


## Research Articles

# Investigation of Orthopedic Research Trends through Published Papers within Q1 Journals through 2021 - 2022

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### Objectives

This study aimed to identify emerging “hot topics” in orthopedic surgery and analyze key factors shaping the future of the specialty, providing insights into evolving challenges and opportunities for practitioners and researchers.

### Methods

In August-September 2024, we analyzed citation counts for articles published in 2021-2022 across 15 high-impact first-quartile (Q1) orthopedic journals. Articles were categorized by subspecialty and trauma relevance, and citation data were collected from Google Scholar. Two reviewers extracted the data, resolving discrepancies with a third reviewer. Citation indices were calculated to compare academic impact, and journals were ranked into quartiles (Q1-Q4) based on citation scores and impact factor.

### Results

In 2021, the average citation index across orthopedic subspecialties ranged from 3.6 for Hand (min-max: 0-19.5) to 15 for General Orthopedics. The highest citation indices were seen in General (15), Knee/Leg (12.4), and Trauma (12.4). The average citation index in 2022 for the Hand topic was 3.6 (min-max: 0-11.2), the Wrist topic 6.7 (0-11.8), the Elbow/Forearm topic 4.3 (0-9.3), the Shoulder/Humerus topic 7.4 (0-12.2), the Hip/Pelvis/Femur 8.2 (4.9-10.6), the Knee/leg topic 10.1 (4.8-18.8), the Foot & Ankle topic 9.8 (4-33), the Spine topic 8.3 (0-15.5), the Clavicle topic 4.3 (0-14.5), the Basic Science topic 2.8 (0-8.7), General topic 9.4 (3.6-17.9), and the Trauma topic was 8.7 (3-16.3). The cumulative citation index for 2021-2022 showed General (24.4) and Knee/Leg (22.5) as the highest, followed by Trauma (21.1) and Shoulder/Humerus (21.6).

### Conclusion

Analyzing citation trends in orthopedic subspecialties helps predict emerging discoveries and guides patient care, research, and education advancements. Staying informed on these trends ensures the field evolves with the most impactful developments.

## INTRODUCTION

Orthopedic surgery is rapidly growing with advances in devices and biological substitutes<sup>1</sup> as well as evolutions in surgical techniques.<sup>2</sup> Moreover, orthopedic surgery is be-

coming more subspecialized, with some fields growing faster and having a higher publication rate.<sup>3</sup> It can be related to higher engagement of the academic faculty in the subspecialty, causing faster dissemination and sharing of the science. “hot fields” indirectly show the shift of interest

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towards specific fellowships and engagement in academic activities.<sup>4</sup> By identifying the “Hot Topics” in orthopedic surgery and the key factors influencing its future, our study seeks to delve into these trends.

This study explores emerging “hot topics” in orthopedic surgery and analyzes trends shaping the future of the field, offering insights into evolving challenges and opportunities for practitioners and researchers.

## METHODS

This study was performed in August-September 2024, looking at the number of citations received for each published article in 2021 and 2022 in a series of the first quartile (Q1) general orthopedic journals. We selected fifteen high-impact orthopedic journals in the Q1 category that cover all orthopedic subspecialties. All published articles were separated by the journal and year into respective Excel Datasheets. Each article was sub-grouped based on the related orthopedic subspecialty, including hand, wrist, elbow, shoulder, hip and pelvis, knee, foot and ankle, spine, general, and basic science. Moreover, each article was categorized as to whether it was related to trauma surgery. Google Scholar was used to find the number of citations each article received over the past years, which will be a surrogate determinant of a Journal Impact Factor (IF).

Citation counts were extracted in Excel by two independent reviewers (AC & NN) using a standardized form, with disputes resolved by a third reviewer (ARK). The data was analyzed to determine the number of publications and citation counts per subspecialty, and a citation index (citations per subspecialty publication) was calculated to compare academic impact across orthopedic topics.

Journals are ranked into four quartiles: Q1 (top 25%), Q2 (25-50%), Q3 (50-75%), and Q4 (bottom 25%) based on citation scores.<sup>5</sup>

The impact factor is calculated by dividing the current year's citations by the number of citable publications from the previous two years. It serves as a measure of a journal's prestige.<sup>6</sup>

## RESULTS

The average citation index in 2021 for the Hand was 5.3 (min-max: 0-19.5), the Wrist 6.5 (0-15), the Elbow/Forearm 8.5 (0-19.2), the Shoulder/Humerus 14.2 (0-21), the Hip/Pelvis/Femur 11 (5.4-15), the Knee/leg 12.4 (3-21.5), the Foot & Ankle 11.5 (0-21.4), the Spine 9.7 (0-16.5), the Clavicle 4.1 (0-11.7), the Basic Science 5.3 (0-19), General 15 (7.9-24), and the Trauma was 12.4 (4.6-19.9). [Table 1]

The average citation index in 2022 for the Hand was 3.6 (min-max: 0-11.2), the Wrist 6.7 (0-11.8), the Elbow/Forearm 4.3 (0-9.3), the Shoulder/Humerus 7.4 (0-12.2), the Hip/Pelvis/Femur 8.2 (4.9-10.6), the Knee/leg 10.1 (4.8-18.8), the Foot & Ankle 9.8 (4-33), the Spine 8.3 (0-15.5), the Clavicle 4.3 (0-14.5), the Basic Science 2.8 (0-8.7), General 9.4 (3.6-17.9), and the Trauma was 8.7 (3-16.3). [Table 2]

The cumulative citation index in 2021 and 2022 for the Hand was 8.9, the Wrist 13.2, the Elbow/Forearm 12.8, the Shoulder/Humerus 21.6, the Hip/Pelvis/Femur 19.2, the Knee/leg 22.5, the Foot & Ankle 21.3, the Spine 18, the Clavicle 8.4, the Basic Science 8.1, General 24.4, and the Trauma was 21.1.

The average citation index for both 2021 and 2022 for the Hand was 5.03, the Wrist 6.43, the Elbow/Forearm 6.62, the Shoulder/Humerus 10.72, the Hip/Pelvis/Femur 9.66, the Knee/Leg 11.30, the Foot/Ankle 10.79, the Spine 8.96, the Clavicle 4.0, the Basic Science 4.32, the General 12.21, and the Trauma was 10.41. [Table 3]

## DISCUSSION

This study analyzed articles from major orthopedic journals, categorizing them by body part focus and evaluating citation counts to assess academic impact. By examining citation patterns in Q1 journals from 2021-2022, we identified subspecialties driving academic activity. Citation trends offer insights into emerging research areas and potential breakthroughs, highlighting topics with significant development and future relevance.

In 2021, General Orthopedics led with a Citation Index of 14.97, followed by Shoulder/Humerus at 14.2, indicating a strong research focus on shoulder-related topics. In 2022, Knee/Leg topped with 10.18, followed by Foot/Ankle at 9.8, highlighting them as key research hotspots. Cumulatively, General Orthopedics had the highest index at 24.4, with Knee/Leg at 22.5.

Upon reviewing the current literature, we identified studies comparable to ours. A bibliometric analysis of *Acta Orthopaedica* reviewed 976 articles and identified trauma (n=207), general orthopedics (n=144), and spine (n=105) as the most prominent subspecialties.<sup>7</sup> Another study evaluated the status and trends of robotic orthopedic surgery. Results showed that most of the robotic surgeries in orthopedics were applied in the knee and spine.<sup>8</sup> Another systematic review study used machine learning prediction models to identify the most studied topics in orthopedics and found that survival management was among the most reported outcome domains, just below medical management.<sup>9</sup> Of the survival studies, six focused on orthopedic oncology and five on orthopedic trauma. Spinal surgery emerged as the most commonly involved subspecialty.<sup>9</sup> Another study in Italy on hand and wrist trauma during the COVID-19 (CoronaVirus Disease) emergency found that despite strict restrictions in 2020, trauma rates remained like the previous year. However, there was a shift in injury causes, with a decrease in sport- and traffic-related traumas and an increase in domestic injuries. The age group most affected also shifted from young adults to the elderly and active adults experiencing accidental injuries.<sup>10</sup> Another study on the impact of COVID-19 on orthopedic trauma showed significant changes in injury distribution from 2019 to 2020. Polytrauma decreased by 92.5%, while head-neck injuries rose by 13.1%. Clavicle injuries dropped by 95%, shoulder injuries by 67.9%, and humerus injuries by 46.2%. Elbow injuries increased by 76.2%, and forearm, wrist, and

**Table 1. Citation Index for 2021**

Citations / Publications = Citation Index												
	Hand	Wrist	Elbow/ Forearm	Shoulder/ Humerus	Hip/Pelvis/ Femur	Knee/ Leg	Foot & Ankle	Spine	Clavicle	Basic Science	General	Trauma
International Orthopaedics	6.6	11.5	19.2	7.8	11.5	14.6	11.0	8.6	7.0	9.2	14.5	11.6
JBJS	3.0	11.8	9.8	15.1	13.7	16.2	14.1	14.9	0	11.8	16.8	13.0
Bone and Joint Journal	4.6	8.5	13.0	51.2	13.9	21.5	26.5	8.4	6.0	18.9	24.2	14.0
JAAOS	8.3	9.0	13.8	13.8	12.5	12.5	11.3	9.3	8.0	4.0	9.9	4.6
Archives of Ortho-Trauma Surgery	5.3	1.1	8.0	12.7	11.0	16.0	15.5	14.7	9.0	0	19.4	19.0
Ortho, Trauma, Surgery, Research	3.0	7.8	6.2	10.7	10.8	10.9	9.7	5.5	3.0	0	16.2	7.5
CORR	9.0	7.0	15.0	8.4	13.2	9.4	10.8	14.4	11.7	9.0	18.0	18.3
Bone and Joint Open	0	12.5	4.0	14.6	8.7	11.4	13.9	4.0	9.5	0	14.0	11.8
EFORT Open Reviews	19.5	0	7.7	20.9	9.8	15.9	21.4	17.0	0	0	20.0	19.9
Acta Orthopedics	0	4.0	7.7	10.3	11.8	8.8	16.5	9.7	0	5.0	16.7	14.0
JBJS Reviews	9.3	0	7.3	9.9	6.6	14.6	8.8	9.5	0	2.0	7.9	10.8
Bone and Joint Research	0	8.5	0	0	15.1	11.9	0	16.5	7.0	10.8	12.9	8.1
Journal of Ortho-Traumatology	0	0	7.5	13.9	9.5	8.5	7.0	0	0	0	11.5	8.0
Clinics in Ortho Surgery	7.0	15.0	2.2	7.8	5.4	9.2	5.2	13.2	0	6.0	8.9	8.3
JBJS Open Access	0	0	1.0	11.0	14.0	3.0	13.0	9.0	4.0	8.0	8.0	10.1
Current Reviews in MSK Medicine	9	7.0	13.8	19.3	9.5	14.6	0	0	0	0	20.7	19.0
Total Average Citations /Article	5.3	6.5	8.5	14.2	11.1	12.4	11.5	9.7	4.1	5.3	15.0	12.4

**Table 2. Citation Index for 2022**

Citations / Publications = Citation Index												
	Hand	Wrist	Elbow/ Forearm	Shoulder/ Humerus	Hip/Pelvis/ Femur	Knee/ Leg	Foot & Ankle	Spine	Clavicle	Basic Science	General	Trauma
International Orthopaedics	11.2	11.8	3.3	9.3	10.1	9.4	6.0	10.0	0	8.5	18.0	16.4
JBJS	7.0	0	7.7	8.9	9.9	8.9	4.0	15.6	5.0	0	6.5	12.1
Bone and Joint Journal	5.3	3.0	4.7	7.5	7.8	9.2	8.8	7.9	8.0	0	9.3	8.1
JAAOS	5.6	10.8	4.8	8.5	7.8	7.9	5.2	5.8	13.0	4.0	3.6	8.5
Archives of Ortho-Trauma Surgery	0	0	0	8.8	11.0	4.2	5.5	6.0	11.0	0	7.2	3.0
Ortho, Trauma, Surgery, Research	2.0	3.0	3.5	5.3	6.7	13.1	10.5	6.8	0	0	10.5	7.2
CORR	1.0	4.0	7.0	5.0	6.4	18.8	6.0	10.4	3.5	0	6.9	5.4
Bone and Joint Open	2.5	3.0	3.7	3.6	6.9	9.1	11.4	5.4	14.5	2.0	7.4	9.0
EFORT Open Reviews	0	0	0	0	7.0	10.4	33.0	0	0	8.8	13.9	8.0
Acta Orthopedics	10.5	7.3	6.0	9.9	10.4	11.2	10.4	10.6	0	0	10.1	9.1
JBJS Reviews	6.7	8.8	5.0	12.3	9.1	11.3	6.9	12.1	0	7.3	14.2	11.1
Bone and Joint Research	1.0	10.0	8.4	8.5	10.7	12.6	23.0	11.7	0	0	14.4	13.2
Journal of Ortho-Traumatology	2.0	6.0	9.3	12.0	10.2	14.5	9.0	9.4	4.0	6.0	10.6	10.0
Clinics in Ortho Surgery	0	4.0	0	4.7	4.9	6.8	7.3	5.0	0	3.0	4.6	4.7
JBJS Open Access	4.0	24.0	6.7	6.6	5.7	7.0	4.9	10.1	3.3	5.3	6.2	7.4
Current Reviews in MSK Medicine	0	11.6	0	8.6	7.4	8.8	6.5	6.2	8.0	0	7.5	7.2
Total Average Citations /Article	3.7	6.7	4.4	7.5	8.2	10.2	9.9	8.3	4.4	2.8	9.4	8.8

**Table 3. Citation Index Averaging 2021 and 2022**

Citations / Publications = Citation Index												
	Hand	Wrist	Elbow/ Forearm	Shoulder/ Humerus	Hip/Pelvis/ Femur	Knee/ Leg	Foot & Ankle	Spine	Clavicle	Basic Science	General	Trauma
International Orthopaedics	5.3	17.8	13.0	7.2	8.6	10.8	8.0	9.3	5.2	7.3	10.4	9.5
JBJS	1.5	8.9	9.6	13.6	11.9	15.4	11.6	12.2	2.0	8.9	13.7	11.5
Bone and Joint Journal	4.1	9.3	10.7	29.8	12.3	17.0	24.8	10.1	3.0	9.5	19.3	13.6
JAAOS	8.3	10.3	6.9	11.2	9.9	10.6	8.9	7.8	8.0	2	8.7	5.9
Archives of Ortho-Trauma Surgery	5.3	2.0	6.3	10.1	9.4	12.6	12.1	11.3	8.5	0	14.3	13.6
Ortho, Trauma, Surgery, Research	3.0	6.7	8.5	7.8	9.6	9.3	8.8	5.3	4.4	6.5	10.1	5.6
CORR	9.0	7.9	10.-	10.4	11.1	10.4	8.8	13.3	5.9	8.1	16.1	14.7
Bone and Joint Open	2.6	8.3	5.5	9.8	7.5	15.1	9.9	7.21	6.5	0	10.4	8.6
EFORT Open Reviews	10.8	3.7	6.8	15.4	10.1	13.6	15.9	13.8	0	0	15.1	14.5
Acta Orthopedics	1.5	4.0	3.8	7.5	8.3	7.8	11.9	7.3	0	4.0	10.7	9.4
JBJS Reviews	8.6	1.5	5.5	6.7	6.8	11.9	10.1	7.4	7.3	2.0	7.6	9.9
Bone and Joint Research	4.3	4.3	0	0	11.1	11.1	16.5	8.3	3.5	9.8	13.4	8.1
Journal of Ortho-Traumatology	2.2	0	7.6	11.4	9.7	8.7	5.5	7.8	2.5	0	9.0	10.1
Clinics in Ortho Surgery	6.4	13.4	2.7	8.5	7.7	9.3	5.6	11.6	0	7.3	13.4	12.3
JBJS Open Access	3.3	0	0.5	9.9	12.5	3.6	9.3	7.5	7.5	4.0	7.6	6.5
Current Reviews in MSK Medicine	4.5	5.0	8.7	12.3	8.1	13.9	5.3	3.4	0	0	15.6	13.1
Total Average Citations /Article	5.0	6.4	6.6	10.7	9.7	11.3	10.8	9.0	4.0	4.3	12.2	10.4

hand injuries decreased by 75%, 87.1%, and 62%, respectively. Pelvis, hip, and rotula injuries dropped by 50%, 55.1%, and 85.7%, while knee injuries slightly rose by 9.1%. Leg injuries fell by 96.8%, ankle injuries by 66.7%, and foot injuries by 84.8%. Vertebral injuries plummeted by 98.1%, and other injuries decreased by 86.5%.<sup>11</sup> Another study on research trends in computer-assisted orthopedic surgery (CAOS) found 639 articles published, averaging 32 per year. Most (47.6%) appeared in top journals, with 81.2% from the top 10 countries. Digital techniques comprised 62.3%, and knee, spine, and hip/pelvis accounted for 89% of publications. Citation rates increased in the latter half of the period, and the largest publication growth was seen in hand/wrist (+1,300%), ankle (+467%), and shoulder (+367%).<sup>12</sup> Another study assessed the Orthopedic research productivity of KSA. It showed that the breakdown of specific orthopedic topics reveals that "Broad coverage" leads with 42.33% of publications, followed by "Spine" at 19.07% and "Trauma" at 8.14%. Topics like "Pediatric Orthopedics," "Knee," and "Sports and Arthroscopy" show moderate representation (~3.5–7%), while less attention is given to areas like "Arthritis," "Geriatric Orthopedics," and "Orthopedic Infection," each under 1%. These results emphasize comprehensive and spine-related research, with lesser emphasis on niche topics.<sup>13</sup> A bibliometric analysis of orthopedic theses in Turkey found orthopedic trauma (28.1%), adult reconstruction and arthroplasty (15.8%), and spine surgery (10.6%) were the most studied topics. Bone and soft tissue tumors were the least studied (3.8%). Orthopedic trauma was the most consistently published topic across all years.<sup>14</sup> Another bibliometric analysis of orthopedic publications by Indian authors revealed that most articles were on General Orthopaedics (1,405 articles, 14,517 citations), followed by knee and leg (322 articles, 1,417 citations) and hip and thigh (223 articles, 1,198 citations). The General category included multi-specialty and basic science articles, and research on metals, materials, and arthroplasty.<sup>15</sup> A bibliometric analysis of the top 50 most cited publications in the Journal of Clinical Orthopaedics and Trauma found trauma and adult reconstruction as the most common subspecialties, with Level 4 studies most frequent. Basic science and COVID-19 articles received the highest citations.<sup>16</sup>

There are potential limitations associated with this study. As of October 25th, 2024, 80 journals are categorized

as Q1 Orthopedic Journals.<sup>17</sup> This study analyzed 15 of the Q1 orthopedic journals, offering a broad overview, but the small sample size limits generalizability. Categorizing articles, especially those covering multiple subspecialties, was challenging. Despite these limitations, the study provides valuable insights into current orthopedic research trends.

## CONCLUSION

Understanding citation trends in orthopedic surgery helps predict emerging areas of discovery and improvement. Staying current on these trends is crucial for maintaining high-quality patient care and advancing the field. Citation patterns across subspecialties reveal the state of the field, guide future research, and influence funding, resource allocation, and education in orthopedics.

## DECLARATION OF CONFLICT OF INTEREST

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## DECLARATION OF ETHICAL APPROVAL FOR STUDY

The Institution does not require ethical approval for reporting individual cases, case series, etc., or you have a waiver of ethical approval (e.g., basic science studies involving cadaver specimens, etc.).

## DECLARATION OF INFORMED CONSENT

There is no information (names, initials, hospital identification numbers, or photographs) in the submitted manuscript that can be used to identify patients.

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