Impact Factor and Altmetrics: What Is the Future?

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9.1 Introduction

The huge volume of academic literature that has been produced so far requires the use of specific tools for ascertaining quality, importance, and relevance. Traditionally, peer review, citation counting, and journal impact factor (JIF) have been used to assess the quality of scholarly work and filter out the most important and relevant scholarly material. Peer review, however, is a slow and conventional process that fails, in most instances, to filter out the volume of scholarly work (as most authors eventually succeed in publishing their work somewhere), while citation counting is even slower than peer review and insufficient to isolate influential work (which may remain uncited). The JIF is a measure reflecting the average number of citations received per paper published in a certain journal during the two preceding years [1]. While impact factor is frequently used as a measure of the relative importance of a journal within its field, it is not appropriate for assessing the quality of individual articles. Usually, a small number of a journal's articles contribute to the journal's IF, while the article under consideration may only have a very limited number of citations. In addition, editorial policy sometimes require that authors of submitted articles cite other articles that appear in the journal or commissions review articles, which generally tend to receive more citations. For these reasons a movement against inappropriate use of JIF has taken shape. A group of editors and publishers of scholarly journals met during the annual meeting of the American Society for Cell Biology (ASCB) in San Francisco, CA, on December 16, 2012, and developed a set of recommendations, referred to as the San Francisco Declaration on Research Assessment (DORA), aiming to improve the ways in which the output of scientific research is evaluated [2]. Although traditional metric tools, such as citation

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reference count and JIF, will remain an important component of research assessment, they steadily fail to keep pace with the continuously evolving new forms of research output and scholars' interactions with them.

9.2 What Are the Challenges that Researchers Face in the Modern Era?

- Domination of digital environment over the classical print-based world.
- New forms of scholarly outputs are gaining ground.
- A growing tendency to assess the societal impact of research.
- Poor performance of classical tools in tracking and evaluating the new forms of Web-driven research outputs as well as the impact of individual articles.
- Need for development of alternative metric tools to meet modern research requirements.

The domination of the Web as a means of communicating scientific activity has resulted in the development of new forms of scholarly output, including research datasets, posters and presentations at conferences, electronic theses, blogs, online teaching activities (such as classes, lectures), etc.

The continuously expanding volume of Web-driven academic work has set new standards for reliable evaluation and filtering of the most important and relevant scholarly material out of a huge volume of accrued scientific work. On the other hand, there has been a shift in recent years from the general assumption that research should be conducted, communicated, and evaluated only within the scientific community, toward a more open approach that tends to take into account its impact on the society. While in the past science was the core of interest of the academic community, currently, there is much concern in demonstrating its value to society [3, 4].

New metric tools have surfaced in order to measure the impact of scholarship under the currently established circumstances. While the traditionally used bibliometrics for evaluation of the impact of research have been focused on journal level (such as impact factor) or researcher level (such as h-index [5]), the newly developed metric tools concentrate on article level and on society. These alternative metric tools are referred to as altmetrics, a term coined by Jason Priem and his colleagues in 2010 to describe metric tools that focus both on individual article assessment and evaluation of the impact of alternative scholarly outputs [6]. These newly emerged metric tools are based on article level and utilize social Web for analyzing and informing scholarship, and in no case they should be considered as a surrogate to traditional metrics, but rather as a complement to them.

The article-level metrics (ALMs) include both traditional tools of impact (such as citation counts) and newer metrics like the number of times an article was downloaded. The biggest limitation of ALMs is their inability to distinguish quality within the collected feedback a scholarly output received. Altmetrics in essence represent Web-based metric tools designed to gauge the societal impact of

publications and other scholarly material by using data derived from social media platforms [7, 8]. So far, a number of tools have been developed aiming at capturing and displaying these alternative metrics (altmetrics). A brief description of the most prominent of these tools is provided below:

- Altmetric. It tracks social media sites, newspapers, and magazines for any mentions of hundreds of thousands of scholarly articles. Altmetric then creates a score for each article, representing both quantitative and qualitative measure of the attention that a scholarly article has received.
- ImpactStory. It is an open-source altmetric tool that draws relevant data from a variety of social and scholarly data sources, including Facebook, Twitter, CiteULike, Delicious, PubMed, Scopus, CrossRef, ScienceSeeker, Mendeley, Wikipedia, SlideShare, etc. Altmetrics are reported in both raw numbers and percentiles compared to a sample of articles published the same year.
- Plum Analytics. They track metrics for various scholarly outputs, including journal articles, book chapters, datasets, presentations, and source codes. Their main area of focus is universities and other research institutions as they provide a measure of researcher's productivity.
- PLOS. This tool has been available since 2009. It provides cites in recognized citation indexes and captures data from social networks and platforms where the article has been referenced or uploaded. Information on the usage of an article is also provided as a function of time.

9.3 Tips and Tricks for a Successful Submission

Despite the increasing tendency by many researchers to communicate their scholarly work through the Web, publication in peer-reviewed journals remains a vital target for those who wish to preserve high-quality standards in their professional level and secure a successful career progression. The continued dependency of researchers on publications, as expressed in the phrase "publish or perish," has resulted in an overwhelming number of submitted manuscripts to many frontline biomedical journals [9, 10]. The majority, however, of these papers are rejected for not meeting standard requirements of medical writing [11, 12]. It is therefore important that prospective authors adhere to certain methodological details in order to create a high-quality scholarly work, appropriate for publishing. So far, certain guidelines have been developed aiming to ensure transparency and completeness of reporting and enhance the credibility of research. Examples of them represent the STROBE statement [13] (designed for observational studies), the CONSORT statement [14] (aiming at improving the reporting of randomized control trials), and the PRISMA statement for reporting systematic reviews and meta-analyses [15]. As most submitted papers follow the IMRaD format [16], which established introduction, methods, results, and discussion as constituent parts of a current scientific article, we will analyze some important tips and tricks for each of these constituent sections of an article.

9.3.1 Title of the Manuscript

It is the first important element in medical writing, as it introduces the paper to the editor and reviewers and can serve as indexing label to medical libraries. Ideally, it should feature the following qualities:

- Announce the main topic of the work and attract the readers' attention.
- Be concise, accurate, complete, and specific.
- Include, if possible, key words usable for indexing and search.
- It can include the results or the answer to the review question.

9.3.2 Abstract

A properly structured abstract should summarize accurately within the limited number of words, set by the instructions for authors (usually 150–250 words), the background, materials, methodology, key findings, and final conclusion of the project. Therefore, it should be written at the conclusion of the manuscript and before its submission. It usually follows the format of the main text, featuring the following sections:

- Background or Introduction. It should be limited to a couple of sentences, exposing the problem and stating the aim of the study.
- Methods. It should include very briefly study design, setting of the study, dates of recruitment, eligibility criteria, and primary outcome of interest.
- Results. It should convey information on follow-up and dropout rates and present the key finding of the study. The reader should be convinced that the results of the study address the research question described in the background section.
- Conclusion. It should express emphatically a "take-home message" to the readership, implying either a change to or reiteration of the already followed practice.

9.3.3 Introduction

It should encompass the following topics a brief description of the problem with emphasis on its epidemiology, reference to the established methods of treatment, gap of knowledge with respect to the "gold standard" treatments that allow for the potential development of alternative treatments, purpose of the study, formulation of the study hypothesis, study type. The most critical part of the Introduction section is its last paragraph which should describe in the most clear and direct way the author's aim in preparing the submitted manuscript.

9.3.4 Materials and Methods

Probably the most important section of the manuscript as it should describe in details the included patients' population and the methodology used for the analysis.

It is advisable that this section follows the PICO format [17] (participants (eligibility, inclusion, and exclusion criteria), intervention (surgeon, surgery, rehabilitation), comparator or control (operative versus non operative, type of surgery versus other type of surgery), outcome measure). The authors should provide details on the following aspects:

- Study design. Study design, setting in which the study took place and issues of ethical approval should be addressed. Moreover, in cases of randomized control trials (RCTs), the exact method of random allocation used should be adequately presented.
- Study population. Details of baseline characteristics and demographics of the included population should be provided. Furthermore, a clear account of eligibility criteria (inclusion and exclusion criteria) should be given.
- Interventions. In case of operative intervention, not only its technical aspects should be described completely, but also the operator(s) (and level of experience in performing such a procedure) should be stated. If several surgeons were involved, details on their level of experience and expertise should be also given.
- Comparator or control group. When a new therapy is compared to an existing one, a group of individuals, serving as controls, is used. Details on the "matching process" between the treatment and control groups on various confounding variables are of paramount importance, as they are indicative of potentially existing confounding bias that would distort the validity of the study's results.
- Outcome. It is the effect of the intervention. Outcome measures used in the study should be validated. It is also important for clinical studies to include functional outcome measures (at least, one disease-specific, such as Oxford hip score, and a generic health outcome measure, such as SF-36).
- Statistics. The statistical issues that should be clearly addressed in this section are the following:
  - Power of the study and sample size. Power analysis is typically performed at the beginning of the research project and is invaluable in determining the required resources needed to perform the study and, particularly, the required sample size to determine significance when it actually occurs. Power of a study is the probability of finding a significant association when one truly exists and is defined as 1 – probability of type II error. As the probability of type II error is usually set by convention at 0.20, then the respective power of the study is 0.80, meaning that there is 80% chance that the study will detect a difference when one truly exists. The power of a study is very important as it reflects the validity of the results, particularly, when no significant association is demonstrated. Power of a study is related to sample size, meaning that when the sample size is small, the respective study might be underpowered. Readers of research reports need to know the required sample size for a clinically meaningful difference to be truly detected (with a probability above 80%). As power analysis and sample size calculations are typically performed at the beginning of a research project, respective details should appear in the methods section of the article.
  - Appropriate use of statistical tests, based on dataset distribution (parametric or nonparametric tests) and type of data (nominal, continuous, or discrete).

9.3.5 Follow-Up

Follow-up data should be complete and include the following:

- Duration of follow-up. Early clinical results usually require 1–2 years of follow-up, while midterm and long-term results would require 5 and 8–10 years of follow-up, respectively.
- Frequency of follow-up visits.
- Outcome assessor at each follow-up visit. Was he involved in the therapeutic management of the patients or was he totally blinded to the preceded treatment? These are invaluable details and give the readership an idea of potentially existing detection bias.

9.3.6 Results

This section should be brief and concise. The authors should avoid duplication of data (e.g., information presented in tables should not be repeated in the main text). This section should include the following elements:

- Recruitment. Dates defining the period of recruitment and duration of follow-up.
- Presentation of baseline characteristics and demographic data of the study population (preferably in table format).
- Details regarding participants in the study as well as losses to follow-up. Calculating loss to follow-up may be somewhat intriguing. For retrospective studies, all individuals receiving treatment during the study period should be used as the denominator, not just those with complete data. As for RCTs, the denominator for each group is the number of patients who were randomized and not those who received treatment. Loss-to-follow-up rate is very important in determining a study's validity, as usually patients lost to follow-up have different prognosis than those who completed the study. As a rule of thumb, loss to follow-up <5% leads to little bias, while >20% poses a significant threat to validity of results (attrition bias) [18, 19].
- Outcomes. For both primary and secondary outcomes presentation of the effect size along with respective confidence intervals.
- Ancillary analyses, such as subgroup analyses, adjusted analyses, etc.

9.3.7 Discussion

Writing this section is a challenging task for the authors, as they will attempt to generalize their findings. This should be done in a methodological way. For this purpose, the following steps are recommended:

- Short restatement of the main results of the study that answer the research question.
- Interpretation and general applicability of the findings of the study.

- Explanations for any conflicting or unexplained results.
- Limitations of the study and addressing potential sources of bias.
- Provide suggestions for future research directions with respect to your initial hypothesis.

9.3.8 Conclusions

This section should summarize three basic elements:

- The findings of the study, with respect to research question.
- A take-home message.
- Provide a suggestion for future direction of research on related to the topic of your work.

9.3.9 Acknowledgments

They should be listed before the reference section. They usually include funding sources as well as colleagues (other than the authors) who provided any help in the preparation or for the improvement of the manuscript.

9.4 Common Mistakes and How to Prevent Them

As a general rule, the overall quality of the manuscript in regard to proper use of grammar and syntax rules is of paramount importance. Misspelling, typing errors, and poor syntax should be avoided as they predispose negatively the reviewers and increase the likelihood of rejection. The final version of the manuscript should be thoroughly reviewed by the authors for accurate flow, syntax, and spelling.

The commonest mistakes, associated with the distinct sections of an article, are listed below.

9.4.1 Introduction

- Insufficient background information on the topic and inappropriate review of the literature.
- Lack of a clear research question statement and research objectives.

9.4.2 Methods Section

- Inappropriate study design. In RCTs, for example, a biased allocation of comparison groups is a frequent cause of selection bias.
- Inadequate handling of "dropouts," introducing attrition bias to the final results.

- Lack of power analysis. When the sample size of a research project is insufficient, the respective results cannot be considered valid and robust. Therefore, early power calculation, during the research process, is strongly advocated to determine the required sample size and appropriate resources.

9.4.3 Results

- Errors in calculating the results. The calculated rates of outcomes do not add up to 100%.
- Incorrect use of statistical tests. As most biological data are not normally distributed, the use of nonparametric tests should be preferred, unless the normality of data distribution is evident or proven. For the same reason, reporting the median and range (instead of mean and standard deviation) is preferable, when dealing with continuous data.
- Poor quality figures and tables.

9.4.4 Discussion

- Failure to discuss the significance of findings.
- Conclusions that were not substantiated by the presented results.
- Failure to discuss the limitations of the study.

9.4.5 Conclusion

- Failure to address the study question.

9.5 Take-Home Messages

- New metric tools, focusing on individual article level rather than journal level, are continuously evolving, aiming to improve the assessment of scholarly work in the modern Web-based environment.
- The art of orthopedic medical writing and publishing, vital for knowledge dissemination and career advancement, is not an easy task.
- Although an expanding volume of research material within the field of orthopedics is being produced, only a small portion of it is ultimately considered appropriate for publishing.
- Certain guidelines have been developed to ensure transparency and completeness in reporting, such as the CONSORT statement for RCTs, the STROBE statement for observational studies, and PRISMA statement for systematic reviews and meta-analyses.
- Strict adherence to certain methodological details, such as an original research question, a valid study design, a proper statistical documentation of the

results, and a well-structured manuscript written in a lucid and flowing language with appropriate syntax, are the minimal prerequisites for a successful publication.

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