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### ► To cite this version:

Guillaume Villatte, Pierre-Sylvain Marcheix, Maxime Antoni, Patrick Devos, Stéphane Descamps, et al.. Do bibliometric findings differ between Medline, Google Scholar and Web of Science? Bibliometry of publications after oral presentation to the 2013 and 2014 French Society of Arthroscopy (SFA) Congresses. *Orthopaedics & Traumatology: Surgery & Research*, 2020, 106 (8), pp.1469-1473. 10.1016/j.otsr.2020.09.005 . hal-03138334

**HAL Id: hal-03138334**

**<https://uca.hal.science/hal-03138334v1>**

Submitted on 15 Dec 2022

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**Do bibliometric findings differ between Medline, Google Scholar and Web of Science?  
Bibliometry of publications after oral presentation to the 2013 and 2014 French Society of  
Arthroscopy (SFA) Congresses.**

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## Abstract

### Introduction

Bibliometrics consists in quantitative and qualitative analysis of an individual's or group's communication (volume, visibility), and impacts research funding. There are a number of bibliometric data sources, functioning in different ways and liable to give rise to differing statistics. This point has not been investigated in relation to publication following presentation to a French congress. We therefore conducted a study comparing the main bibliometric instruments, aiming to assess: 1) publication rates following oral presentation to the 2013 and 2014 French Society of Arthroscopy (SFA) Congresses according to the database used, and 2) citation rates for these publications according to database.

### Hypothesis

Publication and citation rates differ according to database.

### Material and method

All 199 Abstracts of oral presentations to the 2013 and 2014 SFA Congresses were included. Based on author names and key-words, manual search was conducted in the Medline, Web of Science and Google Scholar databases. Publication characteristics (citation rate) were studied using the 3 databases and the French SIGAPS (*Système d'Interrogation, de Gestion et d'Analyse des Publications Scientifiques*: Scientific Publication Search, Management and Analysis System) website.

### Results

Publication rates according to Medline and Google Scholar were the same (48.2%: 96 articles for 199 presentations), but significantly lower on Web of Science (44.7%: 89/199;  $p= 0.002$ ).

Citation rates differed significantly ( $p < 0.001$ ) between sources, with Google Scholar listing a mean 1.5-3.4-fold more citations per article than the other 2 databases. Citation rates between the 3 databases correlated strongly ( $r = 0.93$ ).

## Discussion

The example presented in this study illustrates the differences in bibliometrics found between different databases. There was a 4% difference (7/199 articles) in publication rates following oral presentation to an SFA Congress, and even greater differences in citation rates per article, with 1.5-3.4-fold more citations according to Google Scholar. Bibliometric studies need to acknowledge the database(s) being used, which should be as many as possible to enhance exhaustiveness.

Level of evidence: IV; descriptive epidemiologic study

Keywords: publication rate; congress, bibliometry.

## 1. Introduction

Clinical and experimental medical research is fundamental to the initial training of young surgeons. It is also vital throughout a physician's career, continuous medical training being mandatory [1,2], so that practices can progress, providing ever-more well-adapted care. Research results are communicated in the community by 2 principal vectors: oral presentation in a national or international congress, and publication of a written article in a journal [3]. Both are often deployed together, as each has its pros and cons. Bibliometrics is the statistical study of scientific publication. It is particularly important as it quantifies an individual's or group's communication in terms not only of volume but of visibility, influence, partnerships, etc. It is also part of the basis of research funding in France, where Teaching, Research, Referencing and Innovation Missions (*Missions d'Enseignement, de Recherche, de Référence et d'Innovation: MERRI*) are funded via the Scientific Publication Search, Management and Analysis System (*Système d'Interrogation, de Gestion et d'Analyse des Publications Scientifiques: SIGAPS*) [4,5].

Bibliometric data can be found in a number of sources, including Web of Science, Google Scholar and Medline, which differ in origin, functioning and referencing system [6–9]. This may lead to differences in bibliometric statistics that are relevant for researchers, journals and congress organizers.

This point has not been investigated in relation to publication following presentation to a French congress. We therefore conducted a study comparing the main bibliometric instruments, aiming to assess: 1) publication rates following oral presentation to the 2013 and 2014 French Society of Arthroscopy (SFA) Congresses according to the database used, and 2) citation rates for these publications according to database. The study hypothesis was that publication and citation rates differ according to database.

## 2. Material and method

### 2.1 Material

A bibliometric study included all oral presentations to the December 2013 and 2014 SFA Congresses. This minimum 5 years' post-congress interval was chosen in the light of findings that 95% of publications following congress presentations are within 4 years [10]. Two consecutive years were included so as to have a sufficient number of presentations.

The following parameters were studied in the congress Abstracts: main topic (joint: shoulder, elbow, wrist and hand, hip, knee, foot and ankle) and subcategory (focus: ligament, tendon, meniscus, cartilage, anatomy, hardware), country of first author, number of centers involved, methodology (multicenter, prospective, randomized), level of evidence, and subsequent publication as article.

Systematic article search was manual on Medline and Google Scholar and digitized on Web of Science, based on author names and key-words in the Abstract, following a previously described methodology [10–14], by two of the present authors. Abstracts were compared between the presentation and the article to check that the two concerned the same study; in case of disagreement, a consensus was reached.

One hundred and ninety-nine presentations were included: 159/199 individual presentations (80%), 28/199 instructional courses (14%), 8/199 fundamental research presentations (4%) and 4/199 symposia (2%). The first author was French in 168/199 cases (84%), other European in 24/199 (12%), North American in 4/199 (2%), and North African in 2/199 (1%). There were 43/199 multicenter studies (22%) and 48/199 reports from international teams (24%).

One hundred and twenty-seven abstracts (64%) concerned clinical studies, including 83/199 prospective (65%) and 14/199 randomized (17%). The retrospective studies (44/199: 35%) were comparative in 11/199 cases (25%). The other presentations concerned experimental

studies (37/199: 19%), literature reviews (30/199: 15%), epidemiologic studies (3/199: 1.5%) and case reports (2/199: 1%).

## **2.2 Methods**

Three bibliographic databases were searched for post-congress articles: Medline, Web of Science and Google Scholar. Citations per article were also retrieved from each database. The SIGAPS category and impact factor (IF) of the journal were retrieved from the SIGAPS database.

## **2.3 Statistics**

Statistical analyses used Excel™ software (Microsoft, Redmond, WA) and the 2019 XLSTAT™ statistical and data analysis solution (Addinsoft, Long Island, NY). Quantitative results were reported as mean ± standard deviation (range), or median and quartiles in case of non-normal distribution on Shapiro-Wilk test. Differences in mean values were assessed on Student or non-parametric McNemar test, according to normality of distribution. Comparison of annual citation rates according to SIGAPS category used Kruskal-Wallis test. Frequencies were compared on Fisher exact or Chi<sup>2</sup> test as appropriate. Correlations were assessed on Pearson test. There were no missing data and all Abstracts were analyzed. First-order risk was set at 5% and confidence intervals at 95%.

## **3. Results**

Post-congress publication rates were the same according to Medline and Google Scholar (48.2%: 96 articles for 199 presentations), and significantly lower on Web of Science (44.7%: (89/199; p= 0.002). Table 1 describes the 7 articles [6–8,15–18] not indexed on Web of Science.

Citation rates differed significantly ( $p < 0.001$ ) between the 3 databases, with Google Scholar listing 1.5-3.4-fold more citations on average than the other two:  $21.7 \pm 25.9$  [0 – 153],  $14.1 \pm 17.6$  [0 – 112] and  $6.3 \pm 9.4$  [0 – 71] respectively in Google Scholar, Web of Science and Medline. Citation rates in the 3 databases correlated strongly ( $r = 0.93$ ) (Fig. 1). Citation rates were significantly associated with the journal's SIGAPS category ( $p = 0.005$ ) (Fig. 2).

Mean congress-to-publication interval was  $19.6 \pm 17$  months [-15 to 63]. Mean number of authors was  $6.1 \pm 2.3$  [2-15]. Publications appeared in 26 journals, 6 of which accounted for 75% (71/96):

- Orthopedics & Traumatology: Surgery & Research (32 articles, 33%) (SIGAPS D),
- Knee Surgery Sports Traumatology Arthroscopy (14 articles, 15%) (SIGAPS B),
- Arthroscopy (11 articles, 12%) (SIGAPS B, then A since 2015),
- American Journal of Sports Medicine (5 articles, 5%) (SIGAPS A),
- Knee (5 articles, 5%) (SIGAPS C),
- Journal of Shoulder and Elbow Surgery (4 articles, 5%) (SIGAPS B).

Mean IF was  $2.6 \pm 1.8$  [0.29-13.2] and figure 1 shows journals according to SIGAPS category.

#### **4. Discussion**

The example of publication following oral presentation at an SFA Congress confirmed the study hypothesis: there was a difference in indexed publication rates between databases, with a 4% lower rate on Web of Science (7/199) compared to Medline and Google Scholar ( $p = 0.002$ ).

With the development of the Internet in the early 2000s, digitized bibliographic databases became the standard means of access to scientific data [9]. Numerous bibliographic sources are available, but it is difficult to determine which is best suited to a given question:



several factors can be taken into account, such as how the database functions and its specialization, relevance and volume of contents [19–21].

Web of Science is the oldest general scientific database, created in 1960. It is managed by Clarivate Analytics, and since 1997 on-line access has been by subscription. It indexes several specialist databases in medicine, biology, agriculture, mathematics, law, etc. It contains some 100 million articles, the oldest of which date back to the early 20<sup>th</sup> century [9].

Google Scholar was created by Google in 2004 as an open-access general academic database, and is now the most widely used in the world [22] thanks to its ease of access and of use. It is also the most widely criticized database, as it is said to be plagued by issues of validity [9]: indexing is not controlled by any committee or predefined official rules. Document quality is therefore very variable: articles in indexed peer-reviewed journals, articles in open-access journals, doctoral theses, books and also non-validated free or commercial “gray literature” documents [23]. Some 389 million documents were indexed in 2019, the oldest of which date back to the 18<sup>th</sup> century [9].

Medline, since 1972, specializes in life sciences and biomedicine, with documents going back to the early 20<sup>th</sup> century. It is publicly funded by the United States National Library of Medicine. Access is free of charge via PubMed. In 2019, it comprised over 31 million indexed documents in about 5,600 journals selected by its Literature Selection Technical Review Committee [24,25]. Selection is based on a set of criteria: quality and influence of published studies, credibility and independence of the editorial board, article selection methodology, etc. Only 20-25% of journals analyzed get selected, making Medline the database most widely used by researchers in biology and medicine.

These features of the 3 databases can account for the present findings. Five [6–8,15,17] of the 7 articles [6–8,15–17] not found on Web of Science were published in journals not directly indexed there. The other 2 [16,18] were published in a journal indexed on Web of

Science and there had probably been a problem of indexing the actual article's Digital Object Identifier (DOI). Citations rates increase with the number of indexed articles (i.e., size of the database). Thus, Google Scholar gives citations rates that are 1.5-3.4-fold higher on average than the others. However, several reports considered Google Scholar unreliable for bibliometric studies or assessing an author's visibility or that of a journal [26,27], as its functioning is felt to be "obscure" [9] and results cannot be controlled.

The present study had 2 main limitations. Firstly, the initial search list comprised articles published following oral presentation to a general orthopedic congress dedicated to arthroscopy. There happen to have been many reports on bibliometric data for congresses, notably in orthopedics-traumatology, in recent years [11], providing a benchmark for expected publication rates. Using a search methodology similar to that used in similar studies [3] gave publications rates of 44.7-48.2%, which was around the average found for similar congresses [3,11]. Thus, using presentations to the SFA congresses as a basis for the study and as an example to illustrate the hypothesis was validated. Secondly, database search may not have been exhaustive, being manual for 2 of the 3. However, 2 investigators made the search separately for each oral presentation, using the names of the first and last authors and the key-words separately or together, so as to maximize retrieval.

## **5. Conclusion**

Publication rates following oral presentation to the 2013 and 2014 SFA congresses ranged from 44.7% to 48.2%, depending on the database. This example illustrates the bibliometric differences found between databases. Google Scholar and Medline provided more indexed publications (both at the same rate). Even greater differences emerged for citation rates, with 1.5-3.4-fold more citations according to Google Scholar. Bibliometric

studies, for whatever purposes, should thus present a clear search methodology and use multiple sources so as to be exhaustive and enable comparison between studies.

**Acknowledgments:** The authors thank the SFA and MCO Congrès (Ms Audrey Martin Bayon) for transmission of data.

**Disclosure of interest:** RE, SD, MA, PSM and PD have no conflicts of interest to disclose. Outside of the present study, SB is a consultant for Zimmer and GV a consultant for FH Ortho.

**Funding:** none

**Author contributions:** GV: study design, data analysis, article writing and re-editing. RE and PD: statistical analysis. PSM and MA: re-editing. SD and SB: supervision.

## Figure legends

Figure 1: Scatter plot of citations per article according to database. Correlation between the 3 databases was excellent (coefficient  $r > 0.93$ ).

Figure 2: Citations rate according to journal SIGAPS category. The higher the SIGAPS category, the higher the citations rate ( $p= 0.005$ ). (SIGAPS: *Système d'Interrogation, de Gestion et d'Analyse des Publications Scientifiques* (Scientific Publication Search, Management and Analysis System)).

Figure 3: Distribution of articles according to journal SIGAPS category. 53% of articles (51/96) were in SIGAPS A, B or C. (SIGAPS: *Système d'Interrogation, de Gestion et d'Analyse des Publications Scientifiques* (Scientific Publication Search, Management and Analysis System)).

Table 1: Publications not retrieved from Web of Science.

| Article DOI                     | Journal (publication type)           | Date of publication | First author country | Topic                  | Type of study                          |
|---------------------------------|--------------------------------------|---------------------|----------------------|------------------------|--|
| 10.1016/j.otsr.2013.10.009 [16] | Orthop Traumatol Surg Res (Hybrid)   | 2013                | France               | Ankle, instability     | Literature review and consensus        |
| 10.1016/j.otsr.2014.10.003 [18] | Orthop Traumatol Surg Res (Hybrid)   | 2014                | France               | Knee, instability      | Retrospective, multicenter             |
| 10.1007/s00590-014-1546-5 [15]  | Eur J Orthop Surg Traumatol (Hybrid) | 2015                | France               | Shoulder, instability  | Retrospective single-center            |
| 10.1007/s00590-014-1562-5 [17]  | Eur J Orthop Surg Traumatol (Hybrid) | 2015                | France               | Shoulder, instability  | Retrospective single-center            |
| 10.11138/jts/2015.3.3.109 [6]   | Joints (Open access)                 | 2016                | Italy                | Shoulder, rotator cuff | Prospective, randomized, single-center |
| 10.1177/1758573216681208 [7]    | Shoulder & Elbow (Open access)       | 2017                | Canada               | Shoulder, instability  | Retrospective single-center            |
| 10.1186/s40634-019-0198-0 [8]   | J Exp Orthop (Open access)           | 2019                | France               | Knee, instability      | Retrospective single-center            |

DOI: Digital Object Identifier.

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