Trends and Risk Factors in Revision and Re-Revision Total Hip Arthroplasty in Medicare Patients from 2016-2022

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INTRODUCTION:

With the increasing prevalence of total hip arthroplasty (THA), the burden of revision and re-revision surgeries is anticipated to rise. Revision THA presents challenges due to higher mortality risks and its substantial economic burden to the US healthcare system. This study aims to assess the incidence, diagnoses, and risk factors for both revision and re-revision THA, considering patient and surgeon-related variables.

METHODS:

This retrospective study analyzed 732,544 THAs in the Centers for Medicare & Medicaid Services (CMS) fee-for-service inpatient and outpatient claims data performed between 2016 and 2022. Patient demographics, surgical indications, length of stay, discharge status, comorbidities, surgeon annual volume, and calendar year performed were collected. The analysis was limited to patients who had two or more years of follow-up after the primary THA. Median follow-up time was 3.5 years. Kaplan-Meier analysis and Cox proportional hazard models were employed to estimate revision rates, identify risk factors, and assess subsequent revisions.

RESULTS: The overall revision rate was 3.2%, with a one-year revision rate of 2.1%. The primary indications for THA were predominantly primary osteoarthritis (89%), followed by fracture (7%) and necrosis (2%). In contrast, revision THA cases were primarily attributed to device instability (26%), device-related infection (20%), and device loosening (17%). Over the 7-year postoperative period, the cumulative incidence rates for first revisions and all revisions rose from 2.1% to 3.2% and from 2.3% to 4.1%, respectively **(Figure 1)**. Younger age, female sex, white race, pre-operative diagnosis of fracture or avascular necrosis, prolonged length of stay, discharge to post acute care facilities, and lower surgeon volume were identified as significant risk factors for revision ($p < 0.001$) (Table 1). Medical co-morbidities most strongly associated with revision THA included malnutrition, major kidney disease, and morbid obesity ($p < 0.001$) **(Table 1)**. Surgery in more recent years (2019, 2020) were associated with a lower risk for revision ($p < 0.001$) **(Figure 2)**. Of patients undergoing revision THA, we found 16.5% of patients required re-revision. Younger age ($p < 0.001$), extended length of stay ($p < 0.001$), non-home discharge ($p = 0.013$), major kidney disease ($p < 0.001$), major mental health illness ($p = 0.034$) and diagnosis of rheumatoid arthritis ($p < 0.001$) were shown to be the strongest risk factors for further revision surgery. Revision indication of infection was the diagnosis with the strongest association with re-revision ($p < 0.001$).

DISCUSSION AND CONCLUSION:

This study provides insights into revision THA trends and risk factors in the U.S. Medicare population. Understanding these factors aids in pre-operative counseling and enhances planning for improved patient outcomes.

Figure 1. Incidence of the First Revision and All Revisions, by Time Since the Primary Total Hip Arthroplasty

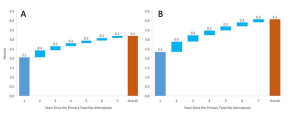
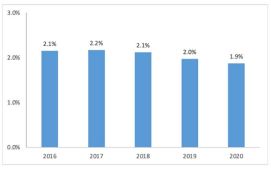


Figure 2. One-Year Incidence of First Revision, by Calendar Year



Covariates	Any Revision	
	Hazard Ratio	P-value
Stroke	0.923	0.165
Vascular diseases	1.183	<0.001
Chronic obstructive pulmonary disease	1.202	<0.001
Major kidney diseases	1.738	<0.001
Annual surgeon hip arthroplasty volume		
<15 cases	Reference	
>15 and ≤35 cases	0.860	<0.001
>35 and ≤60 cases	0.779	<0.001
>60 cases	0.667	<0.001
Calendar year		
2016	Reference	
2017	0.989	0.579
2018	0.941	0.005
2019	0.854	<0.001
2020	0.813	<0.001

Note:
* Comorbidities are yes/no variables, and the reference is without having a condition.
Major liver diseases: chronic hepatitis, cirrhosis of liver, and end-stage liver disease; major mental health illnesses: major depressive, bipolar, and paranoid disorders; major heart diseases: angina pectoris, acute myocardial infarction, heart arrhythmias, congestive heart failure, cardio-respiratory failure and shock; major kidney diseases: acute renal failure, chronic renal disease, end-stage renal disease, dialysis.

Table 1. Risk Factors for the First Revisions After Primary Total Hip Arthroplasty

Covariates	Any Revision	
	Hazard Ratio	P-value
Social Demographics		
Age in years		
<65	Reference	
65 to 74	0.756	<0.001
75 to 84	0.729	<0.001
≥85	0.559	<0.001
Female	1.139	<0.001
Race		
White	Reference	
Black	0.645	<0.001
Other	0.781	<0.001
Procedure indication		
Osteoarthritis	Reference	
Fracture	1.208	<0.001
Necrosis	1.191	<0.001
Other diagnosis	1.800	<0.001
Length of stay		
≤1 day	Reference	
2 days	1.043	0.026
≥3 days	1.059	0.010
Discharge status		
Home, without home health	Reference	
Skilled nursing home or inpatient rehabilitation facility	1.068	0.008
Home health	1.055	0.002
Other	1.273	<0.001
Comorbid medical conditions*		
Cancer	0.994	0.798
Diabetes	0.963	0.029
Malnutrition	1.927	<0.001
Morbid obesity	1.622	<0.001
Major liver diseases	1.412	<0.001
Rheumatoid diseases	1.393	<0.001
Dementia	1.549	<0.001
Major mental health illnesses	1.533	<0.001
Major heart diseases	1.149	<0.001