index, comparing two BMI-based subgroup analyses and assessing complications, length of stay, radiographic changes, and standardized functional scores.	Patients with BMI ≥ 35 demonstrated significantly poorer functional results, while complication rates and radiographic findings were similar across BMI groups, indicating that severe obesity adversely affects postoperative function without increasing measurable implant-related complications.
Fu et al. 2017 ²⁵	The impact of insulin dependence on short-term postoperative complications in diabetic patients undergoing total shoulder arthroplasty.	The study analyzed a national surgical database to compare 30-day postoperative complications, readmissions, and length of stay across non-diabetic, non-insulin-dependent diabetic, and insulin-dependent diabetic patients undergoing total shoulder arthroplasty. Multivariable logistic regression was used to determine the independent effect of	Non-insulin-dependent diabetes did not confer additional postoperative risk after adjustment, whereas insulin dependence independently predicted higher rates of several complications. Insulin status should be incorporated into preoperative risk

		insulin dependence on postoperative outcomes after adjusting for demographic and comorbidity factors.	stratification for diabetic patients undergoing shoulder arthroplasty.
Issa et al. 2016 ³⁶	Total Shoulder Arthroplasty Demographics, Incidence, and Complications—A Nationwide Inpatient Sample Database Study.	Evaluated contemporary national trends in total shoulder arthroplasty using the Nationwide Inpatient Sample (1998–2010), assessing temporal changes in utilisation, demographic patterns, and inpatient outcomes. Multivariable regression was applied to determine independent associations between patient factors, complications, and length of stay.	Incidence of total shoulder arthroplasty increased substantially over the study period, while complication rates remained stable and length of stay declined. Older age, female sex, and greater comorbidity burden were independently associated with higher complication risk, and several demographic and insurance factors contributed to prolonged hospitalisation.
Weinreb et al. 2016 ⁸³	Shoulder Arthroplasty: Disposition and Perioperative Outcomes in Patients With and Without Rheumatoid Arthritis.	Retrospective analysis of a national inpatient database comparing perioperative complication profiles and hospital disposition between patients undergoing shoulder arthroplasty with and without rheumatoid arthritis, using multivariable regression to adjust for demographic and hospital factors.	Rheumatoid arthritis was associated with increased transfusion requirements and modest differences in perioperative resource use and discharge patterns, while overall complication rates remained comparable. Further work is needed to clarify drivers of these disparities and optimize perioperative management.

Mollon et al. 2016 ⁶⁴	The influence of a history of clinical depression on peri-operative outcomes in elective total shoulder arthroplasty: a ten-year national analysis.	This study used a national inpatient database to evaluate whether a documented history of depression independently influences peri-operative complications and discharge disposition in patients undergoing elective total shoulder arthroplasty. Multivariable analyses were performed to identify associations between depression and adverse in-hospital outcomes.	Depression was independently associated with a higher risk of several post-operative complications and non-home discharge. The findings support routine pre-operative screening and targeted peri-operative management to mitigate risk in this vulnerable patient group.
Kandil et al. 2016 ³⁹	Blood transfusion after total shoulder arthroplasty: Which patients are at high risk?	Used a national inpatient database to evaluate contemporary transfusion incidence in TSA and to identify preoperative variables independently associated with transfusion. Assessed relationships between transfusion status and hospital utilization metrics.	Several preoperative comorbidities were independently associated with transfusion, allowing clearer stratification of higher-risk patients. Transfusion was also linked to greater resource use, underscoring the importance of targeted risk counseling and perioperative optimization.
Murphy et al. 2016 ⁶⁶	Metabolic syndrome and shoulder arthroplasty: epidemiology and peri-operative outcomes.	Retrospective analysis of national inpatient discharge data to evaluate temporal trends in metabolic syndrome among shoulder arthroplasty patients and to examine its independent association with peri-operative complications, length of stay, and discharge disposition using multivariable logistic regression.	Metabolic syndrome demonstrated a marked rise over the study period and independently increased the risk of peri-operative morbidity and resource utilization. Enhanced recognition and peri-operative optimization of metabolic syndrome may improve outcomes in shoulder arthroplasty.

Sivasundaram et al. 2016 ⁷⁹	Preoperative risk factors for discharge to a postacute care facility after shoulder arthroplasty.	Using a national inpatient database, the study evaluated patient and hospital characteristics associated with discharge to postacute care following total or reverse shoulder arthroplasty. Multivariate modelling was applied to identify independent predictors while adjusting for relevant covariates.	The analysis identified several demographic, clinical, and procedural factors that independently increase the likelihood of postacute care discharge, providing a basis for preoperative risk stratification and more efficient discharge planning.
Garcia et al. 2016 ²⁶	Malnutrition: a marker for increased complications, mortality, and length of stay after total shoulder arthroplasty.	Retrospective cohort study using a national surgical quality database to quantify malnutrition prevalence in TSA and evaluate postoperative complication risk associated with low preoperative albumin. Malnutrition was defined biochemically, and outcomes were compared between nutritional groups using propensity-adjusted analyses.	Preoperative hypoalbuminemia was associated with substantially increased postoperative morbidity and early mortality in TSA. Malnutrition independently predicted higher transfusion requirements, prolonged hospitalization, and markedly elevated short-term mortality risk.
Basques et al. 2015 ⁵	Length of Stay and Readmission After Total Shoulder Arthroplasty: An Analysis of 1505 Cases.	The study examined patient-related predictors of extended hospital stay and 30-day readmission following primary total shoulder arthroplasty using a national surgical quality database. Bivariate and multivariate regression models were applied to evaluate associations between preoperative characteristics and postoperative utilization outcomes.	Specific comorbidities were independently linked to prolonged hospitalization and early readmission, highlighting the value of targeted risk stratification to guide preoperative counselling and postoperative planning.

Matsen et al. 2015 ⁵⁹	Factors Affecting Length of Stay, Readmission, and Revision After Shoulder Arthroplasty: A Population-Based Study.	Analyzed statewide administrative data from primary shoulder arthroplasty procedures to identify patient, diagnosis, and provider factors independently associated with prolonged hospitalization, 90-day readmission, and revision surgery. Multivariable models were used to determine which characteristics predicted each adverse outcome.	Distinct clinical and demographic variables were linked to extended stay, early readmission, and need for revision. Readily identifiable patient and provider characteristics may inform perioperative optimization strategies and support targeted efforts to reduce complications and associated healthcare costs.
Pappou et al. 2014 ⁷⁰	Outcomes and Costs of Reverse Shoulder Arthroplasty in the Morbidly Obese: A Case Control Study.	The study compared postoperative outcomes, complications, discharge disposition, and hospital costs between morbidly obese patients and matched nonobese controls undergoing primary reverse shoulder arthroplasty. A joint registry cohort with minimum two-year follow-up was analyzed using standardized functional measures, comorbidity indices, perioperative metrics, and recorded postoperative events.	Reverse shoulder arthroplasty demonstrated comparable functional gains and complication rates in morbidly obese patients relative to nonobese controls, though obesity was associated with increased perioperative resource utilization, higher costs, and a greater likelihood of requiring post-acute rehabilitation rather than home discharge.
Ponce et al. 2014 ⁷⁴	Diabetes as a risk factor for poorer early postoperative outcomes after shoulder arthroplasty.	The study analysed a national inpatient database to compare postoperative mortality, complications, length of stay, and discharge disposition between diabetic and non-diabetic patients undergoing shoulder arthroplasty, using bivariate and multivariable logistic regression to determine independent associations.	Preexisting diabetes independently increased the risk of perioperative morbidity, mortality, prolonged hospitalization, and non-home discharge after shoulder arthroplasty, without influencing hospital costs. Further prospective investigation is warranted.

Griffin et al. 2014 ²⁸	Morbid obesity in total shoulder arthroplasty: risk, outcomes, and cost analysis.	Retrospective analysis of a national inpatient database comparing postoperative complications, mortality, and resource utilization between morbidly obese and non-obese patients undergoing total shoulder arthroplasty using multivariate logistic regression modeling.	Morbid obesity was associated with greater postoperative respiratory complications, longer hospitalization, and higher inpatient costs, while most other complication rates and early mortality showed no significant increase. Further investigation is warranted to refine risk stratification and support preoperative counseling.
Johnson et al. 2014 ³⁸	Does preoperative American Society of Anesthesiologists score relate to complications after total shoulder arthroplasty?	Retrospective cohort analysis evaluating whether ASA classification predicts surgical complications, medical complications, and hospitalization duration following primary and revision total shoulder arthroplasty. Logistic regression was used to model complication risk as a function of ASA score.	Higher ASA class was independently associated with increased surgical complications, including prosthesis-related failure, and with longer hospital stay, but showed no association with medical complications. The ASA score may serve as a useful tool for perioperative risk stratification and counseling.
Griffin et al. 2013 ²⁷	Obstructive sleep apnea as a risk factor after shoulder arthroplasty.	Leveraged a national inpatient database to compare postoperative in-hospital complications, resource use, and length of stay between shoulder arthroplasty patients with and without a diagnosis of obstructive sleep apnea using multivariate logistic regression.	OSA was not associated with higher in-hospital morbidity, mortality, or costs and was linked to a modestly shorter hospital stay, indicating it may not represent a significant perioperative risk factor in shoulder arthroplasty.

Humphries et al. 2008 ³⁵	Effect of the Deyo score on outcomes and costs in shoulder arthroplasty patients.	Evaluated whether preoperative comorbidity burden, quantified by the Deyo index, independently predicted perioperative mortality, complications, hospital stay, and costs in shoulder arthroplasty. Outcomes were compared across comorbidity strata using chi-square and F-tests, with multivariable logistic and linear regression models adjusting for key demographic and provider factors.	Greater comorbidity burden was independently associated with increased perioperative risk and higher resource utilization. The Deyo index functioned as a meaningful predictor to inform patient selection and risk-benefit discussions for shoulder arthroplasty.
Elsabbagh et al. 2025 ²¹	Does use of glucagon-like peptide-1 agonists increase perioperative complications in patients undergoing shoulder arthroplasty?	Retrospective cohort study using a national database to compare postoperative and joint-related outcomes in T2DM patients undergoing primary TSA with or without GLP-1 therapy. Propensity-score matching and multivariable logistic regression were used to evaluate 90-day medical complications, length of stay, and 2-year joint-related events.	GLP-1 therapy was not associated with increased postoperative medical or joint-related complications nor with prolonged length of stay. Findings suggest perioperative GLP-1 use does not elevate surgical risk in TSA and may be safely continued, supporting further prospective evaluation.
Alder et al. 2024 ²	Increasing severity of preoperative anemia is associated with higher postoperative medical and surgical complications after primary shoulder arthroplasty.	Evaluated midterm outcomes of primary shoulder arthroplasty stratified by preoperative anemia severity using a single-institution registry with ≥2-year follow-up. Compared medical and surgical complications, reoperations, revisions, and implant survivorship across anemia categories.	Greater preoperative anemia severity was associated with higher rates of medical and surgical complications. Postoperative transfusion further increased complication rates and short-term mortality, underscoring the need for targeted perioperative optimization and monitoring in anemic patients.

Khokhar et al. 2024 ⁴⁰	Does morbid obesity negatively impact perioperative outcomes following elective reverse shoulder arthroplasty?: a propensity-matched comparative study.	Retrospective propensity-matched analysis of primary elective rTSA cases using a uniform short-stem implant system to evaluate the independent association of morbid obesity with perioperative surgical and medical outcomes. Multivariable regression assessed relationships between obesity status and operative parameters, postoperative complications, disposition, and short-term unplanned health care utilization.	Morbid obesity did not independently worsen perioperative or short-term postoperative outcomes. With appropriate preoperative optimization, morbid obesity alone should not be considered a contraindication to elective rTSA.
Destine et al. 2024 ¹⁷	Effect of hospital length of stay on functional outcomes and readmission after total shoulder arthroplasty.	A retrospective cohort study evaluated whether postoperative length of stay (≤ 24 vs >24 hours) was associated with readmissions, revisions, complications, or functional outcomes following primary total shoulder arthroplasty. Demographic, perioperative, comorbidity, and discharge variables were analyzed to identify factors predictive of prolonged hospitalization.	Prolonged postoperative stay was associated with higher comorbidity burden and increased likelihood of discharge to a nonhome setting but did not influence complication rates, readmissions, revisions, or patient-reported outcomes.
Moore et al. 2024 ⁶⁵	Fibromyalgia syndrome is an independent predictor of increased complications, revision, and cost of admission within 180 days of total shoulder arthroplasty.	Retrospective analysis of a national readmissions database to compare postoperative complication profiles between patients with and without fibromyalgia undergoing primary elective TSA. Cohorts were matched 1:1 on key demographic and comorbidity variables, and multivariate modelling was used to isolate the independent effect of fibromyalgia on postoperative outcomes and healthcare utilisation.	Fibromyalgia independently increased the likelihood of both medical and surgical complications after TSA and was associated with higher revision rates and greater admission costs. Awareness of this elevated risk profile is warranted when planning and counselling patients undergoing TSA.

Miltenberg et al. 2024 ⁶³	Prediction of overnight stay following shoulder arthroplasty utilizing machine learning.	This study evaluated multiple machine learning models to predict likelihood of overnight hospital stay after primary elective total shoulder arthroplasty using a national surgical outcomes database. Models were trained and validated against postoperative disposition categories, with performance compared using discrimination, calibration, and decision curve analyses.	Machine learning—particularly artificial neural networks—provided superior predictive accuracy over traditional regression approaches for forecasting need for postoperative admission. These models can support more precise outpatient selection, inform preoperative counselling, and facilitate resource optimization.
Kopriva et al. 2024 ⁴⁵	Tramadol use before total shoulder arthroplasty: patients have lower risk of complications and resource utilization than those using traditional opioids.	Retrospective cohort analysis of national claims data to compare postoperative resource utilization, complications, and revision risk in TSA patients stratified by preoperative analgesic exposure (opioid-naïve, tramadol, traditional opioids, or combination). Multivariate modelling adjusted for baseline differences and evaluated temporal prescribing trends.	Preoperative tramadol use was associated with a postoperative risk profile similar to opioid-naïve patients, whereas traditional opioid use conferred increased complications, higher resource utilization, and elevated revision risk. Findings support tramadol as a comparatively lower-risk alternative to traditional opioids in the preoperative TSA setting.
Kim et al. 2024 ⁴³	Cumulative effect of chronic dehydration and age on postoperative complications after total shoulder arthroplasty.	This study assessed the effect of preoperative dehydration and age on 30-day complications after total shoulder arthroplasty using ACS-NSQIP data (2015–2019) with multivariable regression analysis.	Preoperative dehydration, particularly in elderly patients, was independently associated with higher complication rates, longer hospital stay, and increased nonhome discharge following total shoulder arthroplasty.

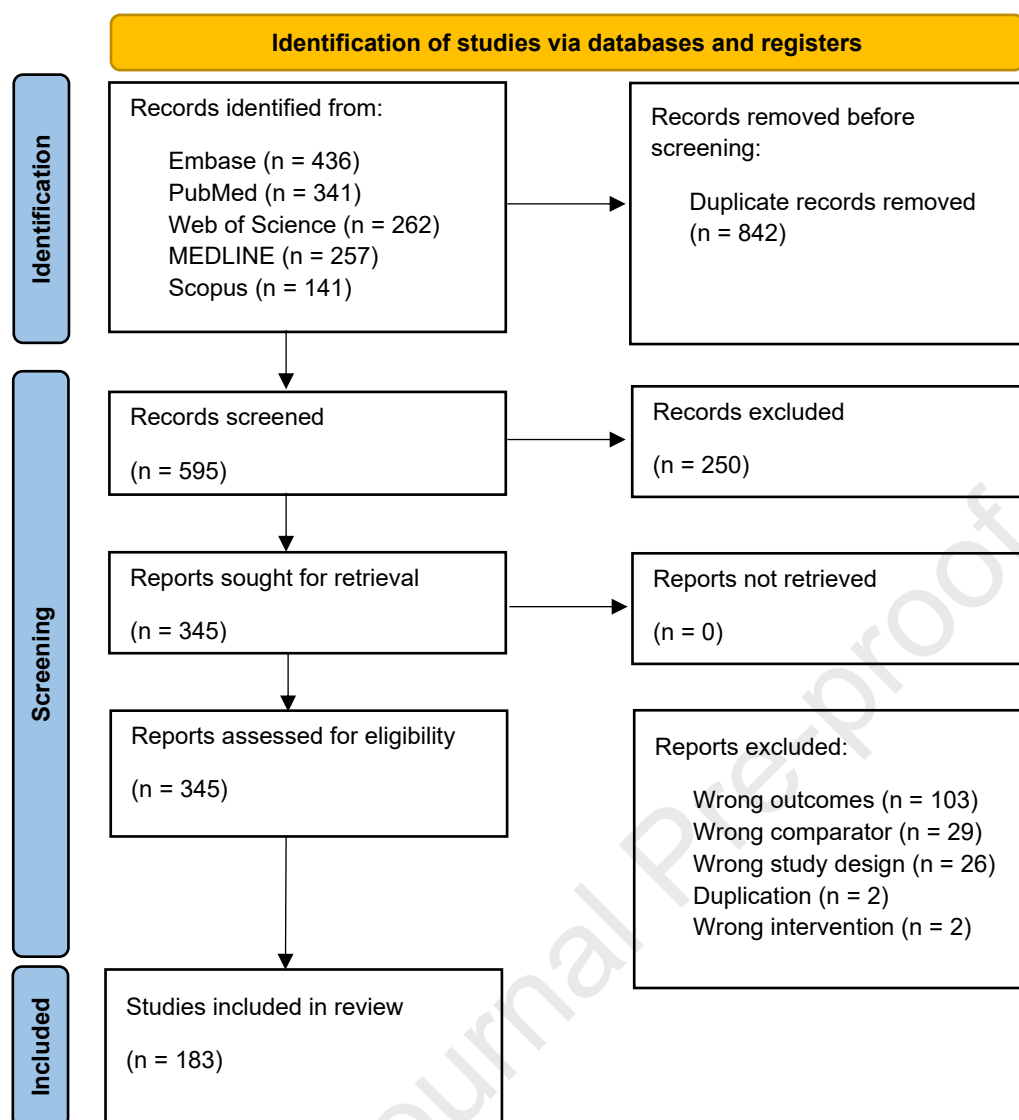
Hartwell et al. 2019 ³¹	Total shoulder arthroplasty: Risk factors for a prolonged length of stay. A retrospective cohort study.	The study used a national surgical quality database to compare patients undergoing total shoulder arthroplasty by postoperative length of stay (≤ 24 hr vs > 24 hr). Univariate and multivariate analyses evaluated preoperative comorbidities, demographic characteristics, and intraoperative variables associated with extended hospitalization.	Several medical comorbidities and higher perioperative risk profiles were independently associated with hospital stays exceeding 24 hours, whereas male sex was protective. These findings highlight key patient and operative factors that may inform perioperative optimization and outpatient pathway selection.
Lonergan et al. 2019 ⁵⁶	Mood disorders do not predict a more difficult course after primary anatomic total shoulder arthroplasty.	Evaluated whether pre-existing mood disorders influence postoperative pain trajectories, narcotic consumption, length of stay, or early complications following primary anatomic TSA. Patients were stratified by documented depression/anxiety or use of mood-stabilizing medications, with serial pain scores, opioid requirements, and 90-day postoperative outcomes collected prospectively.	Mood disorders did not adversely affect early recovery after primary anatomic TSA. Postoperative pain, opioid use, length of stay, and complication profiles were comparable between groups, suggesting mood disorders are not a meaningful risk factor for early outcomes or bundled payment modeling in this setting.
Hammond et al. 2003 ³⁰	Surgeon Experience and Clinical and Economic Outcomes for Shoulder Arthroplasty.	Evaluated whether surgeon case volume was associated with clinical and economic outcomes following total shoulder arthroplasty or hemiarthroplasty, using a statewide hospital discharge database and multivariable adjustment for patient, procedural, and hospital factors.	Higher surgeon volume was associated with lower complication rates and shorter hospital stays, with no significant difference in adjusted costs. Findings support the value of experience and ongoing training in optimising shoulder arthroplasty outcomes.

Lee et al. 2020 ⁴⁸	Preoperative hyponatremia is associated with postoperative major morbidity, prolonged length of stay, non-home discharge, and readmission in total shoulder arthroplasty.	This study used a national surgical quality database to evaluate whether preoperative hyponatraemia independently predicts adverse 30-day outcomes following anatomic or reverse total shoulder arthroplasty. Multivariable logistic regression analyses were performed with stringent statistical correction to assess associations with postoperative morbidity and healthcare utilisation metrics.	Preoperative hyponatraemia was an independent predictor of increased short-term morbidity and higher postoperative resource utilisation after total shoulder arthroplasty. The authors highlight the need for thorough preoperative optimisation and call for further work to clarify the effect of hyponatraemia severity and correction on perioperative outcomes.
Martino et al. 2024 ⁵⁸	Cirrhosis associated with increased complications and healthcare utilization following total shoulder arthroplasty.	Evaluated short-term postoperative outcomes of elective primary TSA in patients with cirrhosis using a nationwide database. Cirrhotic patients were matched 1:1 with non-cirrhotic controls, and postoperative complications and hospital utilisation metrics were compared using adjusted statistical analyses.	Cirrhosis was associated with substantially increased medical and implant-related complications, higher postoperative risk overall, and greater resource utilisation following TSA. Findings highlight the need for targeted preoperative optimisation and risk-mitigation strategies in this population.
Vanderham et al. 2024 ⁸¹	Psychiatric comorbidities are an independent risk factor for perioperative and postoperative complications in patients undergoing primary total shoulder arthroplasty.	Evaluated the impact of preoperative mental health diagnoses on perioperative adverse events, length of stay, and medical/mechanical complications within 180 days after primary TSA using a nationwide administrative database and multivariable logistic regression.	Preoperative mental health disorders independently increased the likelihood of perioperative and mechanical complications and revision, indicating a need for heightened perioperative counselling and postoperative

			surveillance in this population.
Schairer et al. 2015 ⁷⁸	National utilization of reverse total shoulder arthroplasty in the United States.	Used a national inpatient database to characterise utilisation patterns and surgical indications for hemiarthroplasty, TSA, and RSA across the United States. Examined associated diagnoses and hospital factors, and applied multivariable regression to identify determinants of prolonged length of stay.	RSA represented a substantial proportion of arthroplasty procedures, with notable uptake for proximal humerus fractures in addition to cuff-related pathology. Procedure choice varied by indication, and hospital stay was influenced by patient comorbidity and insurance status.
Polisetty et al. 2021 ⁷³	Determining the validity of the Outpatient Arthroplasty Risk Assessment (OARA) tool for identifying patients for safe same-day discharge after primary shoulder arthroplasty.	Retrospective single-surgeon study evaluating the utility of the Outpatient Arthroplasty Risk Assessment (OARA) score for determining appropriateness for same-day discharge after primary shoulder arthroplasty, comparing score thresholds and predictive performance against ASA-PS classification and prior lower-extremity arthroplasty criteria	An OARA cutoff of ≤ 110 points effectively and conservatively identified candidates for same-day discharge, with low emergency utilization and acceptable readmission rates, supporting its use as a screening tool for outpatient shoulder arthroplasty.
Kishan et al. 2025 ⁴⁴	Perioperative complications and length of stay in patients with diabetes mellitus after aseptic revision total shoulder arthroplasty.	Used a national surgical registry to evaluate whether diabetes mellitus independently influences perioperative complications and hospital length of stay following aseptic revision total shoulder arthroplasty. Applied multivariate logistic regression to identify clinical and perioperative predictors of major complications and prolonged admission.	Diabetes was not an independent determinant of short-term complications or extended hospital stay after aseptic revision TSA. Outcomes were more strongly associated with other comorbidities, highlighting the need for individualised risk stratification focusing on factors such as

			hypertension and low preoperative haematocrit.
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Table 2 – Study Summaries



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

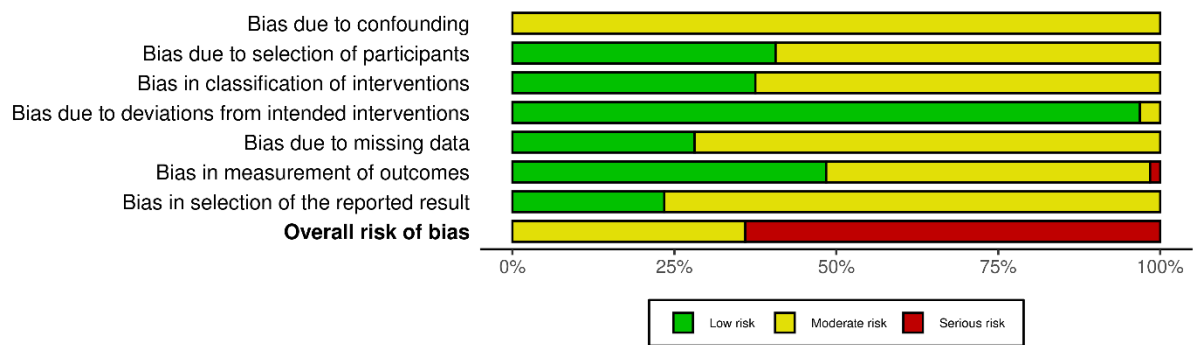


Figure 2 – ROBIN-I Risk of bias