Bibliometric analysis of case report citations and their effect on the impact factor: How does publishing case reports impact journals?

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Original article

Bibliometric analysis of case report citations and their effect on the impact factor: How does publishing case reports impact journals?

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Abstract

Introduction:

Given their low citation rate, case reports may reduce a journal's impact factor (IF), making a journal less likely to accept them for publication. However, this concept has never been proven in a bibliometric study. This led us to carry out a bibliometric analysis to evaluate 1) the exact number of case reports published in orthopedics over a 2-year period, 2) their citation rate, 3) what the journals' IF would be if they had not published these case reports.

Hypothesis:

Publishing case reports reduces a journal's IF, bringing into question whether they should be published.

Materials and Methods

This was a retrospective bibliometric study. We focused on all the articles influencing the year 2017. We looked at all the journals in the "Orthopedics" discipline that had published at least one article in the years N−2 (= 2015) or N−1 (= 2016).

Results:

There were 1925 case reports among the 28,903 articles published in all orthopedics journals in 2015-2016, a 6.7% share of publications. Individually, each case report in 2015-2016 was cited an average of 0.86 times ± 1.4 [0-13] in 2017. Of all the case reports published in 2015-2016, 571 (30%) had not been cited in 2017. When comparing the individual number of each case report citation to the journal's IF, we found 413 instances (21.5%) where the case report was cited more than expected and 1512 (78.5%) where it was cited less than expected based on the journal's IF. The mean IF was 2.013. If the journals had not published any case reports, the mean IF would have been 2.072 ($p < 0.0001$). For all the SIGAPS categories, the mean IF would have been higher if no case reports had been published. On average, the IF was lower by 0.059 points ± 0.121 [−0.165 – 0.537], with the difference being statistically significantly only for SIGAPS C and D journals. In 69 instances, the IF would be higher if the journal had not published any case reports. Conversely, the IF improved in 8 instances by publishing case reports: 3 were tier D journals and 5 were tier E journals.

Discussion:

Our study brings into question whether case reports should be published. Indeed, the publication of case reports lowers the IF of scientific journals. However, we should not completely stop publishing

case reports since they can be useful to clinicians caring for patients with rare diseases or medical conditions.

Level of evidence: IV, systematic retrospective study

Key words: bibliometric, Case report, Publication rate, orthopedics, impact factor

1. Introduction

Scientific publications are a medium to communicate and exchange scientific knowledge. It is used extensively, especially in orthopedics, and the research domains are broad [1–3]. Among the millions of scientific publications throughout the world, few will ever be heavily cited [4]. Scientific journals publish articles to disseminate scientific information in their domains. A journal's impact factor (IF) evaluates its publication rate and citation rate by taking the ratio between the number of times a published article is cited in the 2 years before the analysis and the number of articles published during these same 2 years. While optimizing the IF has positive effects such as having journals compete and helping to rank researchers, it has its drawbacks, since some journals focus narrowly on increasing their IF. While some question whether the IF is still a useful concept, it continues to be used to compare journals to each other [5–9].

Various types of scientific studies can be done depending on the type of pathology, its frequency and whether or not patients can be enrolled in prospective studies. These studies have different levels of evidence, ranging from meta-analyses of randomized trials (highest level) to case-control studies, retrospective studies and lastly, case reports (CR). An investigator aims for the highest level of evidence possible. However, certain disease conditions are rare and can only be documented by publishing a CR about isolated cases. The same goes for complications, novel treatment of a known disease or new conditions. These articles are useful for fewer readers than a study on a more widespread medical condition. Given the low citation rate of CRs [10], they are said to contribute to decreasing the IF of scientific journals, making it harder and harder for them to get accepted for publication [11]. CRs are less desirable to journals that are focused on increasing their IF. However, their true influence on bibliometric data has not been described accurately. This led us to carry out a bibliometric study to evaluate 1) the exact number of case reports published in orthopedics over a 2-year period, 2) their citation rate, 3) what the journals' IF would be if they had not published these case reports. We hypothesized that publishing case reports reduces a journal's IF, bringing into question whether they should be published.

2. Materials and methods

2.1 Materials

This was a bibliometric study. We looked at all the articles influencing the year 2017 (the last year with IF data available when we carried out this study). The 2017 IF was calculated by dividing the number of 2017 citations of articles published in 2015 and 2016 by the number of articles published in 2015 and 2016. The IF data was taken from SIGAPS (software to identify, manage and analyze

scientific publications). The SIGAPS classification helps to make the various disciplines more comparable and is used to rank journals based on their IF [12].

2.2 Methods

We looked at all the journals in the "Orthopedics" discipline that had published at least one article in the years N−2 (= 2015) or N−1 (= 2016). We included all the CRs in the year of interest through a manual search and then analyzed each article by its title and/or abstract. Case series were excluded so as to focus solely on CRs, which are articles featuring a single patient. We did this because the definition of a CR varies between journals and there is no threshold for when a case series becomes a retrospective study. For each journal, we used PubMed and Google Scholar to determine how many articles had been published in this journal in years N−2 and N−1 of the 2017 IF, then we looked at all the CRs published in each journal in years N−2 and N−1. For each CR, we used Google Scholar to determine how many times this article had been cited in 2017, thereby affecting the IF. With these data, we determined the mean number of true citations that we then compared to the expected number of citations for each article based on the journal's IF and its number of publications. The number of citations expected in 2017 for each article published in 2015 and 2016 is equal to the journal's 2017 IF. We determined how many times each CR was cited more or less than the expected number of citations based on the journal's IF. We then looked at what the journals' IF would be if they had not published these CRs by counting how many articles were not CRs and how often they were cited.

2.3 Statistics

Statistical calculations were done using Excel™ software (Microsoft, Redmond, USA) and Addinsoft (2019) XLSTAT™ statistical and data analysis solution (Long Island, NY, USA). The findings were summarized with mean ± standard deviation, minimum and maximum values for quantitative variables or with median and quartiles for data that was not distributed normally. The normality of the distributions was verified using the Shapiro & Wilk test; with normal data, the significance of differences between means was tested using Student's *t* test; otherwise the nonparametric Wilcoxon test was used. Counts were compared using Fischer's exact test or the Chi-square test as appropriate. Correlations were calculated with Pearson's coefficient. There was no missing data; all the abstracts were analyzed. The risk of a Type I error was set 5% and 95% confidence intervals were used.

3. Results

In the year 2017, we identified 79 journals in the Orthopedics category, of which two were excluded because they did not publish articles in the years N−2 and N−1 (Isokinet Exerc Sci and J Am Podiatry Assoc). A list of the journals included with their IF and SIGAPS tier is provided in Appendix 1.

The study flow chart is shown in Figure 1. There were 990 CRs published in 2015 and 935 in 2016, for a total of 1925 CRs in the years 2015 and 2016. On average, the journals had published 12.9 CRs ± 20.4 [0-91] in 2015 and 12.1 CRs ± 20.6 [0-113] in 2016.

Since these journals published 28,903 articles in all of 2015 and 2016, CRs made up 6.7% of these publications (Table 1). On average, each journal had published 192.1 ± 164.0 [0-644] articles in 2015 and 191.1 ± 148.9 [0-588] in 2016. There was a negative but non-significant correlation (−0.159; p = 0.167) between a journal's IF and the number of CRs published.

Individually, each CR was cited an average of 0.86 times ± 1.4 [0-13] in 2017. CRs published in 2015 had a mean of 0.96 ± 1.49 [0-13] citations, while those published in 2016 had a mean of 0.76 ± 1.29 [0-13] citations (p = 0.002). Of all the CRs, 571 (30%) were not cited at all in 2017. When comparing the individual number of each case report citation to the journal's IF, we found 413 instances (21.5%) where the case report was cited more than expected and 1512 (78.5%) where it was cited less than expected based on the journal's IF. There was a weak but significant correlation between the journal's IF and the number of CR citations (Pearson 0.048, p = 0.034). Articles ranked as "*SIGAPS A*" were cited 1.93 times ± 3.28 [0-12], more than average relative to the articles in the other SIGAPS categories (p = 0.003). Articles classified as "*SIGAPS B*" were cited an average of 0.98 times ± 1.41 [0-7] relative to articles in the other SIGAPS categories (p = 0.29). Articles classified as "*SIGAPS C*" were cited an average of 0.76 times ± 1.22 [0-9] relative to articles in the other SIGAPS categories (p = 0.07). Articles classified as "*SIGAPS D*" were cited 0.99 times ± 1.53 [0-13], more than average relative to the articles in the other SIGAPS categories (p = 0.00008). Articles classified as "*SIGAPS E*" were cited 0.54 times ± 0.98 [0-6], less than average relative to the articles in the other SIGAPS categories (p = 0.000004).

The mean IF of journals relative to the SIGAPS rank of their journal and their estimated IF without the CRs is shown in Table 2. The mean IF was 2.013. If the journals had not published any case reports, the mean IF would have been 2.072 (p < 0.0001). For all the SIGAPS categories, the mean IF would have been higher if no CRs had been published, with the difference being statistically significantly only for the SIGAPS C and D journals. On average, the IF was lower by 0.059 points ± 0.121 [−0.165 – 0.537]. In 69 instances, the IF would have increased if the journal had not published any case reports.

Conversely, the IF improved in 8 instances by publishing case reports: 3 were D journals and 5 were E journals.

4. Discussion

Our study found a considerable number of CRs being published in orthopedics. However, their citation rate was lower than expected given the journals' IF. The fact that journals published CRs lowered their IF in most instances, confirming our hypothesis. The advantage of publishing this type of research appears small if we solely look at the IF and citation rate. Nevertheless, more than 20% of the CRs were cited more than expected. The IF differences in our study were small. This is in large part because CRs made up only a small share of the total number of articles published that influence the journals' IF. While the difference in IF with and without CRs is small, the probability was very high because of the large number of articles analyzed (nearly 2000).

Many novel findings came out of our study, including the large number of CRs where the real citation rate was lower than the expected rate. While letters to the editor have previously raised questions about whether CRs should be published at all, no statistical analysis has been done up to now to support these statements [13–15]. An article's citation rate is important because it reflects on its scientific reach. CRs are often read by a surgeon on a case-by-case basis without being used or cited in another article. Clinicians who are faced with a rare but tangible condition often look at case reports. Thus the usefulness of a CR goes beyond being cited; it helps in treating patients with complex or rare medical conditions [16]. CRs have a teaching aspect to them, also making them useful in this manner.

Citations of CRs in the journals with the highest IF (SIGAPS A) were the most common. Conversely, CRs were less cited in lower-tier journals (SIGAPS E). Paradoxically, CR in class D journals were cited more than the other CRs. Nevertheless, this higher rate still contributed to these journals having a lower IF. We can hypothesize that publishing few CRs explains the impact on the IF. In fact, we observed a paradoxical effect in certain journals that published many CRs and were affected in the inverse direction to other journals.

While bibliometric studies such as this one are becoming more common, they have limitations [3].
1) The first limitation is that we only looked at 1 year. Nevertheless, we had a large number of articles, which led to us finding significant differences in the main outcome measure. A major problem with analyzing 2 years would have been taking into account how each journal's IF changes, and especially since certain journals shift from one SIGAPS category to another from one year to the next.

2) The data extraction was done by two of the authors; however, this search was likely not exhaustive and may have missed some articles.

3) We did not include articles that had “case report” in their title but described several cases so as to be more restrictive; in all reality, these articles likely had a higher chance of being cited.

4) This study was retrospective, as any bibliometric analysis would be.

5) Certain journals refuse to consider CRs, which may be a selection bias, although in our analysis, every journal had at least one published CR, even those that typically refuse them.

6) We used the SIGAPS classification in our analysis, although the ranking of the journals provided by this classification is not perfect. This problem often occurs with journals classified in different categories based on their target specialty: orthopedics, surgery, etc. Despite these limitations, our original study casts doubt on whether it is useful to publish CRs from a purely bibliometric viewpoint. A long-term analysis would be needed to verify these conclusions and to see if the observed effects increase or decrease over time.

5. Conclusion

Our study brings into question whether case reports should be published. Indeed, the publication of case reports lowers the IF of scientific journals. However, we should not completely stop publishing case reports since they can be useful to clinicians caring for patients with rare diseases or medical conditions.

Conflict of interest: SB is a consultant with Zimmer outside this study. SD is a consultant with SERF, Euros and DePuy outside this study. PSM was compensated by Sanofi outside this study. GV is a consultant with FH Ortho outside this study. The other authors have no conflict of interest to disclose in which payment was received.

No funding was received for this study

Author contributions:

RE designed the study, collected data, did the statistical analysis, wrote the manuscript and made corrections
JD contributed to the design of this study, data collection
GV contributed to the design of this study, data collection, writing the article and corrections
PSM contributed to correcting the article
SD contributed to the design of this study and correcting the article
SB contributed to the design of this study and correcting the article

Figure legends

Figure 1: Flow chart (only the articles featuring a single patient were retained as a case report; those with two or more patients were excluded)

References

[1] Dartus J, Saab M, Erivan R, Reina N, Ollivier M, Devos P. Bibliometric evaluation of orthopaedics and traumatology publications from France: 20-year trends (1998-2017) and international positioning. Orthop Traumatol Surg Res 2019;105:1425–37.

[2] Saab M, Dartus J, Erivan R, Reina N, Ollivier M, Devos P. Publication output of French orthopedic and trauma surgeons: Quantitative and qualitative bibliometric analysis of their scientific production in orthopedics and other medical fields. Orthop Traumatol Surg Res 2019;105:1439-1446..

[3] Ollivier M, Jacquet C, Erivan R, Devos P, Bouyer B, Ehlinger M. Disrupting research in orthopedics: Reasons for facing the challenge of change. Orthop Traumatol Surg Res 2020;106:213-215.

[4] Van Noorden R, Maher B, Nuzzo R. The top 100 papers. Nat News 2014;514:550.

[5] de Barros MPM, Matsunaga FT, Tamaoki MJS. Relation between impact factor in orthopedic journals and level of evidence. Acta Ortop Bras 2018;26:275–7.

[6] Giebaly DE, Haddad FS. Getting Research Published and Achieving the Highest Impact Factor. Instr Course Lect 2017;66:673–9.

[7] Kodumuri P, Ollivere B, Holley J, Moran CG. The impact factor of a journal is a poor measure of the clinical relevance of its papers. Bone Joint J 2014;96:414–9.

[8] Haddad FS. The impact factor: yesterday's metric? Bone Joint J 2014;96:289–90.

[9] Erivan R, Villatte G, Ollivier M, Reina N, Descamps S, Boisgard S. The top 100 most-cited Orthopaedics & Traumatology: Surgery & Research articles. Orthop Traumatol Surg Res 2019;105:1459-1462

[10] Edelmayer LW, Fenton JE, Yellin SA, Shearer DJ, Coelho DH. Case report classics in otolaryngology - head and neck surgery: citation analysis. J Laryngol Otol 2018;132:651–6.

[11] Malatack JJ. The Case for the Case Report. Pediatrics 2018;141:S379–84.

[12] Yuen J. Comparison of Impact Factor, Eigenfactor Metrics, and SCImago Journal Rank Indicator and h-index for Neurosurgical and Spinal Surgical Journals. World Neurosurg 2018;119:e328–37.

[13] Mason RA. The case report--an endangered species? Anaesthesia 2001;56:99–102.

[14] Ruano-Ravina A, Pérez-Ríos M. Regarding a case report: Rare diseases and bibliometric impact factor. J Clin Epidemiol 2012;65:916–7.

[15] Roos J. Let's hear it for the case report. BMJ 2017;356. doi: 10.1136/bmj.j124.

[16] Firat AC, Araz C, Kayhan Z. Case reports: Should we do away with them? J Clin Anesth 2017;37:74–6.

Table 1: Analysis of case reports published in 2015 and 2016 with the number of citations in 2017

SIGAPS tier	Number of journals	Number of case reports published in 2015 and 2016	Total number of articles published in 2015 and 2016	% case reports	Number of case reports cited in 2017
A	7	15	4717	0.32%	29
B	9	133	5029	2.64%	131
C	16	472	8228	5.74%	359
D	27	971	7704	12.60%	957
E	18	334	3225	10.36%	181
TOTAL	77	1925	28903	6.66%	1657

Table 2: Projected impact factor (IF) whether or not case reports are published

Bold values indicate significant differences

SIGAPS tier	Mean true IF	Mean IF without case reports	*p* value (two-tail)	*p* value (one-tail)
A	4.639	4.644	0.155	0.077
B	3.006	3.080	0.153	0.077
C	2.367	2.457	**0.029**	**0.015**
D	1.628	1.711	**0.009**	**0.004**
E	0.758	0.769	0.109	0.054
TOTAL	2.013	2.072	**< 0.0001**	**< 0.0001**

Appendix 1: List of journals evaluated with their 2017 impact factors and SIGAPS classification

Journal title	SIGAPS rank	Official 2017 impact factor	2017 impact factor without case reports
Acta Chir Orthop Traumatol Cech	E	0.645	0.663
Acta Orthop	B	3.076	3.104
Acta Orthop Belg	E	0.542	0.555
Acta Orthop Traumatol Turc	E	0.637	0.696
Acta Ortop Bras	E	0.546	0.546
Am J Sports Med	A	6.057	6.069
Arch Orthop Trauma Surg	C	1.967	2.022
Arch Osteoporos	D	2.382	2.445
Arthroscopy	A	4.33	4.333
BMC Musculoskelet Disord	D	1.998	2.009
Bone Joint J	B	3.581	3.582
Bone Joint Res	C	2.362	2.362
Braz J Phys Ther	D	1.699	1.699
Cartilage	C	2.621	2.644
Chir Main	D	1.14	1.472
Clin Biomech (Bristol, Avon)	D	1.863	1.867
Clin J Sport Med	C	2.224	2.394
Clin Podiatr Med Surg	E	0.919	0.956
Clin Spine Surg	D	2.31	2.334
Clin. Orthop. Relat. Res.	A	4.091	4.113
Connect. Tissue Res.	D	2.608	2.608
Connect. Tissue Res.	D	2.156	2.156
Eklem Hastalik Cerrahisi	D	1.292	1.603
Eur Spine J	C	2.634	2.762
Foot Ankle Clin	E	0.871	0.869
Foot Ankle Int	B	2.653	2.687
Foot Ankle Surg	D	1.458	1.660
Gait Posture	D	2.273	2.279
Hand Clin	D	1.171	1.172
Hand Surg Rehabil	D	1.14	1.432
Hip Int	D	1.276	1.363
Indian J Orthop	E	0.98	0.993
Injury	C	2.199	2.267
Int Orthop	C	2.377	2.377
J Am Acad Orthop Surg	C	2.638	2.648
J Am Podiatr Med Assoc	E	0.445	0.394
J Arthroplasty	B	3.338	3.338
J Back Musculoskelet Rehabil	E	0.982	0.981
J Bone Joint Surg Am	A	4.583	4.583

J Child Orthop	E	1.092	1.092
J Foot Ankle Res	D	1.683	1.683
J Foot Ankle Surg	D	1.138	1.146
J Hand Surg Am	D	1.776	1.903
J Hand Surg Eur Vol	C	2.648	3.065
J Hand Ther	E	1.04	1.062
J Knee Surg	C	2.079	2.079
J Orthop Sci	D	1.264	1.801
J Orthop Sports Phys Ther	B	3.09	3.500
J Orthop Surg (Hong Kong)	E	0.994	1.009
J Orthop Surg Res	D	1.61	1.602
J Orthop Translat	C	2.078	2.078
J Orthop Trauma	C	2.381	2.396
J Pediatr Orthop	C	1.853	1.875
J Pediatr Orthop B	E	0.61	0.669
J Physiother	A	4.542	4.542
J Plast Surg Hand Surg	E	1.1	1.104
J Shoulder Elbow Surg	B	2.849	2.933
J Spinal Disord Tech	D	2.31	2.305
J. Orthop. Res.	A	3.414	3.414
Knee	C	1.903	1.951
Knee Surg Sports Traumatol Arthrosc	B	3.21	3.280
Oper Orthop Traumatol	D	1.188	1.189
Orthop Nurs	E	0.578	0.554
Orthop Surg	D	1.147	1.217
Orthop Traumatol Surg Res	D	1.413	1.484
Orthop. Clin. North Am.	B	2.672	2.672
Orthopade	E	0.632	0.647
Orthopedics	D	1.463	1.538
Osteoarthr. Cartil.	A	5.454	5.454
Phys Sportsmed	D	1.545	1.380
Phys Ther	B	2.587	2.627
Prosthet Orthot Int	D	1.097	1.117
Skeletal Radiol.	D	1.567	1.721
Spine	C	2.792	2.792
Spine J	C	3.119	3.602
Sportverletz Sportschaden	E	0.463	0.449
Z Orthop Unfall	E	0.572	0.601

SIGAPS: software to identify, manage and analyze scientific publications developed by the Lille CHU in 2002

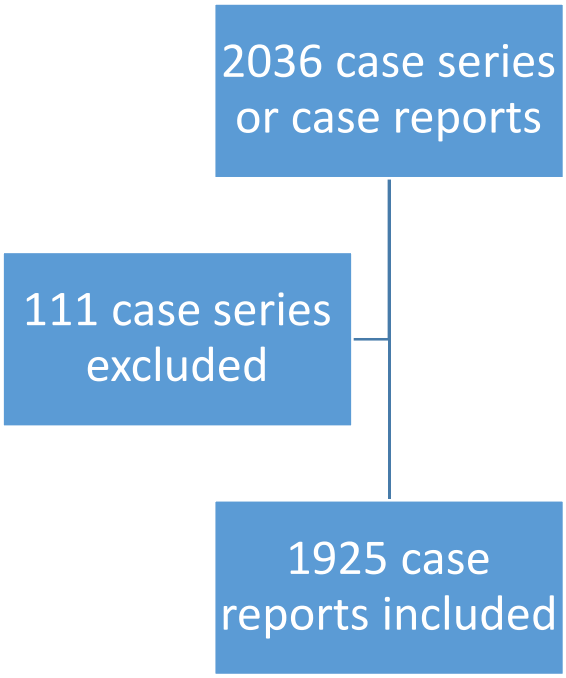
2036 case series or case reports
111 case series excluded
1925 case reports included

Figure 1: