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Original Research

Rates of Registry Research Have Increased in Podium and Poster Presentations at the American Association of Hip and Knee Surgeons

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ABSTRACT

Background: As state, regional, and national registries have rapidly expanded, the goal of this study is to assess the frequency of registry abstracts accepted for both podium and poster presentations at the American Association of Hip and Knee Surgeons between 2012 and 2022.
Methods: Final programs and poster e-collections were examined over the past 11 years. Two reviewers evaluated each abstract to determine if they utilized large datasets and the location of each registry. Studies were excluded if they used institutional registries. Reviewers also identified the most frequently utilized registries to determine how their use has fluctuated over this time frame.
Results: A total of 3354 abstracts were reviewed and included. Of those, 577 abstracts utilized data obtained from orthopaedic registries (17.2%): 450 of which were poster presentations (16.5% of total poster acceptances), and 127 were podium presentations (20.5% of accepted podiums). The National Surgical Quality Improvement Program (NSQIP) was the most frequent dataset utilized, with 118 (20.5%) abstracts. Of note, NSQIP's use peaked between 2018 and 2020 and has since slowly trended downward. On the other hand, use of both American Joint Replacement Registry (AJRR) and PearlDiver registry have drastically increased since 2019, with only 6 abstracts chosen in 2019 and 28 abstracts in 2022 (10 AJRR [3 podiums] and 18 PearlDiver [6 podiums]). The proportion of registry data has increased, with the registry abstracts peaking in 2022 as 24% of posters and 37% of podium utilized data from large registry data sets ($P < .001$).
Conclusions: There has been a significant increase in the number of studies utilizing registry data for both podium and poster presentations at the American Association of Hip and Knee Surgeons annual meeting. While NSQIP was the most utilized, its use has steadily declined while AJRR and PearlDiver use have increased over the past 3 years. Individuals should understand the strengths and weaknesses of each registry before making conclusions on study results.
Level of Evidence: Level IV.

Introduction

Registry research in orthopaedic surgery continues to grow as "big data" has emerged from the widespread adoption of electronic medical records. Recently, there has been a concerted effort by total joint replacement surgeons in the United States to improve the capture of a high volume of cases to analyze topics including surgical techniques, implant utilization, and patient-reported outcome

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scores [1]. These efforts have been performed in multiple avenues, including institutional collaborations, private sector claims, statewide registries, and now the creation and growth of the American Joint Replacement Registry [2-4].

Registries do provide significant value to our research and literature. Level I, double-blinded, prospective randomized control trials remain the gold standard of evidence-based medicine. However, they are technically challenging to perform in orthopaedic surgery as they can be resource-consuming and limited by ethical dilemmas [5]. They also typically study a small patient population, which can limit the generalizability of their conclusions. Finally, they are often performed at specialized tertiary centers, which may make it difficult compared to the broad medical care landscape [6]. This is, therefore, where registries provide a useful avenue to explore trends and complications that might normally appear in these smaller trials.

While these registries and databases can provide valuable information, these data sources have important limitations. As these data sets examine numerous variables with large numbers, they can often show statistically significant associations that might be of limited clinical relevance [7]. Even with these associations, they cannot prove a causal relationship between an exposure and an outcome due to unmeasured cofounders and possible sampling bias [8]. Finally, each data set has its own limitations, ranging from expense to gain access, poor accuracy and inconsistency of each data point collected, and completeness of follow-up [9-11]. These limitations must be taken into mind when any analysis of registry data is published.

It is the goal of this manuscript to assess the yearly incidence of registry research projects over the past decade. To accomplish this, we assessed both podium and poster presentations each year at the Annual Meeting of the American Association of Hip and Knee Surgeons (AAHKS). As the largest organization of arthroplasty surgeons in the United States, with over 4000 members, it is their goal to disseminate up-to-date research each year at their annual meeting [12]. By assessing the accepted podiums and poster presentations, our goal is to determine trends in registry utilization. It is hypothesized that the use of registries has increased over the past decade, especially with the increased utilization of the American Joint Replacement Registry (AJRR).

Material and methods

Final programs and poster e-collections were obtained from the AAHKS website. Programs from the past 11 years between 2012 and 2022 were reviewed by 2 independent, blinded reviewers. These 2 independent reviewers evaluated all abstracts to determine if they utilized data from state, national, commercial claims, and government administrative databases. These included, but were not limited to, the Medicare administrative dataset, the National Inpatient Sample (NIS), the National Surgical Quality Improvement Program (NSQIP), the Veterans Health Administration, IBM MarketScan, OptumLabs, Humana Claims, PearlDiver, the Michigan Arthroplasty Registry Collaborative Quality Initiative, the New York Statewide Planning and Research Cooperative System, the Australian Registry, and the AJRR databases. Single institutional registries, such as the Mayo Clinic's internal registry, were not considered to be a large database study for this report. Disagreements were discussed by the 2 reviewers until consensus was reached, and any remaining discrepancy was reviewed by the first author (A.D.). Reviewers noted each registry that was utilized for the accepted abstract to determine how their use has fluctuated over this time frame. Two reviewers also examined the status of the 2020 accepted registry abstracts to see if they had become published manuscripts by November 1st, 2022.

To assess interreviewer agreement, a kappa (κ) statistic was utilized, with κ of 0.81 to 0.99 considered almost perfect agreement, κ of 0.61 to 0.80 considered substantial agreement, κ of 0.41 to 0.60 considered moderate agreement, κ of 0.21 to 0.40 considered fair agreement, and κ of less than 0.20 considered poor agreement. Pearson chi-squared analyses were used to evaluate changes in the percentage of registry abstract acceptances over time. Findings were considered to be statistically significant if the *P* value was less than .05. Statistical analysis was completed using Minitab version 18.0 (Minitab, State College, PA).

Results

A total of 3354 abstracts that were accepted to the AAHKS annual meeting between the years 2012 and 2022 were reviewed and included in this report. There were 2735 posters and 619 podium presentations accepted during this time frame. Of those, 577 abstracts utilized data obtained from orthopaedic registries (17.2%). Four hundred fifty poster abstracts utilized registry data (16.5% of the accepted posters), while 127 podium abstracts utilized registry data (20.5% of accepted podiums). There was near-perfect agreement among the reviewers (k = 0.9403, 95% confidence intervals = 0.67736 to 1.20264).

Trends of registry-based abstracts for posters and podium are seen in Figures 1 and 2, respectively. Rates of registry abstracts have continued to trend upward since 2019, with the highest poster acceptances in 2020 (24.28% of poster acceptances contained registry data) and the highest podium acceptances in 2022 (37.04% of

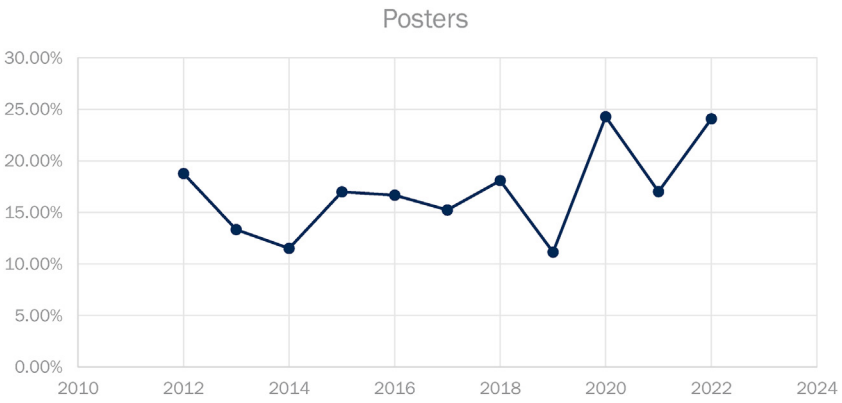

Figure 1. Percentage of posters accepted at AAHKS utilizing large database and registry information.

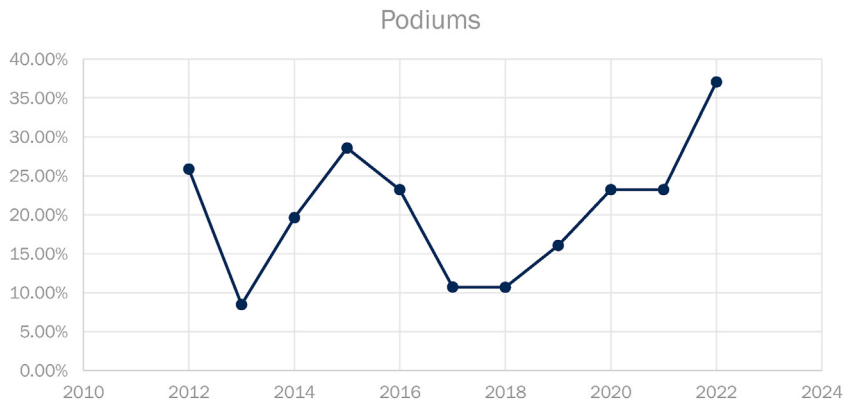

Figure 2. Percentage of podiums accepted at AAHKS utilizing large database and registry information.

podium acceptances). These trends did fluctuate throughout the years, as they were not linear in nature.

Looking at specific registries over this time frame, NSQIP was the most frequent dataset utilized, with 118 abstracts (20.5% of all registry abstracts). This is followed by the NIS dataset with 87 abstracts, then the Medicare dataset with 81 abstracts, and finally PearlDiver with 46 abstracts. There were interesting trends in the use of these databases over time. It is clear that the use of AJRR and PearlDiver have dramatically increased since 2020, while NSQIP has decreased over this time frame (Fig. 3).

A survey of the 2020 registry abstract acceptances was also performed to see if they were published by the time of review. There were a total of 98 registry-based abstracts that were accepted to AAHKS in the year 2020. Of those, 65 (66.32%) have been published in peer-reviewed journals. Thirty-six of those have been published in the Journal of Arthroplasty.

Discussion

The major finding of this study was that there was a significant increase in the number of studies utilizing registry data at the AAHKS annual meeting. As a preeminent meeting for North American arthroplasty surgeons, the AAHKS annual meeting serves as a reasonable proxy for academic output and up-to-date literature. This was confirmed in our literature search of the 2020 registry abstracts, with the majority already published in peer-reviewed journals. Our hypothesis was proven correct: large database and registry research continues to grow. It has even been the focus of symposiums, workshops, and grants exploring the potential utilization of these data sources [1]. We hope that this information will demonstrate the importance of recognizing the widespread use of this information so that orthopaedic surgeons can critically evaluate these studies with a systematic approach.

In this age of big data, these data samples can be divided into national databases and registries. Nationwide databases tend to sample US institutions to capture short-term information on hospitalization and the early postoperative period [13]. While these data sets are good for evaluating the performance of individual surgical procedures and inpatient stays, there is a lack of granularity [14]. This is beneficial in tracking inpatient events; however, it does little to capture what happens when the patient is discharged. For example, delayed wound closure requiring local wound care would not be captured by these data sets. Examples of these data sets are NIS, NSQIP and Medicare, and even outside of arthroplasty, their utilization has been shown to grow rapidly [15]. American College of Surgeons NSQIP is thought to be the most reliable of these sources, with paid research personnel who thoroughly review codes and adverse events to be as accurate as possible [10,16,17]. It is important for individuals to use these large national databases because there can be a lack of clinical detail and that this can result in imprecision, as seen by the considerable variation in complication rates among databases [18].

Registries, on the other hand, were initially created for implant and patient outcome surveillance, and have been performed on a regional, national, and international level [19]. Again, these are observational in nature; therefore, insights into causation are limited. AJRR, for example, is still limited by a smaller number of patients, which limit generalizability, and also has administrative coding that can result in inaccuracies [4]. There has been continued work in an attempt to link to electronic medical records and patient-reported outcomes to improve the dataset, but individuals need to be aware of its deficiencies when reviewing their manuscripts. Other large registries, such as the UK National Joint Registry and the Australian Orthopaedic Association National Joint Replacement Registry, tend to have more complete follow-up with information close to 100% participation from surgeons. They are also limited by selection bias and coding errors, as seen in large observational sets [20].

Our study demonstrated the growth of datasets that require to "pay" for using their data, such as PearlDiver, IBM MarketScan,

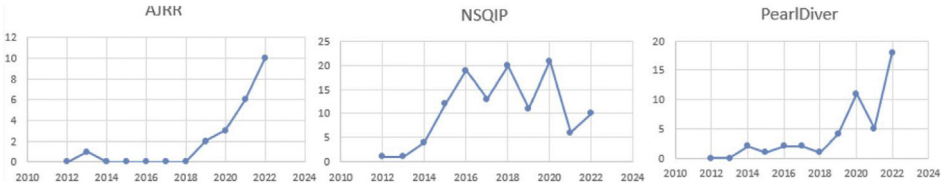

Figure 3. Number of abstracts at AAHKS utilizing (a) AJRR, (b) NSQIP, and (c) PearlDiver between 2012 and 2022.

OptumLabs, and Humana Claims. Not only does this result in a source of bias, but it also significantly limits the proper review of trends and conclusions drawn by papers that use their data. It is true that these types of datasets provide records that enable more large-scale comparisons, but their use will hopefully diminish as artificial intelligence continues to grow in the medical industry. In particular, large language models will hopefully allow data across multiple electronic medical records to translate seamlessly, so that information from inpatient and outpatient settings or between multiple healthcare systems can effortlessly link. This would allow our field to answer questions that require a large sample size, achieving the promise of large databases with a large capture rate. It is possible that artificial intelligence could even allow comparisons between data across different registries. With the growth of these models, hopefully the barrier to paying for access will diminish as well.

Other fields have also noted a similar increase in registry publications, as there has been a push for evidence-based medicine [18]. A review of evidence in podium presentations at the American Academy of Orthopaedic Surgeons Annual Meeting from 2001 to 2010 demonstrated level I evidence at around 2%-7%. Similarly, another analysis reviewing all orthopaedic journals noted 11.3% of articles to be Level I evidence. More recent analyses have seen a concerted effort to increase Level I evidence, with podium presentations at both the American Shoulder and Elbow Surgeons and AAHKS meetings with increasing rates up to 17% and 11.8%, respectively [12,21]. It is hypothesized that Level I arthroplasty evidence has not grown as rapidly as the large dataset and registries continue to provide ample information for this field, as confirmed in this manuscript.

Limitations

There are limitations in this manuscript that should be noted. The AAHKS annual meeting is only one sample of accepted research and does not capture all international works in the field of arthroplasty. Our survey of 2020 accepted abstracts could also have been too recent of a review to examine if they go on to publication, but it does provide a sample percentage of how many were distributed in manuscript form. Finally, our analysis was based on an abstract review. Abstracts are brief in form, with AAHKS current guidelines requiring 300 words or less. This therefore provides little information in the data source of each project and therefore could result in misclassification.

Conclusions

This review of AAHKS abstracts from 2012 to 2022 has demonstrated a significant increase in the number of studies utilizing registry data. NSQIP sample was the most utilized large database during this time frame; however, its use has slightly decreased recently. On the other hand, AJRR and PearlDiver have both demonstrated increased utilization over the past 3 years, surpassing NSQIP in 2022. While registries provide helpful surveillance data and can show associations, individuals should understand that causation cannot be proven. Each of these databases and registries have strengths and weaknesses that should be fully examined before any conclusions can be made from the study results.

Conflicts of interest

J. M. Jennings receives royalties from Total Joint Orthopedics, is a paid consultant for Total Joint Orthopedics and Xenex, has stock options in Xenex, and receives research support from DePuy and A Johnson & Johnson Company. D. A. Dennis is a DePuy and A Johnson & Johnson Company speaker and receives royalties from them; is a paid consultant for Corin USA, DePuy, and A Johnson & Johnson Company; has stock options in Joint Vue; receives research support from DePuy, A Johnson & Johnson Company, and AdventHealth Porter; receives royalties from Wolters Kluwer Health-Lippincott Williams & Wilkins; and is an editorial board member of CORR, JOA, JBJS, and Orthopedics Today. All other authors declare no potential conflicts of interest.

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CRediT authorship contribution statement

Adam Driesman: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Olivia Vyge:** Writing – review & editing, Resources, Data curation. **Caroline Poate:** Writing – review & editing, Formal analysis, Data curation. **Nicole Quinlan:** Writing – review & editing, Methodology, Investigation, Data curation. **Roseann M. Johnson:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Formal analysis, Data curation, Conceptualization. **Douglas A. Dennis:** Writing – review & editing, Supervision, Data curation, Conceptualization. **Jason M. Jennings:** Writing – review & editing, Project administration, Methodology, Investigation, Conceptualization.

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