3-4-2015

Characteristics of Clinical Shoulder Research Over the Last Decade: A Review of Shoulder Articles in *The Journal of Bone & Joint Surgery* from 2004 to 2014

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Notes/Citation Information
Published in *The Journal of Bone & Joint Surgery*, v. 97, no. 5, article e26, p. 1-8.

Digital Object Identifier (DOI)
http://dx.doi.org/10.2106/JBJS.N.00831

THE ORTHOPAEDIC FORUM

Characteristics of Clinical Shoulder Research Over the Last Decade: A Review of Shoulder Articles in *The Journal of Bone & Joint Surgery* from 2004 to 2014

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Background: The purpose of this study was to determine characteristics and trends in published shoulder research over the last decade in a leading orthopaedic journal.

Methods: We examined all clinical shoulder articles published in *The Journal of Bone & Joint Surgery* from 2004 to 2014. The number of citations, authorship, academic degrees of the authors, country and institution of origin, topic, level of evidence, positive or nonpositive outcome, and inclusion of validated patient-reported outcome measures were assessed for each article.

Results: Shoulder articles that included an author with an advanced research degree (MD [Doctor of Medicine] with a PhD [Doctor of Philosophy] or other advanced degree) increased during the study period ($p = 0.047$). Level-I, II, and III studies were more likely to have an author with an advanced research degree, and Level-IV studies were more likely to have MDs only ($p = 0.03$). Overall, there was great variability of outcome measures, with at least thirty-nine different validated or nonvalidated outcome measures reported.

Conclusions: Over the last decade, there was an improvement in the level of evidence of shoulder articles published in *The Journal of Bone & Joint Surgery* that corresponds with recent emphasis on evidence-based medicine. A consensus is needed in shoulder research for more consistent application of validated patient-reported outcome measurement tools.

Peer Review: This article was reviewed by the Editor-in-Chief and one Deputy Editor, and it underwent blinded review by two or more outside experts. The Deputy Editor reviewed each revision of the article, and it underwent a final review by the Editor-in-Chief prior to publication. Final corrections and clarifications occurred during one or more exchanges between the author(s) and copyeditors.

Disclosure: None of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of any aspect of this work. One or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.

There have been several trends in orthopaedic research publications. Authorship proliferation in publications has occurred with more authors per article along with an increase in the proportion of nonclinician scientists[1,2]. The level of evidence has also improved[3,4]. Geographic diversity has increased, with more publications from countries outside of the United States[2,4] and more multinational collaboration[2]. There has also been concern that publication bias exists in orthopaedic journals toward positive-outcome studies[5,6]. To our knowledge, no information has assessed whether these trends apply to shoulder research, and a critical assessment of the characteristics and trends of clinical shoulder research has not been published.

Materials and Methods

We completed a PubMed search (http://www.ncbi.nlm.nih.gov/pubmed) of all *The Journal of Bone & Joint Surgery* (JBJS) publications over a ten-year period,

TABLE I Top Ten Most-Cited Articles on Thomson Reuters Web of Science with Authors and Country of Origin

Year	Article	No. of Citations	Overall JBJS Citation Ranking	First Author	Last Author	Country of Origin
2004	The Outcome and Repair Integrity of Completely Arthroscopically Repaired Large and Massive Rotator Cuff Tears[11]	495 (45/yr)	3	Galatz, Leesa	Yamaguchi, Ken	United States
2005	Arthroscopic Repair of Full-Thickness Tears of the Supraspinatus: Does the Tendon Really Heal?[17]	308 (30.8/yr)	9	Boileau, Pascal	Krishnan, Sumant	France
2005	Treatment of Painful Pseudoparesis Due to Irreparable Rotator Cuff Dysfunction with the Delta III Reverse-Ball-and-Socket Total Shoulder Prosthesis[18]	214 (21.4/yr)	14	Werner, Clement	Gerber, Christian	Switzerland
2004	Detection and Quantification of Rotator Cuff Tears: Comparison of Ultrasonographic, Magnetic Resonance Imaging, and Arthroscopic Findings in Seventy-one Consecutive Cases[19]	197 (17.9/yr)	21	Teefey, Sharlene	Yamaguchi, Ken	United States
2006	Risk Factors for Recurrence of Shoulder Instability After Arthroscopic Bankart Repair[20]	180 (20/yr)	26	Boileau, Pascal	Neyton, Lionel	France
2005	The Reverse Shoulder Prosthesis for Glenohumeral Arthritis Associated with Severe Rotator Cuff Deficiency: A Minimum Two-Year Follow-up Study of Sixty Patients[21]	169 (16.9/yr)	28 (tie)	Frankle, Mark	Vasey, Matthew	United States
2006	The Demographic and Morphological Features of Rotator Cuff Disease: A Comparison of Asymptomatic and Symptomatic Shoulders[22]	158 (17.6/yr)	36 (tie)	Yamaguchi, Ken	Teefey, Sharlene	United States
2007	Repair Integrity and Functional Outcome After Arthroscopic Double-Row Rotator Cuff Repair: A Prospective Outcome Study[23]	158 (19.8/yr)	36 (tie)	Sugaya, Hiroyuki	Moriishi, Joji	Japan
2007	Reverse Total Shoulder Arthroplasty: A Review of Results According to Etiology[24]	151 (18.9/yr)	42 (tie)	Wall, Bryan	Walch, Gilles	France
2006	Reverse Total Shoulder Arthroplasty: Survivorship Analysis of Eighty Replacements Followed for Five to Ten Years[25]	151 (16.8/yr)	42 (tie)	Guery, Jacques	Walch, Gilles	France

TABLE II Top Ten Most-Cited Articles on Google Scholar with Authors and Country of Origin

Year	Article	No. of Citations	First Author	Last Author	Country of Origin
2004	The Outcome and Repair Integrity of Completely Arthroscopically Repaired Large and Massive Rotator Cuff Tears[11]	786 (71.5/yr)	Galatz, Leesa	Yamaguchi, Ken	United States
2005	Arthroscopic Repair of Full-Thickness Tears of the Supraspinatus: Does the Tendon Really Heal?[17]	477 (47.7/yr)	Boileau, Pascal	Krishnan, Sumant	France
2005	Treatment of Painful Pseudoparesis Due to Irreparable Rotator Cuff Dysfunction with the Delta III Reverse-Ball-and-Socket Total Shoulder Prosthesis[18]	408 (40.8/yr)	Werner, Clement	Gerber, Christian	Switzerland
2005	The Reverse Shoulder Prosthesis for Glenohumeral Arthritis Associated with Severe Rotator Cuff Deficiency: A Minimum Two-Year Follow-up Study of Sixty Patients[21]	362 (36.2/yr)	Frankle, Mark	Vasey, Matthew	United States
2004	Detection and Quantification of Rotator Cuff Tears: Comparison of Ultrasonographic, Magnetic Resonance Imaging, and Arthroscopic Findings in Seventy-one Consecutive Cases[19]	314 (28.5/yr)	Teefey, Sharlene	Yamaguchi, Ken	United States
2007	Repair Integrity and Functional Outcome After Arthroscopic Double-Row Rotator Cuff Repair: A Prospective Outcome Study[23]	304 (38.0/yr)	Sugaya, Hiroyuki	Moriishi, Joji	Japan
2006	Latissimus Dorsi Transfer for the Treatment of Irreparable Rotator Cuff Tears[26]	303 (33.7/yr)	Gerber, Christian	Espinosa, Norman	Switzerland
2006	Risk Factors for Recurrence of Shoulder Instability After Arthroscopic Bankart Repair[20]	294 (32.7/yr)	Boileau, Pascal	Neyton, Lionel	France
2006	Reverse Total Shoulder Arthroplasty: Survivorship Analysis of Eighty Replacements Followed for Five to Ten Years[25]	277 (30.8/yr)	Guery, Jacques	Walch, Gilles	France
2007	Reverse Total Shoulder Arthroplasty: A Review of Results According to Etiology[24]	276 (34.5/yr)	Wall, Bryan	Walch, Gilles	France

between January 1, 2004, and December 31, 2013, using the key word *shoulder*. The PubMed search (completed on January 6, 2014) yielded 575 articles. We completed a separate search on the JBJS web site (http://jbjs.org) (January 6, 2014) under the "Browse by" feature using *Shoulder*, which yielded 546 articles. A single reviewer (B.J.M.) excluded duplicates and screened all titles and abstracts to determine eligibility. All scientific articles and Evidence-Based Orthopaedics articles were evaluated for inclusion. Exclusion criteria included cadaveric and computer-modeling studies, basic science articles (in vitro studies and nonhuman studies), pediatric studies (studies focused on patients younger than eighteen years of age), articles on clavicle and humeral shaft fractures, and articles from selected Instructional Course Lectures, Case Reports, Current Concepts Reviews, The Orthopaedic Forums, Topics in Training, Specialty Updates, Commentary and Perspectives, Editorials, Ethics in Practice, Surgical Techniques, JBJS Classics, Expressions of Concern, and Book Reviews. A total of 347 articles were excluded, leaving 228 clinical shoulder articles of the 575 articles that met the inclusion criteria. Among the 347 excluded articles were Current Concepts Reviews, Instructional Course Lectures, and reviews (sixty-one articles); articles on cadavers and computer modeling and simulation (forty-six articles); commentaries and author replies (forty-six articles); case reports (thirty-three articles); basic science articles (nine articles); articles on the clavicle, elbow, forearm, wrist, hand, spine, and lower extremity (ninety-nine articles); articles on surgical techniques (thirty articles); and other articles (twenty-three articles).

The articles were assessed by title, year of publication, number of citations (as determined by Thomson Reuters Web of Science and Google Scholar), authorship, academic degrees of the authors, country and institution of origin (including academic or private institution), shoulder topic, level of evidence, positive or nonpositive outcome, and inclusion of patient-reported outcome measurement tools. Two authors (B.J.M. and R.Z.U.) reviewed all 228 eligible articles, and the senior author (G.M.G.) served as a third reviewer and referee for any disagreements.

Determination of the number of citations per article was completed with use of Thomson Reuters Web of Science, a proprietary product[7]. We also determined the number of citations per article with use of Google Scholar (http://scholar.google.com) for comparison. The number of citations was only determined for articles from 2004 through 2011. Articles from 2012 and 2013 were excluded from citation calculations because of the low likelihood of being cited in such a short time period given the publication lag.

TABLE III Top Ten (Including Ties) Most-Published First Authors and Countries of Origin

No. of Publications	First Author	Country of Origin
Seven	Robinson, C. Michael	United Kingdom
Four	Boileau, Pascal	France
Four	Gerber, Christian	Switzerland
Four	Namdari, Surena	United States
Four	Wirth, Michael	United States
Three	Cuff, Derek J.	United States
Three	Henn III, R. Frank	United States
Three	Iannotti, Joseph	United States
Three	Kim, Kyung Cheon	South Korea
Three	Kim, H. Mike	United States
Three	Scalise, Jason J.	United States
Three	Tashjian, Robert	United States

TABLE IV Top Ten (Including Ties) Most-Published Last Author and Country of Origin

No. of Publications	Last Author	Country of Origin
Eleven	Matsen III, Frederick A.	United States
Ten	Gerber, Christian	Switzerland
Nine	Cofield, Robert	United States
Nine	Yamaguchi, Ken	United States
Seven	Iannotti, Joseph	United States
Six	Frankle, Mark	United States
Six	Warner, Jon J.P.	United States
Five	Green, Andrew	United States
Five	Walch, Gilles	France
Four	McFarland, Edward G.	United States
Four	Murrell, George A.C.	Australia

We determined each author's educational background with use of previously described methods[2]. All degree classifications were converted to American degree equivalents, and Doctor of Osteopathy (DO) degrees were treated as MD (Doctor of Medicine) degrees[2]. Each author was categorized as a clinician only (MD without an advanced research degree), a clinician scientist (MD with an advanced degree such as an MPH [Master of Public Health], MSci [Master of Science], PhD [Doctor of Philosophy], or MBA [Master of Business Administration]), a nonclinician scientist (PhD without an MD or DO), or others.

The level of evidence for each article was determined by JBJS at the time of publication. The level of evidence has been included for JBJS articles since 2003[8]. The evaluation of positive or nonpositive conclusions was based on previously described methods[9]. A positive study was one with a conclusion that favored the experimental method in the study over the standard of care. A negative study was one with a conclusion that favored against the experimental method compared with the standard of care. A neutral study made no judgment, either positive or negative, or found no difference between the experimental method and the standard of care. Negative and neutral findings were considered together for calculations and were referred to as nonpositive.

Patient-reported outcome measurement tools were assessed for studies evaluating clinical outcomes. Radiographic studies and short-term diagnostic studies were not considered eligible for evaluation of patient-reported outcomes. We identified 167 of 228 articles that were eligible for inclusion of patient-reported outcomes. The determination of validated or nonvalidated outcome measures was determined by prior publications that were completed to determine validity of the scoring system[10].

Statistical Analysis

All analyses were based on yearly totals for number of authors, academic degrees of the authors, level of evidence, and positive results reporting bias. Chi-square tests were utilized to determine whether count data differed between publication years. The significance level was set a priori at $p < 0.05$.

Source of Funding

There was no external funding source for this investigation.

Results

Most-Cited Articles

A total of 228 eligible shoulder articles were identified among 575 articles. The top ten most-cited articles in the last decade according to Web of Science were highlighted (Table I). The most-cited article, by Galatz et al.[11], "The Outcome and Repair Integrity of Completely Arthroscopically Repaired Large and Massive Rotator Cuff Tears," was cited 495 times according to Web of Science (forty-five citations per year) and was the third most-cited study among all JBJS articles in the last decade.

The top-ten list for most-cited articles according to Web of Science was compared with the top-ten list for citations according to Google Scholar (Table II). The top-ten lists matched on nine of the top ten articles. The average number of citations for all articles published from 2004 through 2011 was 40.2 per article according to Web of Science compared with 78.3 per article according to Google Scholar.

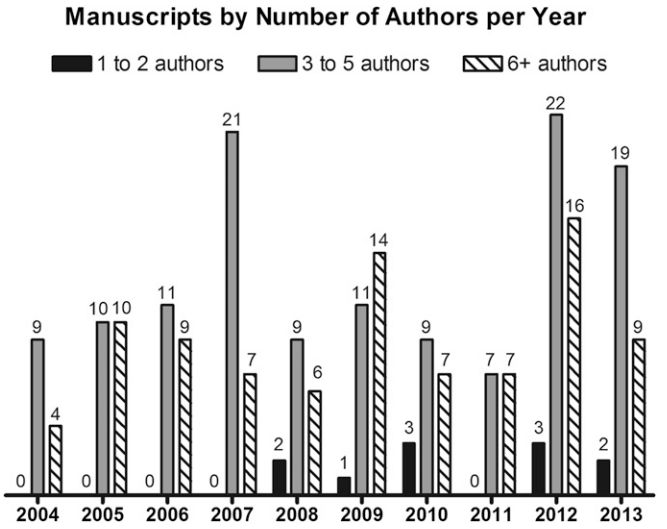

Fig. 1

Manuscripts by number of authors per year.

TABLE V Top Ten Most-Published Combined First and Last Author and Country of Origin

No. of Publications	Author	Country of Origin
Fourteen	Gerber, Christian	Switzerland
Twelve	Matsen III, Frederick A.	United States
Ten	Iannotti, Joseph	United States
Ten	Yamaguchi, Ken	United States
Nine	Cofield, Robert	United States
Eight	Robinson, C. Michael	United Kingdom
Seven	Frankle, Mark	United States
Six	Walch, Gilles	France
Six	Warner, Jon J.P.	United States
Six	Wirth, Michael	United States

TABLE VI The Most Common Shoulder Topics in the Last Decade

Shoulder Topic	No. of Articles* (N = 228)
Rotator cuff	64 (28.1)
Total shoulder arthroplasty	43 (18.9)
Other	37 (16.2)
Instability	31 (13.6)
Reverse shoulder arthroplasty	20 (8.8)
Fracture	16 (7.0)
Hemiarthroplasty	12 (5.3)
Superior labral tear from anterior to posterior (SLAP) or labrum	5 (2.2)

*The values are given as the number of articles, with the percentage in parentheses.

Authorship

The average number of authors per article over the last decade was 5.11. Orthopaedic literature has shown a trend toward an increase in the number of authors per article in the last sixty years[2], but this trend was not significant over the last decade for JBJS shoulder articles ($p = 0.218$). The average number of authors per article was lowest in 2007, at 4.68 authors, and highest in 2011, at 5.57 authors, but this was not significant. There were only eleven articles during the decade with one or two authors (Fig. 1).

We identified the first and last author from eligible clinical articles and compiled a list of all first authors, all last authors, and a combination of both first authors and last authors. We provided a top-ten list for each category (Tables III, IV, and V). Prior studies have only determined authorship on the basis of the first author only; however, this likely underreports the impact of senior authors, who are often listed as the last author[7,12].

Academic Degrees of Authors and Level of Evidence

The academic degrees of the authors indicated a trend toward more nonclinician scientists and MDs with additional degrees. From 2004 to 2013, shoulder articles that included an author with an advanced research degree (MD with a PhD or other advanced degree) increased ($p = 0.047$) over articles that included only clinical MDs; in the thirteen articles in 2004, there were six articles (46%) that included an author with an advanced research degree and seven articles (54%) that included only clinical MDs, but in the thirty articles in 2013, there were eighteen articles (60%) that included an author with an advanced research degree and twelve articles (40%) that included only clinical MDs.

Of the 228 studies, over the study period, the percentage of Level-I studies was 18.0% (forty-one studies), with a slight increase in Level-II studies at 18.9% (forty-three) and Level-III studies at 9.2% (twenty-one) and a decrease in Level-IV studies at 53.9% (123). These trends had large year-to-year variations, making the overall changes nonsignificant. Level-I, II, and III studies were more likely to have an author with an advanced research degree (MD with a PhD or other advanced degree) than were Level-IV studies, which were more likely to have authors with MDs only ($p = 0.03$) (Fig. 2). Overall, the authors had an MD only (74.1%), an MD with additional degrees (8.7%), a PhD (6.0%), or other degrees (11.2%).

Country and Institution of Origin

Of the 228 eligible articles, the country of origin for the articles was most commonly the United States, at 57.5% (131 articles). European countries were the second most common countries of origin, publishing articles at 28.1% (sixty-four articles), with France contributing the largest share, at 8.3% (nineteen articles). Academic departments accounted for the majority of published articles, at 75% (171 articles).

Topics

The most common topic was rotator cuff, at 28.1% (sixty-four articles), and the second most common topic was total shoulder arthroplasty, at 18.9% (forty-three articles) (Table VI).

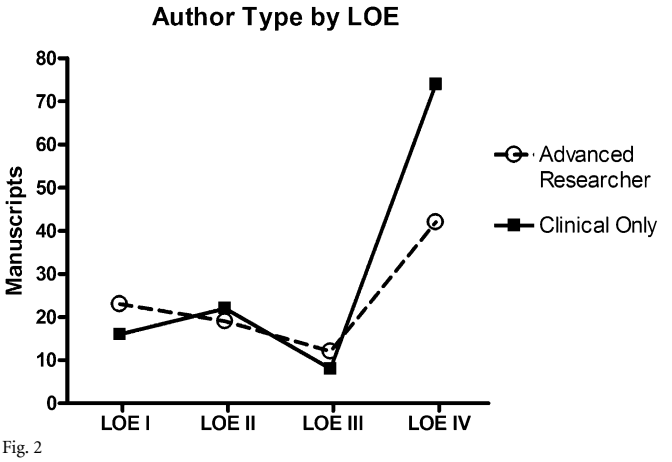

Fig. 2

Author type by level of evidence (LOE). "Advanced researcher" indicates an MD with a PhD or other advanced degree. "Clinical only" indicates an MD only.

TABLE VII The Most Commonly Used Outcome Measurements

Outcome Measurement	No. of Articles* (N = 167)	Measure Validation
Constant score	60 (35.9)	Validated
American Shoulder and Elbow Surgeons score	53 (31.7)	Validated
Simple shoulder test	31 (18.6)	Validated
Visual analog scale for pain	30 (18.0)	Validated
Short Form-36 (SF-36) Health Survey	17 (10.2)	Validated
University of California Los Angeles (UCLA) Shoulder Score	17 (10.2)	Not validated
Subjective shoulder value	16 (9.6)	Validated
Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure	15 (9.0)	Validated
Modified Neer score	9 (5.4)	Validated
Rowe score	8 (4.8)	Not validated
Penn Shoulder Score	7 (4.2)	Validated
Shoulder Rating Questionnaire	4 (2.4)	Validated
Western Ontario Shoulder Instability Index	4 (2.4)	Validated
Western Ontario Osteoarthritis of the Shoulder Index	3 (1.8)	Validated
Western Ontario Rotator Cuff Index	3 (1.8)	Validated
Pain level	3 (1.8)	Not validated
Short Form-12 (SF-12) Health Survey	3 (1.8)	Validated
Oxford Shoulder Score	2 (1.2)	Validated
Shoulder Pain and Disability Index	2 (1.2)	Validated
Musculoskeletal Tumor Society score	2 (1.2)	Validated
Nineteen other measurements used in only one article each	1 (0.6)	Varied

*The values are given as the number of articles that used each outcome measurement, with the percentage in parentheses. Some articles utilized more than one outcome measurement tool, so the summation of percentages is >100%.

Positive or Nonpositive Studies

The majority of the studies were nonpositive studies, at 57.0% (130 articles). There was no positive-outcome publication bias over the last decade ($p = 0.170$).

Patient-Reported Outcome Measurements

Overall, there was great variability of outcome measurements utilized, with at least thirty-nine different validated or nonvalidated outcome measurement tools reported in 167 eligible articles. Of these 167 articles, at least one validated patient-reported outcome measurement was utilized in 139 articles (83.2%), two validated patient-reported outcome measurements were used in fifty-one articles (30.5%), and three or more validated patient-reported outcome measurements were used in twenty-eight articles (16.8%). Outcome measurement tools are noted in Table VII, including the most commonly used outcome measurement tool, the Constant score, in sixty articles (35.9%).

Discussion

Trends in shoulder research published over the last decade in JBJS have indicated an improvement in the level of evidence. Articles with a higher level of evidence were more likely to have an author with an advanced research degree. There was no positive-outcome publication bias over the last decade. Finally, there was great variability in outcome measurement instrument utilization.

Level of Evidence

In 2003, JBJS began requiring authors to provide a level of evidence rating for every clinical article, and the rating is confirmed by the editors[8]. The effort was introduced to help improve quality of clinical research and to allow periodic reporting of trends[8]. Level of evidence has been shown to be an independent predictor of acceptance for publication in JBJS[9]. The percentage of Level-I studies in JBJS increased from 4% in 1975 to 21% in 2005[3]. Similarly, *The American Journal of Sports Medicine* had an increase in Level-I and II studies, from 9.4% in 1996 to 23.0% in 2011[4]. Trends for journals have indicated a shift toward an increase in the level of evidence, but it not clear whether this trend necessarily applies to orthopaedic subspecialties. The majority of clinical foot and ankle articles over the last decade from six orthopaedic journals were Level-IV studies (70.1%), with only 9.4% Level-I studies[13].

Our data indicated a high percentage of Level-I shoulder studies (18.1%) over the last decade in JBJS, which is consistent

with the recent improvements seen with the number of published Level-I studies among all orthopaedic topics in JBJS as well as the recent increased emphasis on evidence-based medicine[3]. The percentage of Level-I shoulder studies was also higher than the percentage reported in foot and ankle articles[13]. There was a higher percentage of shoulder publications with Level-I and II evidence (37.1%) than in the recently reported data for *The American Journal of Sports Medicine* publications[4]. To our knowledge, there have been no prior orthopaedic studies showing a correlation between authors with advanced research degrees and an improvement in the level of evidence.

Authorship

Orthopaedic literature has shown a trend toward increased authorship[2], but our data indicated that this trend has not continued over the last decade in JBJS shoulder articles. Authorship has been labeled as the currency of academic medicine and is used as a way to improve admission to medical school and residency, to obtain research grants, and to gain promotion[2]. Some believe that the increase in authorship, especially the addition of physicians with advanced degrees and nonphysician scientists, may indicate an improvement in the complexity of research questions and study design[2].

Positive or Nonpositive Outcome

There is a discrepancy regarding positive-outcome publication bias in orthopaedics. A study analyzing 1181 manuscripts submitted for publication to JBJS reported no evidence for publication bias[9]. Positive and nonpositive studies were accepted at similar rates[9]. However, a separate study found that 210 peer reviewers for JBJS and *Clinical Orthopaedics and Related Research* were more likely to recommend publication of a positive version of a fabricated manuscript over an otherwise identical no-difference version[5]. Our data did not find a positive-outcome publication bias in JBJS shoulder articles over the last decade, and the majority of the studies represented nonpositive outcomes.

Most-Cited Articles, Top Authors, and Topics

We utilized both Thomson Reuters Web of Science and Google Scholar to determine the number of citations for each article. Thomson Reuters Web of Science is a proprietary product, but Google Scholar is free. There are critiques of both search tools, with no clear better tool for determination of citations[14]. Web of Science has been widely utilized in the orthopaedic literature to determine the number of citations[7,12,15,16]. Web of Science reported approximately half the number of citations per article compared with Google Scholar in our search; however, both search tools matched on nine of the top ten most-cited articles. Ultimately, both search engines only determine the number of times that an article is cited, which does not necessarily determine the true impact or merit of each individual article.

We highlighted the most-cited shoulder articles and the most-published first and last authors in the last decade in JBJS. There have been several recent publications highlighting similar compilations based on the most-cited articles across multiple orthopaedic journals for pediatrics, trauma, hand, and shoulder[7,12,15,16]. The number of citations and the number of publications alone do not completely account for the impact or merits of individual researchers.

The most common shoulder topics in the last decade, rotator cuff and shoulder arthroplasty, were not surprising, especially with growing interest and research regarding reverse shoulder arthroplasty since its approval by the United States Food and Drug Administration (FDA) in 2003. An awareness of shoulder topics published may help to identify areas in which deficiencies exist and growth is needed.

Country of Origin

A recent study showed an increase in publications from outside of the United States in *The American Journal of Sports Medicine,* from 20.3% in 1996 to 53.0% in 2011[4]. Similarly, the number of publications from outside of the United States increased from 40.5% in 1949 to 59.6% in 2009 in JBJS[2].

Patient-Reported Outcome Measurements

There has been an increase in utilization of patient-reported outcome measurements in orthopaedics, but there continues to be considerable inconsistency in the application of these outcome tools[13]. A study analyzing 878 clinical foot and ankle articles from six orthopaedic journals from 2002 to 2011 showed that 139 unique clinical outcome measurements were used[13]. Our data indicated great variability in the outcome measurements utilized in shoulder articles over the last decade in JBJS. A consensus is needed in shoulder research regarding outcome measurement tool utilization.

Strengths and Limitations

It is possible that important articles were inadvertently omitted or were not identified in our original search. Our strict inclusion and exclusion criteria established a priori may have excluded important shoulder-related articles, including cadaveric, computer-modeling and simulation, and basic science studies. It is also possible that we may have missed some of the trends that occurred one to two decades prior to our study period. Another potential limitation is the classification of academic compared with private. There are private practices that participate in resident and fellowship training. For the purposes of this study, we limited the academic distinction to institutions that lead a residency training program. Furthermore, highlighting articles by the number of citations can be misleading, as authors or institutions may frequently cite their own articles, causing inflation in the number of citations. Another limitation of the study was that only JBJS articles were evaluated and the study may not reflect the overall trends in publications of shoulder research in other journals. *The American Journal of Sports Medicine* and *Arthroscopy: The Journal of Arthroscopic and Related Surgery*, among others, also publish shoulder research but do not usually include shoulder arthroplasty or fracture topics. The *Journal of Shoulder and Elbow Surgery* is a shoulder subspecialty journal that may also have a different focus than JBJS has.

In conclusion, overall trends in clinical shoulder surgery publications over the last decade in JBJS indicate an improvement in the level of evidence corresponding to recent increased emphasis on evidence-based medicine. Articles with a higher level of evidence were more likely to have an author with an advanced research degree, reflecting the complexities of this type of research. A consensus is needed in shoulder research for more consistent application of validated patient-reported outcome measurement tools. ■

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