



## Original Article

## Metrics of activity in social networks are correlated with traditional metrics of scientific impact in endocrinology journals



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## ABSTRACT

**Aims:** Traditional journal level metrics, as the impact factor or Scimago journal ranking indicator (SJR) measure the impact of research on other researchers, but fail to assess the reach of these publications among wider audiences. This study aims to assess the correlation between SJR and metrics of presence on social networks of endocrinology journals.

**Materials and methods:** Journals within the area of endocrinology, diabetes and metabolism were identified from the electronic portal Scimago Journal and Country Rank, and their metrics based on the number of citation collected. Different metrics of the presence on social networks, such as the number of followers and number of tweets, were assessed. The correlation between both metrics was evaluated by calculating the Spearman correlation coefficient.

**Results:** Of the 232 journals evaluated, 28 (12.1%) had social networks. The median SJR (1.53 vs 0.60,  $p < 0.01$ ), and H index (58.5 vs 22,  $p < 0.01$ ) were significantly higher among journals with social networks. The correlation between the number of followers on twitter and the SJR was moderate ( $r = 0.60$ ,  $p < 0.05$ ), and it was better in journals with more than 500 publications in the last 3 years ( $r = 0.85$ ,  $p < 0.05$ ). The number of tweets also had a moderate correlation with the SJR ( $r = 0.59$ ,  $p < 0.05$ ).

**Conclusions:** Our results suggest that the dissemination of research on social networks is moderately related to the traditional metrics of impact. Both types of metrics offer complementary information: while metrics based on social media may not perfectly predict the impact a scientific journal, it does have the advantage of immediacy.

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## 1. Introduction

Medical researchers seek that the results of their work have a real impact in their field. Thus, it is important to publish in journals with adequate visibility and acceptance within a specific scientific community.

Traditionally, authors have evaluated the performance of journals to which they consider submitting their work, using metrics based on the number of citations [1]. Examples of these metrics include the impact factor based on the Science Citation Index (FI–SCI) [2], the Eigenfactor score [3], and the Scimago Journal Ranking indicator (SJR) [4]. All of these metrics have serious limitations: they measure the impact of research on the work of other researchers, but fail to assess the reach of these publications among wider audiences [5]. Furthermore, technical reasons unrelated to the quality of the articles may exert an influence on the impact assessment (for instance, when a citation is not recognized by reference management software) [6]. Finally, traditional metrics accumulate citations very slowly because of the long publishing times required for new articles to be available.

*Abbreviations:* Scimago journal ranking indicator (SJR), Science Citation Index.

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We propose a different approach for the evaluation of the impact of scientific journals by measuring their presence on social networks, which allows evaluating the dissemination of research results in broader audiences including clinicians, patients, policy makers, and the media, among others. These new metrics provide additional advantages since they accumulate rapidly and can provide an almost “real time” assessment of the impact of scientific journals. Although this approach has been used previously to evaluate the impact of individual scientific articles (for example through electronic pages that track the mentions of an article in social networks, or in different internet platforms and then weigh them to calculate the online impact of said article) [7], it has not been used to evaluate the reputation and impact of scientific journals in the field of endocrinology.

The objective of this paper is to compare the SJR (a traditional metric based on the number of citations), with metrics based on the presence of journals on social networks such as the number of followers, or number of tweets, in order to determine whether the online dissemination of endocrinology journals correlates with the attention they receive among other medical researchers.

## 2. Methods

The scientific journals classified within the area of endocrinology, diabetes and metabolism were identified from the electronic portal Scimago Journal and Country Rank [8]. SCImago, a research group attached to Consejo Superior de Investigaciones Científicas (CSIC), of the universities from Granada, Extremadura, Carlos III (Madrid) and Alcalá de Henares, developed this tool. It is publicly available, and contains journal indicators developed from information contained in the Scopus<sup>®</sup> database, which was developed by Elsevier B.V. The following indicators were collected for each journal: The SJR indicator, quartile, H index, total documents published within the previous 3-year period, Open Access and publishing region.

Furthermore, we assessed the presence of scientific journals in the most commonly used social networks. The following indicators were evaluated: Number of followers (Facebook, Twitter and Instagram), number of tweets (Twitter), number of subscribers, number of videos and number of views of the most seen video (Youtube), and number of publications (Instagram). Since the time since creation of the social network accounts can directly influence the amount of followers or publications, we also collected the date of creation of the account. In order to identify the official accounts of each journal on social networks, only links appearing on the official page of the journal were used. The accounts that belonged to the publisher or to multiple journals simultaneously were excluded from the analysis. The information taken from both sources of information was collected simultaneously in the second week of February 2019.

Within the indexes based on the number of citations, the SJR was evaluated. Scimago determines the SJR by taking into account the prestige of the journals where the citation appears, and the closeness to the cited journal using the cosine of the angle between the vectors of the two journals' cocitation profiles. Additionally, the SJR minimizes the effect of size by dividing prestige accumulated by the fraction of the citable documents of the journal [4]. The quartiles of the journals were determined based on the SJR score, defining quartile 1 as journals between percentiles 1 and 25, quartile 2 as those between percentiles 25 and 50, and so on. The H index [9] was calculated for journals, taking into account both the number of publications and the number of citations that those publications had obtained in the Scopus database. The metrics of presence in social networks were adjusted according to the time since creation of the account, by dividing number of followers by

the account's years online.

A Shapiro-Wilk test was used to evaluate the assumption of normal distribution of metrics. Differences between journals with and without social networks were evaluated using a Mann-Whitney *U* test. The correlation (global and within different subgroups), between the social media presence metrics and the SJR was evaluated by calculating the Spearman correlation coefficient, since the normality assumption was not met. The statistical significance was set at  $p < 0.05$ . The statistical software Stata 14<sup>®</sup> was used for performing analyses.

## 3. Results

232 journals of endocrinology, diabetes and metabolism were identified in the SCImago portal, 28 (12.1%) had social networks. Within the metrics based on number of citations, the median SJR (1.53 vs 0.60,  $p < 0.01$ ), and H index (58.5 vs 22,  $p < 0.01$ ) were significantly higher among journals with social networks. Similarly, the percentage of quartile 1 journals was higher among journals with social networks (60.7% vs 20.1%,  $p < 0.01$ ). On the contrary, the percentage of Open Access journals was lower within those with social networks (10.71% vs. 28.92%,  $p < 0.05$ ) (Table 1).

All journals with social networks had an account on twitter. Of these, 30.7% had more than 2000 followers, and 21.4% had generated more than 2000 tweets. Only three journals were present on Facebook, with 694 followers on average. Two journals had an account on YouTube, and none on Instagram (Table 2).

The correlation between the number of followers on twitter and the SJR was moderate (Spearman correlation coefficient 0.60,  $p < 0.05$ ), and it was better in journals with more than 500 publications in the last 3 years ( $r = 0.85$ ,  $p < 0.05$ ). Similar findings were obtained for the correlation between the amounts of followers adjusted for time in years since creation of the Twitter account. Both indicators had a better correlation with journals whose publishers were located in Europe, as compared to those published in North America. The number of tweets also had a moderate correlation with the SJR (0.59,  $p < 0.05$ ) (Table 3).

It was not possible to evaluate the correlation between the SJR and the presence on Facebook, YouTube or Instagram, given the small sample of journals present in these social networks.

## 4. Discussion

Our study evaluates the correlation between citation-based impact metrics, and social network-derived metrics for scientific journals of endocrinology, diabetes and metabolism. Our data suggests that journals with social networks have significantly higher values of SJR and H index, and that there is a positive, but moderate, correlation between the SJR and twitter presence metrics.

Within the reputation metrics of scientific journals, the most frequently used is the impact factor derived from the FI-SCI. It is calculated by dividing the total number of citations received for all publications in a journal, by the total number of publications in that same journal over a two-year period. However, the FI-SCI is currently criticized because of relevant disadvantages [10]: The Science Citation Index poorly represents publications from certain geographical and knowledge areas [6]; it is biased towards publications in English[6]; and it does not make corrections by self-citations [11]. In the present study, we preferred to use the Scimago Journal Ranking (SJR) as a citation-based metric. The Scopus database has a greater geographic and theme coverage, it is freely available online, and controls the impact factor by number of self-citations [4].

We found that the percentage of journals with social networks

**Table 1**  
Sample description according to activity on social networks.

	Journals with social networks n = 28	Journals without social networks n = 204	p-value
<b>H Index<sup>a</sup>(median,IQR)</b>	58.5 (22.5–115.5)	22 (6–58)	<0.01
<b>SJR<sup>a</sup> (median,IQR)</b>	1.53 (1.11–2.13)	0.60 (0.16–1.13)	<0.01
<b>Quartile, n (%)</b>			
Q1	17 (60.71)	41 (20.10)	<0.01
Q2	6 (21.43)	52 (25.49)	
Q3	2 (7.14)	56 (27.45)	
Q4	3 (10.71)	55 (26.96)	
<b>Region, n (%)</b>			
Europe	17 (60.71)	128 (62.75)	0.277
North America	9 (32.14)	46 (22.55)	
Asia	0 (0)	20 (9.80)	
Latin America	1 (3.57)	5 (2.45)	
Africa	0 (0)	5 (2.45)	
Oceania	1 (3.57)	3 (1.47)	
<b>Open Access, n (%)</b>	3 (10.71)	59 (28.92)	0.041
<b>Number of published documents in the previous 3-year period, n(%)</b>			
<b>0–199</b>	6 (21.43)	125 (61.27)	<0.01
<b>200–499</b>	10 (35.71)	48 (23.53)	
<b>&gt;500</b>	12 (42.86)	31 (15.20)	

IQR: Interquartile range, <sup>a</sup>compared through the non-parametric U-Mann-Whitney test.

**Table 2**  
Description of activity on social media.

<b>Twitter</b>	
Journals on Twitter n(%)	28 (12.07)
Number of followers n(%)	
<500	10 (38.46)
500–2000	8 (30.77)
>2000	8 (30.77)
Number of tweets n(%)	
<500	9 (32.14)
500–2000	13 (46.43)
>2000	6 (21.43)
Followers/year, median(IQR) <sup>a</sup>	259.92 (66.18–489.97)
<b>Facebook</b>	
Journals with Facebook n(%)	3 (1.29)
Number of followers (mean, SD)	694 (382.39)
Followers/year, median(IQR) <sup>a</sup>	176.4 (31.75–473)
<b>YouTube</b>	
Journals with YouTube n(%)	2 (0.86%)
<b>Instagram</b>	
Journals with Instagram n(%)	0 (0%)

<sup>a</sup> IQR: Interquartile range.

**Table 3**  
Correlation between the SJR and metrics of activity on Twitter.

Twitter n = 28	Number of followers	Number of followers/year	Number of tweets
Global correlation	0.60*	0.57*	0.59*
<sup>a</sup> Q			
Q1 n = 17	0.53*	0.59*	0.54*
Q2–Q4 n = 11	0.57	0.35	0.7*
Regions			
Europe n = 17	0.59*	0.57*	0.57*
North America n = 9	0.38	0.28	0.62
Number of published documents in the previous 3-year period			
<500 n = 16	0.44	0.27	0.58*
>500 n = 12	0.85*	0.85*	0.34
Open Access n = 3	NE <sup>b</sup>	NE <sup>b</sup>	NE <sup>b</sup>
No Open Access n = 25	0.61*	0.6*	0.61*

<sup>a</sup> Quartile \* Statistical significance at p < 0.05.

<sup>b</sup> NE: Non evaluable.

within our field of interest is relatively low (12.1%), and that these journals have significantly higher values of SJR and H index. Similar results have been previously reported in other areas of medical knowledge: Kelly [12] showed that radiology journals with Twitter profiles had a higher impact factor compared to those without it (mean 3.37 vs. 2.14, p < 0.001). Furthermore, Nason [13] reported similar findings in urology journals (mean 3.59 vs 1.78, p = 0.013). The difference can have different explanations: One is that the oldest and most reputable journals have access to better economic and human resources that allow them to have properly managed social network accounts. In fact, journals with social networks were also characterized by having a greater number of published articles. A second possible explanation is that the dissemination of content through social media makes research results more visible, therefore favoring being cited by other researchers. A previous study showed that the articles that received the most tweets in the seven day-period after their publication had a higher number of citations on Google Scholar and Scopus in the timeframe between 17 and 29 months later [14]. However, there are no previous studies that allow to determine if the global number of citations of articles published in a journal increases significantly once said journal begins to have a presence in social networks.

We found that the most frequently used social network among endocrinology journal was Twitter. The advantage of this network for sharing research results is given by the need to present the information in a clear and concise manner (in exactly 140 characters), which allows the information to reach large audiences rapidly. Also, it is possible to attach complementary information (such as the article in a PDF format). Thus, the reader can access full contents if desired [15]. According to our data, the number of tweets, and the number of followers on twitter both have moderate, but statistically significant correlation with the SJR. Cosco et al. [16] reported similar findings for general medicine journals, a positive correlation coefficient (r = 0.68, p < 0.001) was found between the impact factor and number of citations of the journal with the number of followers on Twitter. According to their findings, a 1% increase in the number of citations was associated with having 1.09% more followers on twitter, and a 1% increase in the impact factor with a 1.46% increase in followers on twitter.

In addition, we found that the correlation between the two types of metrics is better for journals published in Europe compared to those published in North America, suggesting

different usage patterns. New studies are required in order to confirm and explain this finding.

Our study has several limitations to report. The accounts in social networks belonging to the publisher or to scientific societies, which were not specific to the journal of interest, were not taken into account for analysis. The aforementioned could underestimate the magnitude of the dissemination of scientific information through social networks. Furthermore, even if variables were collected in the same time period, measurements correspond to different moments. The SJR tells us about the number of citations reached in the 3 years before it is published, and is released once a year, while the number of tweets and followers show us information that accumulates rapidly, so it can offer more up-to-date information about the popularity of the journal in the general public. Despite this, the metrics that we analyzed are those that best represent the information that the researcher really has available when deciding where to submit their work.

Indicators at the journal level and not in individual articles have further limitations. It has been reported that the distribution of the number of citations received by articles published in a journal has a highly skewed distribution, considering that 50% of citations correspond to 15% of the most cited articles. Thus, articles with very few citations may appear in journals with high FI-SCI or vice versa [6]. A similar problem can occur with the amount of tweets, where a few articles may be the cause of most mentions in the social networks of a particular journal. Despite the latter, the metrics at the journal level can become useful tools for researchers, in order to determine the most appropriate journal for their work to achieve greater visibility.

Our results suggest that the popularity of a journal among the general public, determined by the number of tweets or followers on Twitter, is moderately related to the impact that articles published in a particular journal may have for researchers in the field of endocrinology. Nonetheless, they do not allow confirmation of the existence of a causal association between them. Therefore, it must be interpreted that both types of metrics offer complementary information. Also, while metrics based on social media may not perfectly predict the impact a scientific journal, it does have the advantage of immediacy. Thus, rendering it a useful tool.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.dsx.2019.06.018>.

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