

General

The Most Influential Publications in Outpatient Total Joint Arthroplasty

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Background

Total joint replacements are some of the most common procedures performed by surgeons. There has been a recent increase to transition these procedures to the outpatient setting.

Objective

Our study seeks to identify the most influential publications, in terms of total citations, regarding outpatient total hip and knee replacement surgeries.

Methods

The database used to collect the data for this analysis was Clarivate Analytics Web of Science. The search query selected and used to collect data was: “outpatient or ambulatory,” with a “Title” filter AND “total joint replacement” AND “total joint arthroplast*” with “Topic” filters. The papers returned were then sorted by total number of citations and exported to Google Sheets for further analysis.

Results

The most cited publication was “Outpatient total knee arthroplasty with a minimally invasive technique,” by Berger et al.. This was the oldest publication analyzed (2005), the most recent publication being published in 2020. The publications analyzed were cited a total number of 1,774 times and averaged 35.5 citations per year. The Journal with the most attributable publications was The Journal of Arthroplasty.

Conclusion

This study provides a measure of the most cited articles on outpatient arthroplasty. Most literature on the topic were categorized as Clinical Science and Outcomes (50%), comprised level of evidence III (28%), were published in the Journal of Arthroplasty (54%) and came out of the United States (76%). Knowledge of these most influential articles allows for a foundation of understanding on a rapidly growing area of arthroplasty among clinicians.

INTRODUCTION

Total joint replacements are one of the most common surgical procedures in America, and they are being performed at an increase rate. Hip and knee replacements are pro-

jected to increase by 71% and 85%, respectively, by 2030.¹ As of 2010, there were over 1 million total hip and knee replacement procedures performed each year in the United States.² In the United State from 1959 to 2016, life expectancy has increased from 69.9 to 78.9,³ one can assume

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that total joint replacements will only become more prevalent as the population of the United States continues to age. Predictions show that the number of total knee arthroplasty will increase 14% between 2012 and 2050.⁴ With new advances in the field, better optimization, rapid recovery protocols, and new technology, patients are recovering faster and expected to go home sooner.

Currently, most joint replacement surgeries are still performed as inpatient procedures, even though Medicare has taken them out of the in-patient only list. However, there are factors that may cause a shift in this paradigm. Firstly, outpatient total knee arthroplasty (TKA) reduces the cost, on average, by \$8,527 and has been shown to be efficacious and safe, given that the patient meets appropriate inclusion criteria.⁴ When comparing outpatient THA vs inpatient THA, patients undergoing outpatient THA have reported better outcomes in several categories without any statistically significant detriments.^{5,6} Early studies show promising results in terms of outpatient joint replacement surgery. Therefore, it is no surprise that even before COVID a 2019 study predicted that half of all primary joint arthroplasties will be performed in an outpatient setting by 2026.⁷

Given the prevalence of the surgery and the trajectory in which it is going, the authors of this paper sought to analyze the current literature on outpatient total joint arthroplasties. The analysis will be in the form of a bibliometric review, focused on citation frequency. A citation analysis, which this is commonly termed, involves using the number of citations a publication has amassed to quantify its influence on the field. Though direct impact cannot be directly correlated with total number of citations, this analysis creates a baseline for how far TJA research has come and may elucidate any trends for future researcher and clinicians alike.

METHODS

The database used to collect the data for this analysis was Clarivate Analytics Web of Science (WoS), a global publisher-independent citation database. A search query which optimized the number of results and quality of publications was used. This was accomplished via different iterations of Boolean search terms. The final search query selected and used to collect data was: “outpatient or ambulatory,” with a “Title” filter AND “total joint replacement” AND “total joint arthroplast*” with “Topic” filters. Specifically, the term “arthoplast*” was used to avoid unnecessary omission of articles with topics including a plural or past tense term. This search yielded 170 unique results, which required no additional filtering. The papers returned were then sorted by total number of citations and exported to Google Sheets for further analysis. An initial review of this search was deemed acceptable by two independent reviewers (JW and JL), with the understanding that some articles would need to be excluded on the grounds of being tangential or related to Outpatient Total Joint Replacement, but not being included as the primary topic of investigation.

67 papers, in total, were reviewed by two independent reviewers (JW and JL). 50 were deemed acceptable as their

primary focus of investigation was Outpatient Total Joint Replacement. 17 papers ended up being excluded from our analysis, primarily pertaining to anesthesia care, post-operative physical therapy modalities, or inpatient total joint replacement.

The full-text publications of the top 50 included results were then reviewed to determine the Level of Evidence according to Oxford’s guideline. The guidelines for Level of Evidence were as follows:

1 = Systematic reviews of randomized trials, or systematic reviews of inception cohort studies.

2 = Systematic reviews of cohort studies, inception cohort studies, cross-sectional studies, randomized trials, or observational study with dramatic effect.

3 = Cohort studies (primarily retrospective), epidemiological/observational study

4 = Case-control studies, low impact cohort studies, animal trials

5 = Simulations, models, or mechanism-based reasoning

The publications were simultaneously reviewed for classification within the following categories: Clinical Outcomes, Classification, Clinical Guidelines, Economics, and Perceptions. These categories were selected by the authors as the most common topic observed in the top 50 publications.

Using the analysis tools included in the Clarivate Analytics Web of Science (WoS) database, additional data was obtained from the 50 included publications including: primary author, country of origin, number of citations overall, year of publication, and publishing journal. To mitigate inflation in citation quantity for older articles, the results were also sorted by number of citations per year since their publication.

Lastly, the reviewers stratified the publications based on what joint was replaced in each of the papers. This was broken down into Hip, Knee, Hip and Knee, Shoulder, Ankle and Elbow. Shoulder, Ankle, and Elbow were excluded. Only Hip, Knee or papers that included both Hip and Knee were included in the study.

RESULTS

There were five authors who contributed two publications each (Bovonratwet, Courtney, Gromov, Meneghini and Ziemba-Davis) [Figure 1]. The most most popular year for publication was 2018 [Figure 2], which produced 15 publications (30%), followed by 2017, which produced an additional 14 publications (28%). There were zero publications in 2006 and 2008, as well as from 2010-2014 [Figure 2].

Six countries could be attributed to all 50 publications analyzed in this study [Figure 3]. The country that produced the most publications was the United States (n=40), the countries with the second most publications were Denmark (n=4) and The Netherlands (n=4). The remainder of the publications could be attributed to Canada, England, and France. The Indiana University System was the institution(s) with the most attributed publications (n=12), followed by Rush University (n=7) and the University of

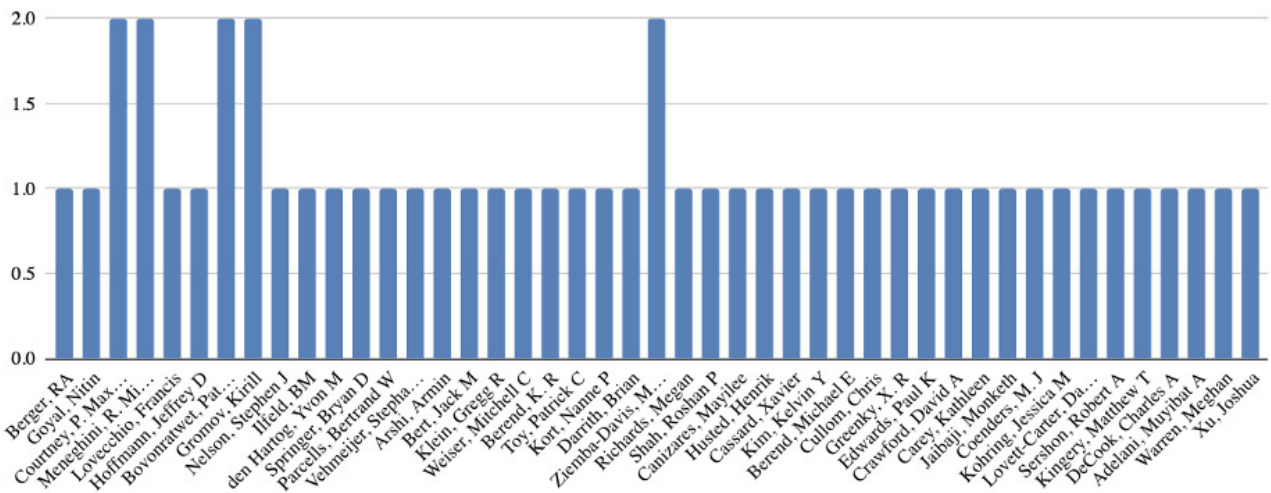


Figure 1. Author Frequency

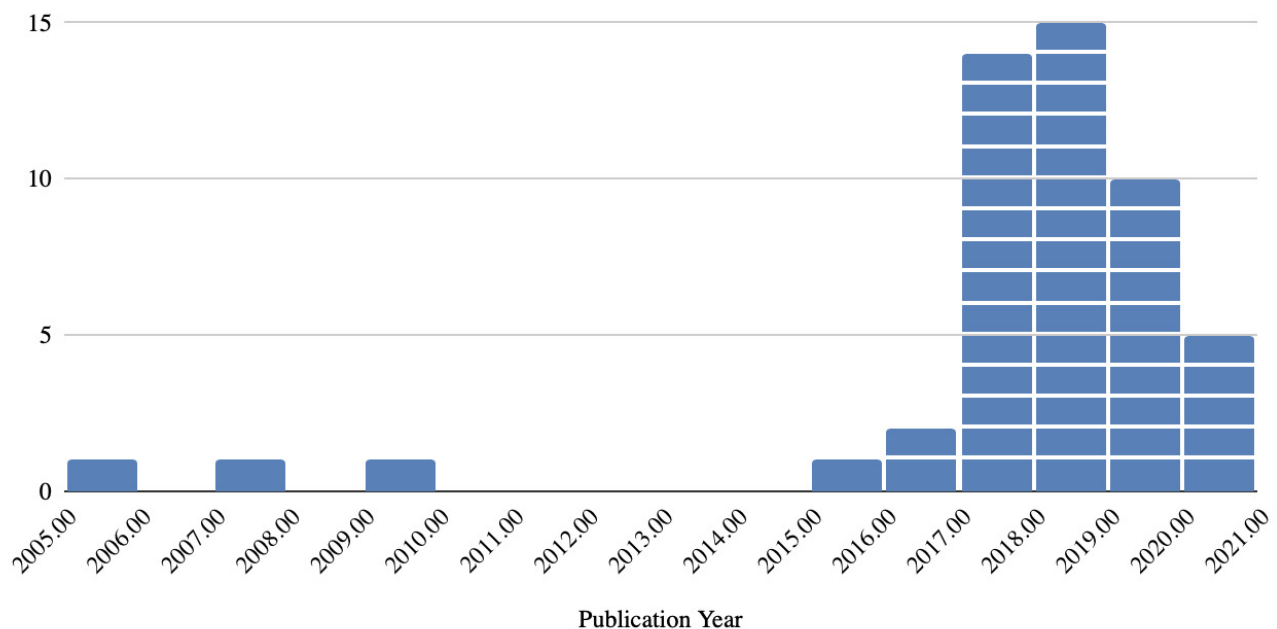


Figure 2. Histogram of Publication Year

Copenhagen (n=4) [Table 1]. Eight other institutions were attributed with three publications.

The 50 publications analyzed for this study were cited a total of 1,774 times (including self citations). The average number of citations for the top 50 articles was 35.5 citations per publication. The raw numbers for total citations and citations per article may be skewed lower due to the recency of the publications, on average. The most cited article amassed 147 citations while the least cited article was cited 8 times. The most recently published article in the top 50 was published in 2020 and the oldest publication analyzed was published in 2005 [Table 2].

The journal that published the most articles in this study was Journal of Arthroplasty, publishing 27 articles (54%). This was followed by ACTA Orthopaedica with 5 publica-

tions (10%). In total, our study included papers from 16 different journals [Figure 4].

Both Total Hip Arthroplasty and Total Knee Arthroplasty were equally investigated in this study with 12 unique papers each. After excluding Total Shoulder Arthroplasty, Total Ankle Arthroplasty, and Total Elbow Arthroplasty, there was only one remaining publication that described Outpatient Total Joint Replacement in general, rather than with respect to specific joints. Although, most of the current literature remains focused on hip and knee. Additionally, our authors found that papers with titles describing “Joint Replacements” almost always referred to both hip and knee arthroplasty. Of note, 25 publications focused on both hip and knee replacement outpatient surgery. [Figure 5].

Of the 50 articles analyzed, most publications met criteria for Level III (n=28, 56%) in terms of Level of Evidence

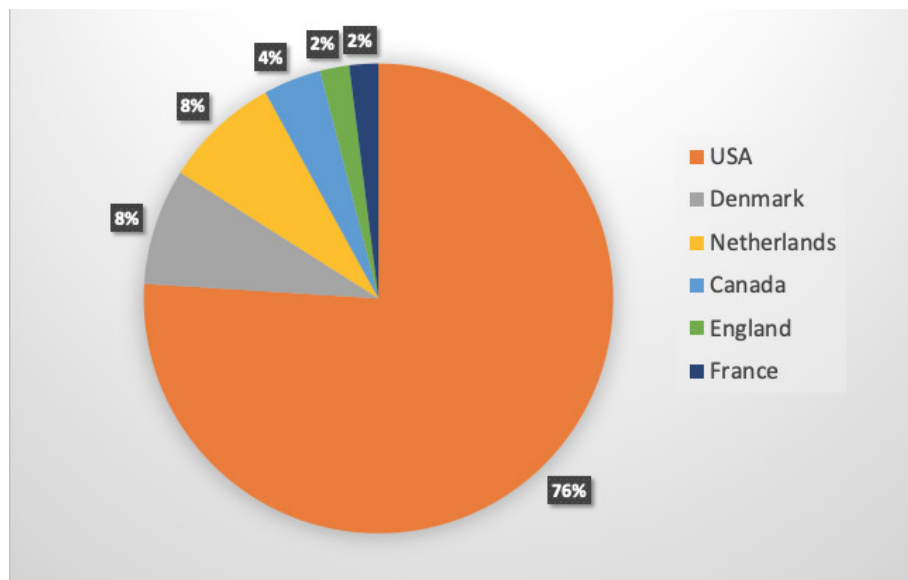


Figure 3. Publications by Country of Origin

Table 1. Contributing Institutions

Name of Institution	Location of Institution	Number of Articles
Indiana University System	Bloomington, Indiana, USA	12
Rush University	Chicago, Illinois, USA	7
University of Copenhagen	Copenhagen, Denmark	4

Multiple institutions may be attributed to a single publication. Only institutions with 4 or more contributions are included.

(LOE) [Figure 6]. Two publications were classified as a Level I publication. There were 10 Level II publications, four Level IV publications and four Level V publications, creating a rather “normal” statistical distribution of data [Figure 6]. There were not any publications in the study that were unable to be assigned an LOE. In terms of categorization of the publications, the most common article category was Clinical Outcomes (n=34). Clinical Guidelines was the second most common category with 12 publications. Unique categories pertaining to outpatient total joint replacement included Economics, contributing six publications, and Perceptions, contributing four publications [Figure 7]. Only two publications were not applicable to our classification system (Shah, Roshan P. et al and Warren, et al), which discussed the surgeon’s increased burden of care and a geographical analysis, respectively. Of note, some publications spanned two categories. Those which spanned two categories were included in the total count, once for each classification.

The three most cited articles in this study described Clinical Outcomes. The most cited article was “Outpatient total knee arthroplasty with a minimally invasive technique,” (2005) by Berger et al.. The study published outcomes from a specific minimally invasive TKA technique. “Otto Aufranc Award: A Multicenter, Randomized Study of Outpatient versus Inpatient Total Hip Arthroplasty,” (2017) by Goyal et al., was the second most cited article in the top 50. The authors of this study conducted a randomized

trial to evaluate clinical outcomes of patients undergoing THA who are discharged on the same day as the surgery compared with those who are discharged after an overnight hospital stay. Furthermore, the 2017 article by Courtney et al., titled “Complications Following Outpatient Total Joint Arthroplasty: An Analysis of a National Database,” was the third most cited article in this study. This study provided guidelines by determining the complications associated with outpatient total joint arthroplasty (TJA) and identifying high-risk patients they thought should be excluded from these protocols.

After ranking the articles in the top 50 based on the number of citations accrued per year since their publication, rather than total citations, the two publications by Goyal et al and Courtney et al, were both in the top three. However, the 2005 article by Berger et al., “Outpatient total knee arthroplasty with a minimally invasive technique,” was not in the top 10 based on citations per year, accruing 9.2 citations per year, likely due to it being slightly ahead of its time and being published 12 years before the peak of research on this topic. Every article in the top 10 ranked in order of citation per year was published in 2016 or later [Table 3].

DISCUSSION

By performing a bibliometric review on “Outpatient Total Joint Replacements” this study aimed to identify the ar-

Table 2. Top 50 Most Cited Outpatient Total Hip and Knee Arthroplasty Publications

Rank	Publication	Total Citations	Citations/ Year of Publication Until 2021
1	Berger, R. A., et al. (2005). "Outpatient total knee arthroplasty with a minimally invasive technique." <i>J Arthroplasty</i> 20(7 Suppl 3): 33-38.	147	9.2
2	Goyal, N., et al. (2017). "Otto Aufranc Award: A Multicenter, Randomized Study of Outpatient versus Inpatient Total Hip Arthroplasty." <i>Clin Orthop Relat Res</i> 475(2): 364-372.	100	25.0
3	Courtney, P. M., et al. (2017). "Complications Following Outpatient Total Joint Arthroplasty: An Analysis of a National Database." <i>J Arthroplasty</i> 32(5): 1426-1430.	92	23.0
4	Meneghini, R. M., et al. (2017). "Safe Selection of Outpatient Joint Arthroplasty Patients With Medical Risk Stratification: the "Outpatient Arthroplasty Risk Assessment Score"." <i>J Arthroplasty</i> 32(8): 2325-2331.	87	21.8
5	Lovecchio, F., et al. (2016). "Is Outpatient Arthroplasty as Safe as Fast-Track Inpatient Arthroplasty? A Propensity Score Matched Analysis." <i>J Arthroplasty</i> 31(9 Suppl): 197-201.	83	16.6
6	Hoffmann, J. D., et al. (2018). "The Shift to Same-Day Outpatient Joint Arthroplasty: A Systematic Review." <i>J Arthroplasty</i> 33(4): 1265-1274.	72	24.0
7	Bovonratwet, P., et al. (2017). "Comparison of Outpatient vs Inpatient Total Knee Arthroplasty: An ACS-NSQIP Analysis." <i>J Arthroplasty</i> 32(6): 1773-1778.	64	16.0
8	Gromov, K., et al. (2017). "Feasibility of outpatient total hip and knee arthroplasty in unselected patients." <i>Acta Orthop</i> 88(5): 516-521.	62	15.5
9	Nelson, S. J., et al. (2017). "Is Outpatient Total Hip Arthroplasty Safe?" <i>J Arthroplasty</i> 32(5): 1439-1442.	55	13.8
10	Ilfeld, B. M., et al. (2007). "Hospitalization costs of total knee arthroplasty with a continuous femoral nerve block provided only in the hospital versus on an ambulatory basis: a retrospective, case-control, cost-minimization analysis." <i>Reg Anesth Pain Med</i> 32(1): 46-54.	53	3.8
11	Hartog, Y. M., et al. (2015). "Total hip arthroplasty in an outpatient setting in 27 selected patients." <i>Acta Orthop</i> 86(6): 667-670.	52	8.7
12	Springer, B. D., et al. (2017). "Impact of Inpatient Versus Outpatient Total Joint Arthroplasty on 30-Day Hospital Readmission Rates and Unplanned Episodes of Care." <i>Orthop Clin North Am</i> 48(1): 15-23.	49	12.3
13	Parcells, B. W., et al. (2016). "Total Joint Arthroplasty in a Stand-alone Ambulatory Surgical Center: Short-term Outcomes." <i>Orthopedics</i> 39(4): 223-228.	47	9.4
14	Bovonratwet, P., et al. (2017). "Definitional Differences of 'Outpatient' Versus 'Inpatient' THA and TKA Can Affect Study Outcomes." <i>Clin Orthop Relat Res</i> 475(12): 2917-2925.	46	11.5
15	Vehmeijer, S. B. W., et al. (2018). "Outpatient total hip and knee arthroplasty." <i>Acta Orthop</i> 89(2): 141-144.	40	13.3
16	Arshi, A., et al. (2017). "Outpatient Total Knee Arthroplasty Is Associated with Higher Risk of Perioperative Complications." <i>J Bone Joint Surg Am</i> 99(23): 1978-1986.	40	10.0
17	Bert, J. M., et al. (2017). "Outpatient Total Joint Arthroplasty." <i>Curr Rev Musculoskelet Med</i> 10(4): 567-574.	38	9.5
18	Courtney, P. M., et al. (2018). "Can Total Knee Arthroplasty Be Performed Safely as an Outpatient in the Medicare Population?" <i>J Arthroplasty</i> 33(7S): S28-S31.	37	12.3
19	Klein, G. R., et al. (2017). "Same Day Total Hip Arthroplasty Performed at an Ambulatory Surgical Center: 90-Day Complication Rate on 549 Patients." <i>J Arthroplasty</i> 32(4): 1103-1106.	37	9.3
20	Weiser, M. C., et al. (2018). "Outpatient Total Hip Arthroplasty Has Minimal Short-Term Complications With the Use of Institutional Protocols." <i>J Arthroplasty</i> 33(11): 3502-3507.	35	11.7
21	Berend, K. R., et al. (2018). "The outpatient total hip arthroplasty : a paradigm change." <i>Bone Joint J</i> 100-B(1 Supple A): 31-35.	31	10.3
22	Toy, P. C., et al. (2018). "Low Rates of Adverse Events Following Ambulatory Outpatient Total Hip Arthroplasty at a Free-Standing Surgery Center." <i>J Arthroplasty</i> 33(1): 46-50.	31	10.3

Rank	Publication	Total Citations	Citations/ Year of Publication Until 2021
23	Kort, N. P., et al. (2017). "Patient selection criteria for outpatient joint arthroplasty." <i>Knee Surg Sports Traumatol Arthrosc</i> 25(9): 2668-2675.	31	7.8
24	Darrith, B., et al. (2019). "Inpatient Versus Outpatient Arthroplasty: A Single-Surgeon, Matched Cohort Analysis of 90-Day Complications." <i>J Arthroplasty</i> 34(2): 221-227.	29	14.5
25	Ziembra-Davis, M., et al. (2019). "Outpatient Joint Arthroplasty-Patient Selection: Update on the Outpatient Arthroplasty Risk Assessment Score." <i>J Arthroplasty</i> 34(7S): S40-S43.	28	14.0
26	Richards, M., et al. (2018). "An Evaluation of the Safety and Effectiveness of Total Hip Arthroplasty as an Outpatient Procedure: A Matched-Cohort Analysis." <i>J Arthroplasty</i> 33(10): 3206-3210.	26	8.7
27	Shah, R. P., et al. (2019). "Rapid Discharge and Outpatient Total Joint Arthroplasty Introduce a Burden of Care to the Surgeon." <i>J Arthroplasty</i> 34(7): 1307-1311.	24	12.0
28	Gromov, K., et al. (2019). "Complications and readmissions following outpatient total hip and knee arthroplasty: a prospective 2-center study with matched controls." <i>Acta Orthop</i> 90(3): 281-285.	24	12.0
29	Canizares, M., et al. (2009). "A population-based study of ambulatory and surgical services provided by orthopaedic surgeons for musculoskeletal conditions." <i>BMC Health Serv Res</i> 9: 56.	22	1.8
30	Husted, H., et al. (2018). "Time-driven activity-based cost of outpatient total hip and knee arthroplasty in different set-ups." <i>Acta Orthop</i> 89(5): 515-521.	21	7.0
31	Cassard, X., et al. (2018). "Outpatient total knee arthroplasty: Readmission and complication rates on day 30 in 61 patients." <i>Orthop Traumatol Surg Res</i> 104(7): 967-970.	20	6.7
32	Kim, K. Y., et al. (2018). "Rapid Discharge in Total Hip Arthroplasty: Utility of the Outpatient Arthroplasty Risk Assessment Tool in Predicting Same-Day and Next-Day Discharge." <i>J Arthroplasty</i> 33(8): 2412-2416.	20	6.7
33	Berend, M. E., et al. (2018). "Outpatient-Focused Joint Arthroplasty Is the Future: The Midwest Center for Joint Replacement Experience." <i>J Arthroplasty</i> 33(6): 1647-1648.	20	6.7
34	Meneghini, R. M. and M. Ziembra-Davis (2017). "Patient Perceptions Regarding Outpatient Hip and Knee Arthroplasties." <i>J Arthroplasty</i> 32(9): 2701-2705 e2701.	20	5.0
35	Cullom, C. and J. T. Weed (2017). "Anesthetic and Analgesic Management for Outpatient Knee Arthroplasty." <i>Curr Pain Headache Rep</i> 21(5): 23.	19	4.8
36	Greenky, M. R., et al. (2019). "Total Hip Arthroplasty and the Medicare Inpatient-Only List: An Analysis of Complications in Medicare-Aged Patients Undergoing Outpatient Surgery." <i>J Arthroplasty</i> 34(6): 1250-1254.	17	8.5
37	Edwards, P. K., et al. (2019). "Inpatient versus Outpatient Total Knee Arthroplasty." <i>J Knee Surg</i> 32(8): 730-735.	14	7.0
38	Crawford, D. A., et al. (2020). "Low complication rates in outpatient total knee arthroplasty." <i>Knee Surg Sports Traumatol Arthrosc</i> 28(5): 1458-1464.	13	13.0
39	Carey, K., et al. (2020). "Patient Outcomes Following Total Joint Replacement Surgery: A Comparison of Hospitals and Ambulatory Surgery Centers." <i>J Arthroplasty</i> 35(1): 7-11.	13	13.0
40	Jaibaji, M., et al. (2020). "Is Outpatient Arthroplasty Safe? A Systematic Review." <i>J Arthroplasty</i> 35(7): 1941-1949.	12	12.0
41	Coenders, M. J., et al. (2020). "Three and a half years' experience with outpatient total hip arthroplasty." <i>Bone Joint J</i> 102-B(1): 82-89.	12	12.0
42	Kohring, J. M., et al. (2018). "Press Ganey Outpatient Medical Practice Survey Scores Do Not Correlate With Patient-Reported Outcomes After Primary Joint Arthroplasty." <i>J Arthroplasty</i> 33(8): 2417-2422.	12	4.0
43	Lovett-Carter, D., et al. (2018). "Impact of Outpatient Total Joint Replacement on Postoperative Outcomes." <i>Orthop Clin North Am</i> 49(1): 35-44.	12	4.0
44	Sershon, R. A., et al. (2019). "Outpatient Total Hip Arthroplasty Performed at an Ambulatory Surgery Center vs Hospital Outpatient Setting: Complications, Revisions, and Readmissions." <i>J Arthroplasty</i> 34(12): 2861-2865.	11	5.5

Rank	Publication	Total Citations	Citations/ Year of Publication Until 2021
45	Kingery, M. T., et al. (2018). "Total Joint Arthroplasty in Ambulatory Surgery Centers: Analysis of Disqualifying Conditions and the Frequency at Which They Occur." <i>J Arthroplasty</i> 33(1): 6-9.	11	3.7
46	DeCook, C. A. (2019). "Outpatient Joint Arthroplasty: Transitioning to the Ambulatory Surgery Center." <i>J Arthroplasty</i> 34(7S): S48-S50.	10	5.0
47	Ziemba-Davis, M., et al. (2019). "Identifiable Risk Factors to Minimize Postoperative Urinary Retention in Modern Outpatient Rapid Recovery Total Joint Arthroplasty." <i>J Arthroplasty</i> 34(7S): S343-S347.	9	4.5
48	Adelani, M. A. and R. L. Barrack (2019). "Patient Perceptions of the Safety of Outpatient Total Knee Arthroplasty." <i>J Arthroplasty</i> 34(3): 462-464.	9	4.5
49	Warren, M. and T. I. Shireman (2018). "Geographic Variability in Discharge Setting and Outpatient Postacute Physical Therapy After Total Knee Arthroplasty: A Retrospective Cohort Study." <i>Phys Ther</i> 98(10): 855-864.	9	3.0
50	Xu, J., et al. (2020). "Comparison of outpatient versus inpatient total hip and knee arthroplasty: A systematic review and meta-analysis of complications." <i>J Orthop</i> 17: 38-43.	8	8.0

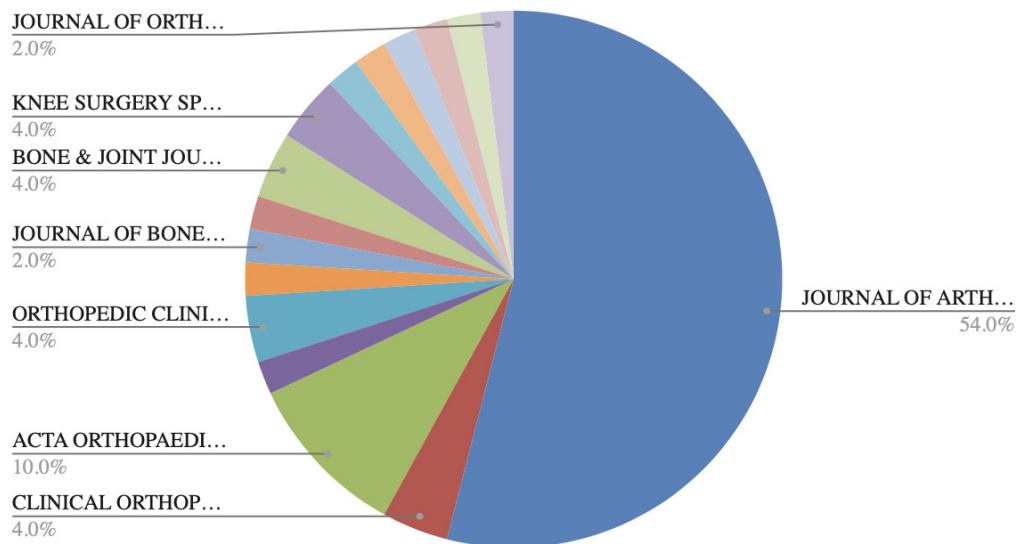


Figure 4. Publishing Journal

ticles that have been most influential in this field of orthopaedic surgery. While total number of citations is not the only metric which determines the influence of a publication, it does provide a frame of reference for that article's recognition in literature. To further substantiate the data acquired in this paper, different metrics were measured to gauge the characteristics and trends seen in the literature. Similar studies have been performed for topics such as total ankle arthroplasty, cervical myelopathy, and elbow surgery.⁸⁻¹⁰

Despite being a newer concept in joint replacement surgery, it has picked up a lot of traction over the decade, Outpatient Total Joint Arthroplasty has become a hot topic in orthopaedic journals. Possibly because the procedure has seen a significant increase in feasibility and popularity in the last ten years, even more so in the last five years, and

the literature reflects this well. Given that Total Joint Arthroplasty is a well established and well tolerated procedure, the logical progression of transitioning lower-risk cases to the outpatient setting achieves a myriad of goals with respect to patient satisfaction and the overall burden on the healthcare system.

Another factor that may be playing into the rapidly growing popularity of outpatient total joints is the ever-evolving changes seen in physician reimbursement. A 2020 study by Lopez et al, demonstrated that despite an increase in TJA volume and utilization, there has been a steady decline in surgeon reimbursement accompanied with significant increases in hospital payments and charges.¹¹ Part of the reason for the disproportionate increase in hospital charges compared to surgeon reimbursement is the cost of inpatient services which has increased 18.6% since 2012.

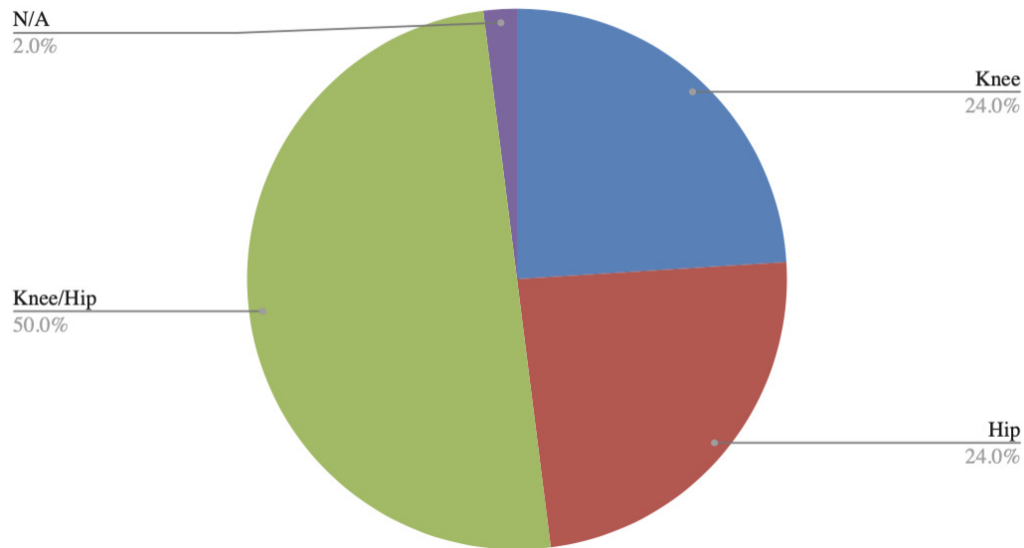


Figure 5. Count of Joint

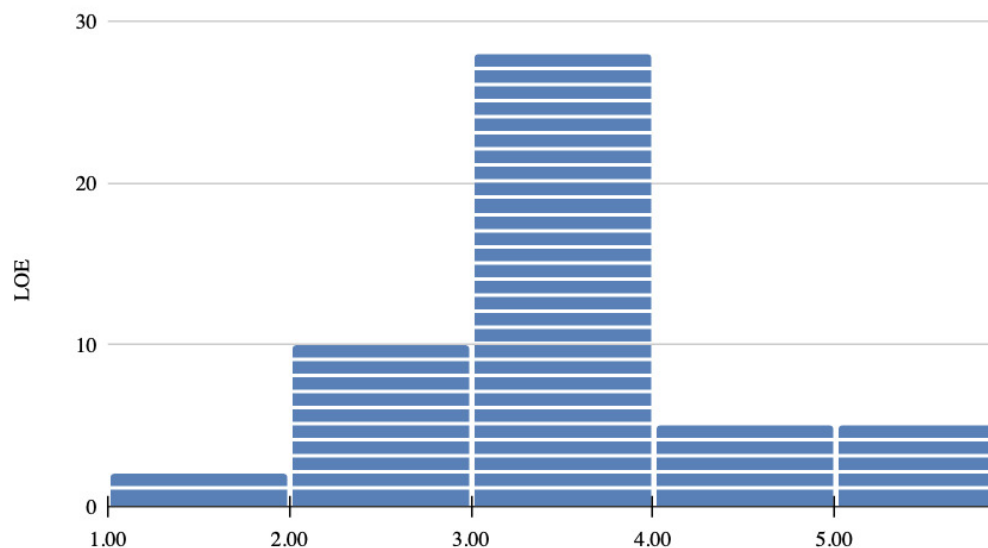


Figure 6. LOE

Therefore, there is great appeal to conducting TJA's in an ambulatory setting to curb the financial burden associated with inpatient services.

Additionally, the COVID-19 pandemic may have put forth an unforeseen pressure pushing TJA's to the outpatient setting. The 2021 study by Chen et al, sought to explore the kind of impact that the COVID-19 pandemic had on different aspects of TJA's via a comprehensive and scoping review of relevant publications. The authors of the study highlighted the importance of outpatient surgery, notably to minimize costs while improving the value of care.¹²

The outpatient total joint replacement research scene is primarily dominated by newer publications from 2016 onward, but a dichotomy of "newer" and "older" still exists, given that the most cited paper in the field is one of the oldest, from 2005. Our study elucidates this rather clearly.

When the top 50 list was ranked in terms of total citations, eight out of the top 10 were from 2016 or later whereas the other two were from 2005 and 2007 respectively. When the top 50 list was ranked in terms of citations per year, all 10 articles were published in 2016 or later.

After analysis of each article's classification in the top 50 most cited works, it is clear that Clinical Outcomes has been the most desired genre of outpatient total joint replacement research. This is likely due to the newer nature of the idea of outpatient total joint replacement and reflects the surgical community's desire to prioritize patient safety when considering a change in practice patterns. Our data demonstrated that articles pertaining to Clinical Outcomes occupied 68% of the top 50. Additional unique categories included Economics and Perceptions, which have undoubtedly driven part of the transition of total joint re-

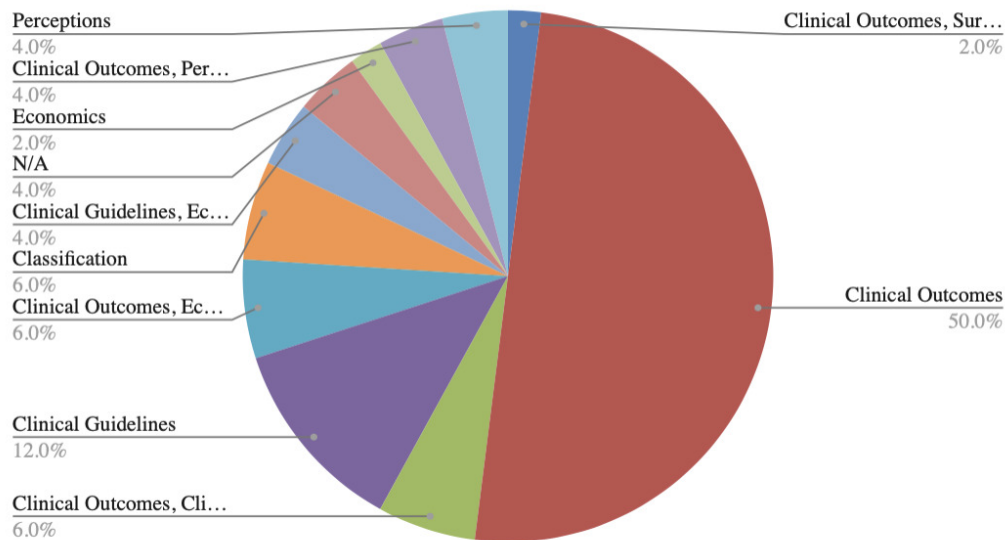


Figure 7. Count of Classification

Table 3. Most cited articles by citations per year

Rank	Publication	Total Citations	Citations per Year	Year Published
1	Goyal, N., et al. (2017). "Otto Aufranc Award: A Multicenter, Randomized Study of Outpatient versus Inpatient Total Hip Arthroplasty." <i>Clin Orthop Relat Res</i> 475(2): 364-372.	100	25.0	2017
2	Hoffmann, J. D., et al. (2018). "The Shift to Same-Day Outpatient Joint Arthroplasty: A Systematic Review." <i>J Arthroplasty</i> 33(4): 1265-1274.	72	24.0	2018
3	Courtney, P. M., et al. (2017). "Complications Following Outpatient Total Joint Arthroplasty: An Analysis of a National Database." <i>J Arthroplasty</i> 32(5): 1426-1430.	92	23.0	2017
4	Meneghini, R. M., et al. (2017). "Safe Selection of Outpatient Joint Arthroplasty Patients With Medical Risk Stratification: the "Outpatient Arthroplasty Risk Assessment Score"." <i>J Arthroplasty</i> 32(8): 2325-2331.	87	21.8	2017
5	Lovecchio, F., et al. (2016). "Is Outpatient Arthroplasty as Safe as Fast-Track Inpatient Arthroplasty? A Propensity Score Matched Analysis." <i>J Arthroplasty</i> 31(9 Suppl): 197-201.	83	16.6	2016
6	Bovonratwet, P., et al. (2017). "Comparison of Outpatient vs Inpatient Total Knee Arthroplasty: An ACS-NSQIP Analysis." <i>J Arthroplasty</i> 32(6): 1773-1778.	64	16.0	2017
7	Gromov, K., et al. (2017). "Feasibility of outpatient total hip and knee arthroplasty in unselected patients." <i>Acta Orthop</i> 88(5): 516-521.	62	15.5	2017
8	Darrith, B., et al. (2019). "Inpatient Versus Outpatient Arthroplasty: A Single-Surgeon, Matched Cohort Analysis of 90-Day Complications." <i>J Arthroplasty</i> 34(2): 221-227.	29	14.5	2019
9	Ziemba-Davis, M., et al. (2019). "Outpatient Joint Arthroplasty-Patient Selection: Update on the Outpatient Arthroplasty Risk Assessment Score." <i>J Arthroplasty</i> 34(7S): S40-S43.	28	14.0	2019
10	Nelson, S. J., et al. (2017). "Is Outpatient Total Hip Arthroplasty Safe?" <i>J Arthroplasty</i> 32(5): 1439-1442.	55	13.8	2017

placement to the outpatient setting. Additionally, it stands to reason that a classification such as "Surgical Technique" might not be as heavily cited in this topic (only once), as there typically isn't a major change in surgical technique, but a combination of protocols and patient optimization, depending on the setting of total joint replacement. As

mentioned, certain publications received more than one category depending on overlapping themes.

The Level of Evidence (LOE) distribution for these articles was rather normal [Figure 6], with the obvious mode being Level III evidence, comprised mainly of retrospective studies. In comparison to other, similar, bibliometric re-

views, this seems to be a trend in the literature. The authors understand that, pragmatically, retrospective studies are essential to the literature in order to get out quality data in a reasonable timeframe; especially in something so safe, effective, and rapidly popular as outpatient total joint replacement, but it call the attention that further prospective level I and II studies are needed for better understanding of it.

Unsurprisingly, hip and knee replacements continue to dominate the discussion, likely due to sheer volume and demand. However, it is worth noting that ankle, elbow and especially shoulder replacements were excluded from this study, but this is an excellent sign of progress in the outpatient total joint replacement space.

As with all research, there are inherent limitations to bibliometric reviews. The most obvious limitation in this study is the lower number of citations of these publications compared to other major topics in orthopaedics. However, due to the newer nature of the field, it is reasonable to expect further investigation requiring long-term increases in citation of many of these cornerstone papers. Another limitation is in the smaller pool of publications the authors were able to pick from, n=170. To ensure our results were specific to outpatient total joint replacement, and not tangential to the focus of the study, more narrowly focused search terms were used. To ensure crucial papers were not missed, many different iterations of the final search were used to rule out gross negligence. However, it is critical to understand that search terms, search engine and user error

may all contribute to errors of omission with respect to this review.

CONCLUSION

This study provides a comprehensive and objective measure of the most cited articles on outpatient arthroplasty. Most of the literature on the topic were categorized as Clinical Science and Outcomes (50%), comprised level of evidence III (28%), were published in the Journal of Arthroplasty (54%) and came out of the United States (76%). Knowledge of these most influential articles allows for a foundation of understanding on a rapidly growing area of arthroplasty among clinicians.

CONFLICT OF INTERESTS

The authors, their immediate family, and any research foundation with which they are affiliated did not receive any financial payments or other benefits from any commercial entity related to the subject of this article. There are no relevant disclosures. We have no conflicts of interest. The Manuscript submitted does not contain information about medical device(s)/drug(s). All authors significantly contributed to the document and have reviewed the final manuscript.

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