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Primary Hip

Home Discharge Has Increased After Total Hip Arthroplasty, However Rates Vary Between Large Databases

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ABSTRACT

Background: There have been significant advancements in perioperative total hip arthroplasty (THA) care and it is essential to quantify efforts made to better optimize patients and improve outcomes. The purpose of this study is to assess trends in discharge destination, length of stay (LOS), reoperations, and readmissions following THA.
Methods: Patients undergoing primary THA were identified using International Statistical Classification of Diseases and Current Procedural Terminology codes in the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) and Humana claims databases. Discharge destinations were assessed and categorized as home or not home. Trends in discharge destination, LOS, readmissions, reoperation, and comorbidity burden were assessed.
Results: In ACS NSQIP, 155,637 patients underwent THA and the percentage of patients discharging home increased from 72.2% in 2011 to 87.0% in 2017 ($P < .0001$). In Humana, 84,832 THA patients were identified, with an increase in home discharge from 56.6% to 72.8% ($P < .0001$). LOS decreased and proportion of patients with an American Society of Anesthesiologists score ≥3 or Charlson Comorbidity Index ≥2 increased significantly for both home and nonhome going patients. Patients discharged home had a decrease in readmissions in both databases.
Conclusion: Patients undergoing THA more often discharged home and had shorter hospital LOS with lower readmission rates, despite an increasingly comorbid patient population. It is likely these changes in disposition and LOS have resulted in significant cost savings for both payers and hospitals. The efforts necessary to maintain improvements should be considered when changes to reimbursement are being evaluated. ACS NSQIP hospitals had a larger proportion of patients discharged home and the source of data used to benchmark hospitals should be considered as findings may differ.

Demand for total hip arthroplasty (THA) in the United States has significantly increased, growing from approximately 160,000 procedures per year in 2000 to nearly 375,000 in 2014 [1]. This increase is projected to continue and exceed 600,000 procedures by 2030 [1]. Total joint arthroplasty (TJA) is a major contributor to US medical costs, accounting for $7 billion in expenditures [2]. Significant costs and increasing demand for TJA have led to development of alternative payment models, such as the Bundled Payments for Care Improvement in 2011 or Comprehensive Care for Joint Replacement in 2016 through the Centers for Medicare and Medicaid Services [2,3]. These new payment models seek to promote value and shift risk from insurers to hospitals and surgeons. Discharge destination has been demonstrated to be a significant contributor to the cost of a TJA episode of care; additionally, discharge destination may influence rates of complications and readmissions following TJA [4–9]. Bozic et al [9] reported the postdischarge time period to be responsible for 36% of payments in TJA, with costs related to postacute care facilities and readmissions accounting for 70% and 11% of postdischarge payments, respectively.

Given the substantial contribution of discharge to care facilities on overall cost of care and association with postoperative complications, limiting discharge to these facilities has the potential to improve the value of THA care. The purpose of this study is to assess whether more patients are being discharged to home after primary

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Table 1
ACS NSQIP and Humana Patient Demographics and Discharge Destination by Year.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Humana											
All patients	3507	4515	5377	6462	7270	8230	10,234	12,663	14,699	11,875	
Age											
<60	628 (17.9%)	768 (17.0%)	865 (16.1%)	900 (13.9%)	944 (13.0%	1124 (13.7%)	1315 (12.8%)	1720 (13.6%)	2081 (14.2%)	1595 (13.4%)	
60-69	1031 (29.4%)	1331 (29.5%)	1636 (30.4%)	1948 (30.1%)	2151 (29.6%)	2437 (29.6%)	3016 (29.5%)	3927 (31.0%)	4748 (32.3%)	3695 (31.1%)	
70-79	1277 (36.4%)	1724 (38.2%)	2053 (38.2%)	2438 (37.7%)	2873 (39.5%)	3253 (39.5%)	4212 (41.2%)	5002 (39.5%)	5742 (39.1%)	4786 (40.3%)	
≥80	571 (16.3%)	692 (15.3%)	823 (15.3%)	1176 (18.2%)	1302 (17.9%)	1416 (17.2%)	1691 (16.5%)	2014 (15.9%)	2128 (14.5%)	1799 (15.1%)	
% Female	57.7%	56.0%	57.9%	58.8%	59.9%	59.1%	59.7%	59.6%	59.4%	59.4%	
CCI mean	1.25 (1.81)	1.75 (2.21)	1.97 (2.41)	2.03 (2.44)	2.13 (2.55)	2.16 (2.53)	2.14 (2.45)	2.11 (2.48)	2.13 (2.55)	1.53 (2.17)	
CCI ≥2	1046 (29.8%)	1806 (40.0%)	2368 (44.0%)	2916 (45.1%)	3426 (47.1%)	4000 (48.6%)	1863 (47.5%)	5940 (46.9%)	6828 (46.5%)	4145 (34.9%)	
Home	1984 (56.6%)	2667 (59.1%)	3239 (60.2%)	3779 (58.5%)	4248 (58.4%)	4982 (60.5%)	6451 (63.0%)	8350 (65.9%)	10,258 (69.8%)	8640 (72.8%)	
Age											
<60	513 (25.9%)	628 (23.5%)	712 (22.0%)	729 (19.3%)	752 (17.7%)	906 (18.2%)	1084 (16.8%)	1429 (17.1%)	1751 (17.1%)	1403 (16.2%)	
60-69	705 (35.5%)	925 (34.7%)	1131 (34.9%)	1353 (35.8%)	1516 (35.7%)	1735 (34.8%)	2199 (34.1%)	2932 (35.1%)	3678 (35.9%)	2935 (34.0%)	
70-79	633 (31.9%)	922 (34.6%)	1169 (36.1%)	1330 (35.2%)	1615 (38.0%)	1893 (38.0%)	2600 (40.3%)	3235 (38.7%)	3877 (37.8%)	3419 (39.6%)	
≥80	133 (6.7%)	192 (7.2%)	227 (7.0%)	367 (9.7%)	365 (8.6%)	448 (9.0%)	568 (8.8%)	754 (9.0%)	952 (9.3%)	883 (10.2%)	
% Female	67.2%	66.0%	67.5%	68.5%	68.7%	68.7%	69.5%	69.4%	69.6%	70.8%	
CCI mean	0.96 (1.54)	1.35 (1.88)	1.50 (1.97)	1.56 (2.03)	1.64 (2.17)	1.70 (2.15)	1.69 (2.06)	1.72 (2.15)	1.74 (2.23)	1.29 (1.97)	
CCI ≥2	442 (22.3%)	841 (31.5%)	1139 (35.2%)	1390 (36.8%)	1611 (37.9%)	2010 (40.4%)	2600 (40.3%)	3359 (40.2%)	4113 (40.1%)	2621 (30.3%)	
Not home	1523 (43.4%)	1848 (40.9%)	2138 (39.8%)	2683 (41.5%)	3022 (41.6%)	3248 (39.5%)	3783 (37.0%)	4313 (34.1%)	4441 (30.2%)	3235 (27.2%)	
Age											
<60	115 (7.6%)	140 (7.6%)	153 (7.2%)	171 (6.4%)	192 (6.4%)	218 (6.7%)	231 (6.1%)	291 (6.7%)	330 (7.4%)	192 (5.9%)	
60-69	326 (21.4%)	406 (22.0%)	505 (23.6%)	595 (22.2%)	635 (21.0%)	702 (21.6%)	817 (21.6%)	995 (23.1%)	1070 (24.1%)	760 (23.5%)	
70-79	644 (42.3%)	802 (43.4%)	884 (41.3%)	1108 (41.3%)	1258 (41.6%)	1360 (41.9%)	1612 (42.6%)	1767 (41.0%)	1865 (42.0%)	1367 (42.3%)	
≥80	438 (28.8%)	500 (27.1%)	596 (27.9%)	809 (30.2%)	937 (31.0%)	968 (29.8%)	1123 (29.7%)	1260 (29.2%)	1176 (26.5%)	916 (28.3%)	
% Female	50.5%	49.1%	51.5%	51.9%	53.7%	52.7%	53.9%	54.5%	55.0%	55.2%	
CCI mean (SD)	1.64 (2.05)	2.33 (2.50)	2.68 (2.80)	2.69 (2.79)	2.82 (2.87)	2.88 (2.87)	2.89 (2.85)	2.87 (2.87)	3.02 (2.96)	2.15 (2.54)	
CCI ≥2	604 (39.7%)	965 (52.2%)	1229 (57.5%)	1526 (56.9%)	1815 (60.1%)	1990 (61.3%)	2263 (59.8%)	2581 (59.8%)	2715 (61.1%)	1524 (47.1%)	
NSQIP											
All patients					8306	13,490	18,290	21,235	27,232	32,367	34,627
Age											
<60					2786 (33.5%)	4062 (30.1%)	5612 (30.7%)	7025 (32.9%)	8624 (31.7%)	9845 (30.4%)	9962 (28.8%)
60-69					2641 (31.8%)	4449 (33.0%)	6141 (33.6%)	7132 (33.4%)	9303 (34.1%)	11,456 (35.4%)	12,328 (35.6%)
70-79					1870 (22.5%)	3395 (25.2%)	4465 (24.4%)	5027 (23.6%)	6582 (24.2%)	7967 (24.6%)	9040 (26.1%)
≥80					1009 (12.2%)	1584 (11.7%)	2072 (11.3%)	2141 (10.1%)	2723 (10.0%)	3099 (9.6%)	3297 (9.5%)
% Female					55.2%	56.2%	54.9%	54.7%	54.5%	54.0%	54.7%
ASA											
1					329 (4.0%)	626 (4.7%)	834 (4.6%)	908 (4.3%)	1073 (3.9%)	1260 (3.9%)	1280 (3.7%)
2					4644 (55.9%)	7611 (56.5%)	10,315 (56.4%)	11,835 (55.6%)	14,748 (54.2%)	16,957 (52.5%)	18,154 (52.5%)
≥3					3327 (40.1%)	5232 (38.8%)	7126 (39.0%)	8550 (40.2%)	11,392 (41.9%)	14,107 (43.6%)	15,155 (43.8%)
Home					5998 (72.2%)	9785 (72.5%)	13,760 (75.2%)	16,575 (77.7%)	21,857 (80.3%)	27,199 (84.0%)	30,122 (87.0%)
Age											
<60					2395 (39.9%)	3535 (36.1%)	4953 (36.0%)	6241 (37.6%)	7764 (35.5%)	9131 (33.6%)	9413 (31.3%)
60-69					2060 (34.3%)	3483 (35.6%)	4993 (36.3%)	5877 (35.5%)	7492 (36.3%)	10,089 (37.1%)	11,169 (37.1%)
70-79					1174 (19.6%)	2131 (21.8%)	2973 (21.6%)	3457 (20.9%)	4773 (21.9%)	6261 (23.0%)	7449 (24.7%)
≥80					369 (6.2%)	636 (6.5%)	840 (6.1%)	1000 (6.0%)	1378 (6.3%)	1718 (6.3%)	2091 (6.9%)
% Female					51.0%	51.9%	50.8%	51.2%	51.4%	51.5%	52.6%
ASA											
1					296 (4.9%)	596 (6.1%)	785 (5.7%)	865 (5.2%)	1035 (4.8%)	1209 (4.5%)	1249 (4.1%)
2					3670 (61.3%)	6013 (61.6%)	8385 (61.0%)	9894 (59.8%)	12,718 (58.2%)	15,216 (56.0%)	16,717 (55.6%)
≥3					2026 (33.8%)	3156 (32.3%)	4579 (33.3%)	5786 (35.0%)	8087 (37.0%)	10,734 (39.5%)	12,121 (40.3%)
Not home					2308 (27.8%)	3705 (27.5%)	4531 (24.8%)	4750 (22.3%)	5375 (19.7%)	5168 (16.0%)	4505 (13.0%)
Age											
<60					391 (16.9%)	527 (14.2%)	659 (14.5%)	784 (16.5%)	860 (16.0%)	714 (13.8%)	549 (12.2%)
60-69					581 (25.2%)	966 (26.1%)	1148 (25.3%)	1255 (26.4%)	1361 (25.3%)	1367 (26.5%)	1159 (25.7%)

(*continued on next page*)

Table 1 (*continued*)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
70-79					696 (30.2%)	1264 (34.1%)	1492 (32.9%)	1570 (33.1%)	1809 (33.7%)	1706 (33.0%)	1591 (35.3%)
≥80					640 (27.7%)	948 (25.6%)	1232 (27.2%)	1141 (24.0%)	1141 (24.0%)	1381 (26.7%)	1206 (26.8%)
% Female					66.1%	67.6%	67.4%	66.8%	67.0%	67.6%	68.3%
ASA											
1					33 (1.4%)	28 (0.7%)	49 (1.1%)	43 (0.9%)	38 (0.7%)	51 (1.0%)	31 (0.7%)
2					974 (42.2%)	1598 (43.2%)	1930 (42.6%)	1941 (40.9%)	2030 (37.8%)	1741 (33.7%)	1437 (31.9%)
≥3					1301 (56.4%)	2076 (56.1%)	2547 (56.3%)	2764 (58.2%)	3305 (61.5%)	3373 (65.3%)	3034 (67.4%)

ACS NSQIP, American College of Surgeons National Surgical Quality Improvement Program; CCI, Charlson Comorbidity Index; SD, standard deviation; ASA, American Society of Anesthesiologists.

THA in recent years. Additionally, we sought to assess whether duration of hospitalization was decreasing, patient comorbidity was increasing, and changes in hospitalization or discharge were associated with a resulting increase in reoperations or readmissions.

Materials and Methods

Patients undergoing THA were identified in the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) and Humana, Inc administrative claims databases. The ACS NSQIP database is comprised of data from over 800 private and academic US hospitals with patients covered by a variety of insurers, including Medicare and Medicaid. Perioperative and 30-day morbidity and mortality data are collected by trained abstractors. Further details regarding data collection are fully explained in the user guide [10]. Additionally, the database has internal auditing practices in place to ensure validity of the data and the disagreement rate has previously been reported at 1.8% [11]. Patients undergoing primary THA were queried using Current Procedural Terminology (CPT) code 27130 from years 2011 to 2017. Of note, 2011 was the first year discharge destination was available as a variable in the ACS NSQIP database [10]. Patients undergoing nonelective or emergent surgery, having disseminated cancer, and undergoing chemotherapy or radiation were excluded to avoid including THA performed for treatment of femoral neck fracture or an oncologic process.

Only patients with a clean wound class and presenting from home were included. Additional CPT codes filed at time of THA were individually assessed to determine whether the additional procedures conceivably could be performed at the time of a routine primary team or may have been related to an intraoperative complication. Patients were excluded if bilateral arthroplasty, revision arthroplasty, or other unrelated procedures clearly outside of what typically occurs during a routine, primary THA (ie, excision of malignant soft tissue mass, lymph node biopsy, knee arthroscopy) were performed. A complete list of included concurrent CPT codes is included in Appendix 1. Patients were subsequently classified as having discharged to home or not home locations, based upon definitions provided by the ACS NSQIP user guide [10]. Home destinations were defined as home, facility which was home, and multilevel senior community. Nonhome locations were skilled nursing facility (not home), unskilled facility (not home), separate acute care, and rehab. Patients who discharged against medical advice, who were discharged to hospice care, who expired during hospitalization, or without documented discharge destination were excluded. Length of stay (LOS), 30-day reoperations, 30-day readmissions, and the number of patients with an American Society of Anesthesiologists (ASA) score ≥3 were assessed at yearly intervals for all patients and those discharged to both home and not home locations.

The Humana administrative claims database contains over 24 million patient records, covered by both commercial insurance and Medicare Advantage Plans. Inclusion in the database, in contrast to NSQIP, is based on insurance coverage and is not dependent on hospital participation in a voluntary quality improvement program. The database was queried using the PearlDiver Research Program (www.pearldiverinc.com; PearlDiver Inc, Fort Wayne, IN). Patients undergoing primary THA were identified using International Statistical Classification of Diseases and Related Health Problem (ICD) 9 and 10 procedure codes. Patients were excluded if they underwent revision THA or hemiarthroplasty using CPT codes 27134, 27137, 27138, and 27125. Bilateral THA was excluding using the 50 modifier. Additionally, patients who underwent THA for femoral neck fracture, acetabular fracture, or metastatic disease were excluded using the respective ICD-9 and 10 diagnosis codes. A full list of excluded ICD codes is provided in Appendix 2. Only the first occurrence of THA in a calendar year was included to avoid a staged contralateral THA potentially counting as a 90-day readmission. Patients were subsequently stratified based on discharge destination and classified having been discharged to home or not home locations, as defined by the claims database. Home discharge locations were home and home with home health. Not home destinations included the following: skilled nursing facility, intermediate care facility, other nursing facility, or other hospital facility. The database contains records from 2007 through first quarter 2017; therefore, the end year for this portion of the study was 2016 to ensure readmissions and reoperations were captured for 90 days following surgery. LOS, 30-day readmissions, 90-day readmissions, and the number of patients with a Charlson Comorbidity Index (CCI) ≥2 were assessed at yearly intervals for all patients and those discharged to both home and not home locations. Ninety-day complications were only calculated through 2015 because full 90-day claims data were not available for all patients undergoing THA in year 2016. CCI scores were calculated by the PearlDiver Research Program utilizing coded medical comorbidities. The study was performed under human subjects research exemption granted by our institution's institutional review board. All data used in this study are de-identified and in compliance with the Health Insurance Portability and Accountability Act.

Analyses were completed using SAS software version 9.4 (SAS Institute, Inc, Cary, NC) and data from each of the 2 databases were analyzed independently. In both the ACS NSQIP and Humana databases, the Cochran-Armitage trend test was used to evaluate trends in LOS, reoperation, readmission, or comorbidity from 2011 to 2017 in home-discharged and nonhome-discharged patients. The trend test was used to evaluate whether there was an increase in proportion of the patients discharging to home destinations whether there were changes in 30-day readmission (ACS NSQIP and Humana), 30-day reoperation (ACS NSQIP), and 90-day readmission (Humana), and proportion of patients with an ASA score ≥3 (ACS NSQIP) or CCI ≥2 (Humana). Logistic regression was used to determine whether the odds of readmission, reoperation, and higher comorbidity was increasing over time in patients discharged home and not discharged home and whether this change in time differed between groups. Odds ratios (OR) and 95% confidence intervals (95% CI) for readmission, reoperation, and greater comorbidity burden were reported. Generalized linear models were used to evaluate change in hospital LOS from 2011 to 2017.

Results

In the ACS NSQIP database, 155,637 patients underwent THA and 54.7% were female. A total of 125,296 (80.5%) patients were discharged home and 30,342 (19.5%) patients were discharged to nonhome locations. Full demographic information is provided in Table 1. In 2011, 72.2% of patients were discharged to home and 27.8% of patients discharged to a nonhome location. By 2017, the percentage of patients discharging home increased to 87.0% and those not discharging home decreased to 13.0% ($P < .0001$). From 2011 to 2017, the percentage of patients discharged home with an ASA score ≥3 increased from 33.8% to 40.3% ($P < .0001$). For patients who did not discharge home, there was also an increase in patients with an ASA score ≥3, from 56.4% in 2011 to 67.4% in 2017 ($P < .0001$). Trends in comorbidity burden and discharge destination are shown in Figure 1.

LOS, 30-day readmission, and 30-day reoperation by year for ACS NSQIP patients are provided in Table 2. LOS decreased from 3.1 days in 2011 to 2.0 days in 2017 for patients being discharged home ($P < .0001$). LOS for patients from both databases is also shown in Figure 2. For patients not discharged home, LOS also decreased from 3.8 days to 3.6 days between 2011 and 2017. Thirty-day readmission decreased from 3.2% to 2.6% in those discharged home ($P = .018$). There was no significant change between 2011 and 2017 in 30-day reoperation rate for those discharged home ($P = .158$). For patients not discharged home, 30-day readmission increased from 5.0% in 2011 to 6.6% in 2017 ($P = .015$). For 30-day reoperation rate, there was an increase from 2.7% to 4.0% between 2011 and 2017 for patients discharged to nonhome destinations.

In the Humana administrative claims database, 84,832 patients underwent THA and 59.1% were female. In total, 54,596 (64.4%) patients were discharged home and 30,234 (35.6%) patients were discharged to a nonhome location. Demographic data for patients in the Humana administrative claims database are also provided in Table 1. The percentage of patients who were discharged home increased from 56.6% in 2007 to 72.8% in 2016 ($P < .0001$). The percentage of patients with a CCI ≥2 increased from 22.3% in 2007 to 30.3% in 2016, with a peak of 40.4% in 2012, for patients discharging home ($P < .0001$). For patients who were discharged to a nonhome location, patients with a CCI ≥2 increased from 39.7% to

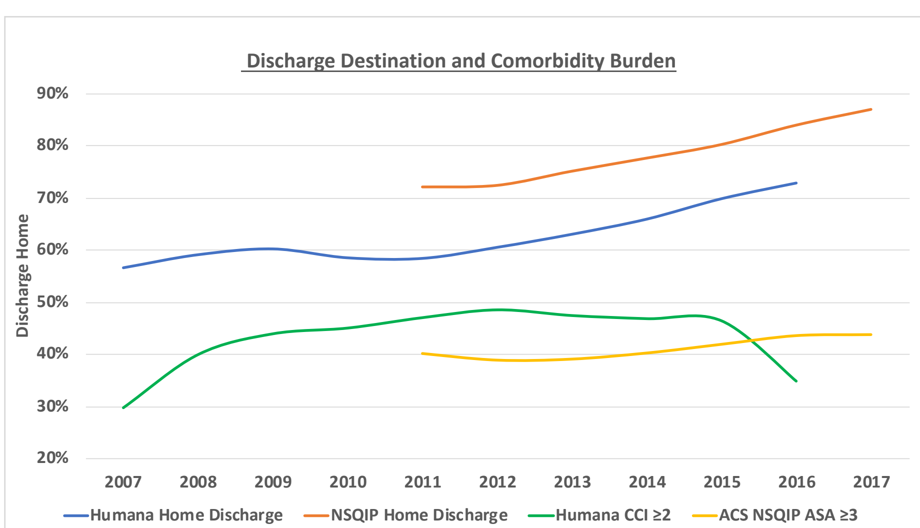

Fig. 1. Discharge destination and comorbidity burden. ACS NSQIP, American College of Surgeons National Surgical Quality Improvement Program; CCI, Charlson Comorbidity Index; ASA, American Society of Anesthesiologists.

Table 2
ACS NSQIP Length of Stay, Readmissions, and Reoperations by Year.

	2011	2012	2013	2014	2015	2016	2017	*P*
Home discharge								
Mean length of stay (d	3.1	2.9	2.7	2.5	2.3	2.2	2.0	<.0001
30-d Readmission	3.2%	2.9%	2.8%	2.8%	2.8%	2.7%	2.6%	.018
30-d Reoperation	1.7%	1.6%	1.5%	1.6%	1.8%	1.6%	1.4%	.158
Not home discharge								
Mean length of stay (d)	3.8	3.6	3.7	3.6	3.6	3.6	3.6	.0003
30-d Readmission	5.9%	5.0%	5.5%	6.1%	5.8%	6.0%	6.6%	.015
30-d Reoperation	2.7%	2.5%	2.9%	3.4%	3.5%	3.4%	4.0%	<.0001

ACS NSQIP, American College of Surgeons National Surgical Quality Improvement Program.

47.1% between 2007 and 2016 ($P < .0001$). Between 2007 and 2017, the OR for having a CCI ≥2 for patients discharging home was 1.36 (95% CI, 1.20-1.53; $P < .0001$) and 1.52 (95% CI, 1.36-1.71; $P < .0001$) for patients who were not discharged home.

LOS, 30-day readmissions, and 90-day readmissions for Humana patients are provided in Table 3. For patients who were discharged to home, LOS decreased from 3.4 days in 2007 to 1.9 days in 2016 ($P < .0001$). LOS decreased from 5.6 days to 3.4 days between 2007 and 2016 for patients who were discharged to nonhome locations ($P < .0001$). Thirty-day readmissions decreased from 4.1% in 2007 to 2.7% in 2016 for patients discharging home ($P < .0001$). Ninety-day readmissions similarly decreased from 8.5% to 7.4% between 2007 and 2015 ($P < .0001$). For patients who were not discharged home, 30-day readmissions decreased from 8.5% to 4.9% between 2007 and 2016 ($P < .0001$). Ninety-day readmission decreased from 14.1% in 2007 to 12.3% in 2015 for patients who did not discharge home ($P < .0001$). Odds of 30-day readmission between 2007 and 2016 were significantly lower in both those discharged home (OR, 0.55; 95% CI, 0.43-0.70; $P < .0001$) and not discharged home (OR, 0.65; 95% CI, 0.50-0.84; $P = .001$). This was not observed for 90-day readmission rates.

Discussion

This study found that more patients are being discharged to home after primary THA and patients are having shorter hospital LOS with fewer readmissions. Reoperations were also found to have decreased for patients discharged home. These improvements occurred despite a significant increase in the proportion of patients with a higher degree of medical comorbidity, as assessed by ASA classification and CCI score.

Grosso et al found a similar decrease in LOS and overall complications after THA between 2006 and 2016, despite broadly querying by CPT code without exclusion of indications such as tumor or fracture that could influence postoperative complications [12]. ACS NSQIP patients who were unable to be discharged to home were found to have a significantly increased rate of both 30-day readmission and reoperation. Conversely, patients insured by Humana were found to have fewer 30-day and 90-day readmissions. Increased rates of readmission and reoperation among ACS NSQIP patients not discharged to home may be a consequence of the successful expansion of home discharge, resulting in a situation where only the patients at greatest risk of these complications are discharged to nonhome locations. Similarly, Otero et al found patients requiring hospitalization for greater than 3 days had increased complications and hospital readmission [13].

Reduction in LOS, increased discharge home, and reduction in perioperative complications resulting in readmission or reoperation are likely the result of improvements in preoperative patient optimization, expansion of multimodal analgesia, and patient education before these elective procedures. Interventions in the preoperative period have been shown to be highly successful in reducing LOS and decreasing overall costs of care [14–24]. Other advancements in arthroplasty practice, such as improvements in surgical technique, greater understanding of the hip-spine relationship, or utilization of larger femoral heads and dual-mobility components, may also have contributed to the findings observed in this study. ACS NSQIP-participating hospitals discharged 84.0% of

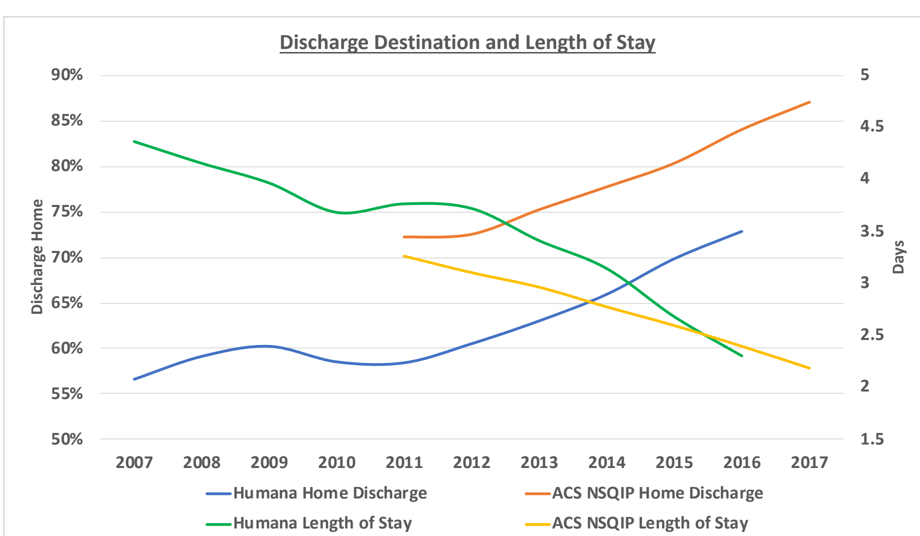

Fig. 2. Discharge destination and length of stay.

Table 3
Humana Claims Database Length of Stay and Readmissions by Year.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	*P*
Home discharge											
Mean length of stay (d)	3.4	3.3	3.3	3.1	3.4	3.3	2.9	2.6	2.2	1.9	<.0001
30-d Readmission	4.1%	4.1%	4.8%	4.1%	3.7%	3.9%	3.4%	3.6%	3.0%	2.7%	<.0001
90-d Readmission	8.5%	8.2%	9.8%	8.2%	8.4%	8.2%	7.4%	7.7%	7.4%	[a]	<.0001
Not home discharge											
Mean length of stay (d)	5.6	5.4	5.0	4.5	4.3	4.4	4.3	4.1	3.8	3.4	<.0001
30-d Readmission	8.5%	8.7%	8.8%	8.9%	8.3%	8.3%	7.9%	6.8%	6.3%	4.9%	<.0001
90-d Readmission	14.1%	15.0%	14.5%	15.6%	14.6%	15.8%	13.7%	12.5%	12.3%	[a]	<.0001

[a] Humana dataset through 2017 Q1 and complete 90-d readmission data are not available for year 2016.

patients home after primary THA in 2016, compared to 72.8% of patients covered by Humana plans in the same year. Greater success among ACS NSQIP-participating hospitals with home discharge after THA may be related to a greater focus on quality improvement, evidenced by voluntary participation in this program, compared to hospitals overall. Additionally, the Humana administrative claims database includes patients with both commercial and Medicare Advantage insurance plans. Relative distributions of payor type may vary and this may influence parameters such as discharge destination; however, age distribution of patients was similar between the 2 databases. While outcomes after THA have been demonstrated to vary when studied in different large databases, further investigation is needed as to why patients from ACS NSQIP-participating hospitals demonstrated greater discharge to home than those from a commercial insurance database [25].

This study demonstrates increased rates of discharge to home were starting to occur as early as 2011-2012 and similar improvements were observed in LOS around 2013-2014 for both databases, which may be related to the introduction of Bundled Payments for Care Improvement in 2011 [3]. This study did not directly assess the financial impact of increased discharge home after primary THA, shorter hospital LOS, and decreased readmissions or reoperations. However, hospitalization LOS and postdischarge care are major contributors to a THA episode of care and these improvements likely resulted in a significant cost savings for both hospital and payors [2,9]. Further studies are needed to better quantify the cost savings resulting from improvements in an episode of care for THA patients. While these improvements have the potential to provide cost savings, achieving and maintaining them require utilization of practice resources and has an associated cost to surgeons. A recent survey of American Association of Hip and Knee Surgeons members found greater than 80% of respondents believed the amount of preoperative work has increased to achieve shorter hospital LOS [26]. Surgeon work in the perioperative period for TJA exceeds the amount of work relative value units assigned by the American Medical Association's Relative Value Scale Update Committee (RUC) [27]. Many of the tasks related to coordination of care, arranging preoperative medical clearance, and managing insurance-related issues are conducted via telephone. While these essential tasks require resources, contemporary RUC reviews do not account for these efforts for when evaluating a procedure. Kheir et al [28] estimated 1.61 additional work relative value units were performed for perioperative telephone encounters associated with primary THA. Nonoffice tasks relating to coordination of care may further increase as a result of the COVID-19 pandemic. The recent removal of THA from the inpatient-only list and expansion of outpatient THA is likely to only further increase the perioperative burden of tasks related to coordination of care [29]. Despite improvement in care and increasing noncompensated tasks relating to coordination of care, Centers for Medicare and Medicaid Services recently flagged primary THA as potentially being misvalued and scheduled review by the RUC [30]. These reviews do not account for all perioperative aspects of care, and some tasks relating to achieving and maintaining improvements may be overlooked.

Limitations of this study include use of retrospective data. Patients were identified using CPT and ICD codes, and the findings of this study are dependent on correct coding. The ACS NSQIP database contains internal quality control measures to provide accurate data [10]. The Humana database contains data from insurance claims and has internal controls in place to ensure accuracy of submitted claims [30]. The sample of patients used in this study may not be perfectly representative of all patients undergoing primary THA; however, these are large national databases including a large variety of patients. The Humana database contains records from only a single insurer, and it is possible data from other insurers could differ from the findings of this study. We are unable to determine reasons why individual patients were discharged to either home or nonhome destinations, and we did not assess specific reasons for readmission or reoperation. Additionally, findings from the ACS NSQIP database are limited to 30 days following the surgical procedure.

Conclusion

Significantly more patients are being discharged to home after primary THA and they are having shorter hospital LOS. These improvements occurred despite an increasing patient comorbidity burden. ACS NSQIP-participating hospitals were able to achieve greater proportion of discharge to home compared to patients in the Humana administrative claims database. Home discharge was found to have occurred concurrently with decreases in both readmission and reoperation. These data demonstrate the improvements in care have increased overall value in THA care. Results did differ when making comparison between databases. As such, the source of the data should be considered when considering changes in policy or reimbursement.

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Appendix 1. Included ACS NSQIP Concurrent CPT Codes

1214, 1215, 1991, 20680, 20900, 20902, 20926, 20985, 23020, 27000, 27001, 27003, 27005, 27006, 27025, 27036, 27054, 27060, 27062, 27095, 27097, 27100, 27110, 27170, 27226, 27227, 27228, 27244, 27245, 27246, 27248, 27305, 27306, 27506, 27507, 27570, 34203, 35226, 36010, 36147, 36430, 36513, 36556, 36620, 37191, 37618, 37620, 37620, 37799, 37799, 43752, 51102, 51701, 51702, 51703, 62311, 62319, 62322, 64425, 64447, 64448, 64449, 64450, 64483, 64708, 64708, 64712, 69990, 72170, 73500, 73502, 73503, 73510, 73520, 73530, 75825, 75940, 76000, 76001, 77002, 85610, 86850, 86900, 86901, 86923, 90935, 94002, 94003, 94660, 96372, 0054T, 0055T, 4046F, 4049F.

Appendix 2. Excluded Humana Administrative Claims Database ICD Codes

Metastatic Malignancy

ICD-9:
170.6, 170.7
ICD-10:
C40.20, C40.21, C40.22, C41.4

Trauma

ICD-9:
820.00, 820.01, 820.02, 820.03, 820.09, 820.10, 820.11, 820.12, 820.13, 820.19, 808.0, 808.1
ICD-10:
S72.001A, S72.001B, S72.001C, S72.002A, S72.002B, S72.002C, S72.009A, S72.009B, S72.009C, S72.011A, S72.011B, S72.011C, S72.012A, S72.012B, S72.012C, S72.019A, S72.019B, S72.019C, S72.021A, S72.021B, S72.021C, S72.022A, S72.022B, S72.022C, S72.023A, S72.023B, S72.023C, S72.024A, S72.024B, S72.024C, S72.025A, S72.025B, S72.025C, S72.026A, S72.026B, S72.026C, S72.031A, S72.031B, S72.031C, S72.032A, S72.032B, S72.032C, S72.033A, S72.033B, S72.033C, S72.034A, S72.034B, S72.034C, S72.035A, S72.035B, S72.035C, S72.036A, S72.036B, S72.036C, S72.041A, S72.041B, S72.041C, S72.042A, S72.042B, S72.042C, S72.043A, S72.043B, S72.043C, S72.044A, S72.044B, S72.044C, S72.045A, S72.045B, S72.045C, S72.046A, S72.046B, S72.046C, S72.051A, S72.051B, S72.051C, S72.052A, S72.052B, S72.052C, S72.059A, S72.059B, S72.059C, S72.061A, S72.061B, S72.061C, S72.062A, S72.062B, S72.062C, S72.063A, S72.063B, S72.063C, S72.064A, S72.064B, S72.064C, S72.065A, S72.065B, S72.065C, S72.066A, S72.066B, S72.066C, S72.091A, S72.091B, S72.091C, S72.092A, S72.092B, S72.092C, S72.099A, S72.099B, S72.099C, S32.401A, S32.401B, S32.402A, S32.402B, S32.409A, S32.409B, S32.411A, S32.411B, S32.412A, S32.412B, S32.413A, S32.413B, S32.414A, S32.414B, S32.415A, S32.415B, S32.416A, S32.416B, S32.421A, S32.421B, S32.422A, S32.422B, S32.423A, S32.423B, S32.424A, S32.424B, S32.425A, S32.425B, S32.426A, S32.426B, S32.431A, S32.431B, S32.432A, S32.432B, S32.433A, S32.433B, S32.434A, S32.434B, S32.435A, S32.435B, S32.436A, S32.436B, S32.441A, S32.441B, S32.442A, S32.442B, S32.443A, S32.443B, S32.444A, S32.444B, S32.445A, S32.445B, S32.446A, S32.446B, S32.451A, S32.451B, S32.452A, S32.452B, S32.453A, S32.453B, S32.454A, S32.454B, S32.455A, S32.455B, S32.456A, S32.456B, S32.461A, S32.461B, S32.462A, S32.462B, S32.463A, S32.463B, S32.464A, S32.464B, S32.465A, S32.465B, S32.466A, S32.466B, S32.471A, S32.471B, S32.472A, S32.472B, S32.473A, S32.473B, S32.474A, S32.474B, S32.475A, S32.475B, S32.476A, S32.476B, S32.481A, S32.481B, S32.482A, S32.482B, S32.483A, S32.483B, S32.484A, S32.484B, S32.485A, S32.485B, S32.486A, S32.486B, S32.491A, S32.491B, S32.492A, S32.492B, S32.499A, S32.499B