Annals of Epidemiology 22 (2012) 649–653

Contents lists available at SciVerse ScienceDirect

Annals of Epidemiology

journal homepage: www.annalsofepidemiology.org

Evidence-based editing: factors influencing the number of citations in a national journal

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ARTICLE INFO

Article history:
Received 6 March 2012
Accepted 25 June 2012
Available online 20 July 2012

Keywords:
Publishing
Editorial policies
Journalism
Citation analyses

ABSTRACT

Purpose: Citations received by papers published within a journal serve to increase its bibliometric impact. The objective of this paper was to assess the influence of publication language, article type, number of authors, and year of publication on the citations received by papers published in *Gaceta Sanitaria*, a Spanish-language journal of public health.
Methods: The information sources were the journal website and the Web of Knowledge, of the Institute of Scientific Information. The period analyzed was from 2007 to 2010. We included original articles, brief original articles, and reviews published within that period. We extracted manually information regarding the variables analyzed and we also differentiated among total citations and self-citations. We constructed logistic regression models to analyze the probability of a *Gaceta Sanitaria* paper to be cited or not, taking into account the aforementioned independent variables. We also analyzed the probability of receiving citations from non-Spanish authors.
Results: Two hundred forty papers fulfilled the inclusion criteria. The included papers received a total of 287 citations, which became 202 when excluding self-citations. The only variable influencing the probability of being cited was the publication year. After excluding never cited papers, time since publication and review papers had the highest probabilities of being cited. Papers in English and review articles had a higher probability of citation from non-Spanish authors.
Conclusions: Publication language has no influence on the citations received by a national, non-English journal. Reviews in English have the highest probability of citation from abroad. Editors should decide how to manage this information when deciding policies to raise the bibliometric impact factor of their journals.

Introduction

The citations received by papers published in a journal serve to increase its bibliometric impact factor (BIF). Although the BIF refers only to citations received in the last 2 years, an increase in citations in other years is a mean to increase a journal's visibility and influence. Because the BIF and, therefore, the citations received are used by researchers to select the journal to which send their works [1], editors try to increase it through different mechanisms to attract the greatest number of submissions that enable the selection of the top quality investigations.

Few attempts have been made to predict the number of citations received by papers published in a specific journal. A journal BIF does not determine the citations that a published work will receive. There are factors precluding a high number of citations, such as the topic of the paper, the prestige of their authors, or the institution where the work has been done. There are other aspects that could influence the number of citations, such as article type, publication language, authors' number, or publication year. The influence of these factors can vary from journal to journal depending on their quality (measured as its relative position in Thomson-ISI classifications) and on their diffusion (local or worldwide) [2]. Scientific journals use strategies to raise their BIF, but sometimes these strategies are borderline with ethics, such as advising authors on citing works previously published in their journals [3]. Citation practices are also intentionally flawed in many occasions [4] and the use of citations received is increasing for benchmarking researchers and by funding bodies.

Journal editors have the duty to select for publication only those papers with the highest scientific standards. The problem appears

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http://dx.doi.org/10.1016/j.annepidem.2012.06.104

when many papers are of high quality and there is a limit of space in journals. Should editors give priority to those papers they think will have a better citation track? And which factors would predict a higher number of citations?

The objective of this paper was to assess the influence of authors' number, article type, publication language and year of publication on the number of citations received by papers published within a Spanish journal of public health.

Methodology

Design and setting

Gaceta Sanitaria is the official journal of the Spanish Society of Public Health and Health Policy, which includes a total of 11 associations, the largest of which is the Spanish Society of Epidemiology, followed by the Health Economics Association. *Gaceta Sanitaria* was founded in 1888 as the *Gaceta Sanitaria de Barcelona*. It is published six times a year and received bibliometric impact factor for the first time in 2009 (BIF: 1.172) [5]. It publishes papers mostly in Spanish, but also in English [6].

To perform the citation analysis we used the web page of *Gaceta Sanitaria* (available from: http://www.elsevier.es/es/revistas/gaceta-sanitaria-138) and the database Web of Knowledge, from the Institute for Scientific Information (Thomson-Reuters; available from: http://www.accesowok.fecyt.es/). The webpage of *Gaceta Sanitaria* has all the summaries published since 1987, with full and free access to the contents. The title of the papers, authors' number, article type, language, and publication year were extracted manually. We searched the ISI-WoK database from April to May 2011 to obtain the total number of citations for each paper, self-citations, and citations from Spanish authors or from abroad.

As inclusion criteria we considered original papers, brief originals, and reviews published in *Gaceta Sanitaria* between 2007 and 2010. It was not possible to include papers published before 2007 because they are not indexed in ISI-WoK. We excluded *Gaceta Sanitaria* supplements and other article types different than those included.

Information retrieval and data preparation for the analysis

We searched for the published papers in *Gaceta Sanitaria* and their citations at the ISI-WoK database. Self-citations were those citing an included paper having at least one author that coauthored the "source" paper. Citations received were also categorized as authors from Spain or authors from abroad, with independency of the citing journal. A citation from abroad was one whose corresponding address was not Spanish.

Statistical analysis

We performed a descriptive analysis of the number of citations received by the included papers and used logistic regression models to analyze the probability of a paper for being cited. In the two first models, the dependent variable was to be cited or not and the independent variables were publication year, number of authors (continuous), publication type, and publication language. The difference between the two models was that in the second model self-citations were excluded.

A further analysis was performed to determine the possible predictors of a high number of citations or not. To do this, the dependent variable was cited two or more times versus one time. This model excluded self-citations and only included papers having at least one citation. The dependent variables were the same as in previous models.

A last analysis was done having as dependent variable the probability of receiving citations from non-Spanish authors. The independent variables were language and publication type, included as mentioned above. All the results are presented as odds ratios with 95% confidence intervals. To know the variability explained by the regression models we also calculated the Nagelkerke R^2 statistic for each regression. The analyses were performed with PASW 18.0 (SPSS, Inc., Chicago, IL).

Results

We included 24 issues of *Gaceta Sanitaria*, with a total of 240 papers. There were 177 original articles, 46 brief original articles, and 17 reviews. The median number of authors was 5 (range, 1–18). The median number of authors in reviews was four, and five in the other publication types. There were 23 papers in English: 14 originals, 5 brief originals, and 4 reviews. By publication year, 2007 was the year with the highest number of papers in English (n = 7), and the year with the lowest number was 2010 (n = 4). Regarding the citations number, they are referred to 238 publications because 2 were not registered in the ISI-WoK database. There were a total of 287 citations in the study period. Of them, 85 were classified as self-citations (30%). The range of citations was from 0 to 15. There were 110 papers (45.8%) with no citations; 24.4% received two or more citations, and 3.4% received five or more citations. Only two papers received more than 10 citations. When analyzing citations after excluding self-citations, the range was from 0 to 13, and 56.7% of papers did not receive any citation. There were 10.1% that received two or more citations and 3.3% received five or more citations. Table 1 shows a description of the included papers.

The variable having more influence on the citations received is the publication year, that is, time since the paper was published. Papers published in 2007 have a nine-fold greater probability of being cited versus those published in 2010. Number of authors, publication language, or publication type did not influence on the possibility of being cited (Table 2). The Nagelkerke R^2 value for this regression is 0.18. When performing the same analysis but excluding self-citations, the results do not change (Table 3). The Nagelkerke R^2 value for this regression is 0.19.

Approximately half of the papers included in the analysis have never been cited. If we exclude those papers and create a variable with two categories (one citation or two or more citations), it is observed that in addition to the publication year, publication type influences the probability of receiving two or more citations. Reviews have nearly six-fold probabilities of being cited twice or more compared with original articles (odds ratio, 5.7; 95% confidence interval, 0.9–34.5). Brief originals, on the opposite, have lower probabilities of being cited twice or more than original papers (odds ratio, 0.4; 95% confidence interval, 0.1–1.1). Language or number of authors do not influence on the number of citations received (Table 4). The Nagelkerke R^2 value for this regression is 0.19.

When the origin of citations is analyzed, language does not seem to influence on the probability of citation. When the type of article is a review, the probability of citations from abroad increases; it is 3.6 times greater (95% confidence interval, 1.2–10.4) when compared with original papers (Table 5). The Nagelkerke R^2 value for this analysis is 0.05. When analyzing reviews exclusively, we find that the mean and median citations for reviews in Spanish are 1.5 and 0 versus 6.5 and 5.5 if they are in English. The results hardly change if we exclude self-citations.

Discussion

The results obtained show that there are some factors that influence the number of citations obtained by a national scientific

Table 1
Description of the included articles

Variable	n (%)
Publication year	
2010	62 (25.8)
2009	71 (29.6)
2008	54 (22.5)
2007	53 (22.1)
Authors' number	
1–2	35 (14.6)
3–4	74 (30.8)
5–6	73 (30.5)
7–8	29 (12.1)
9–10	19 (8.0)
>10	10 (4.0)
Language	
Spanish	217 (90.4)
English	23 (9.6)
Publication type	
Original	177 (73.8)
Brief original	46 (19.2)
Review	17 (7.1)
Citations received	
0	110 (45.8)
1–2	93 (38.8)
3–4	20 (8.4)
5–6	10 (4.2)
>6	5 (2.1)
Citations received excluding self-citations*	
0	136 (56.7)
1–2	68 (32.5)
3–4	16 (6.7)
5–6	6 (2.5)
>6	2 (0.8)
Citations received from non-Spanish authors†	
0	197 (82.1)
1–2	35 (14.6)
3–4	4 (1.7)
5–6	1 (0.4)
>6	1 (0.4)

* Self-citation defined as a citing paper with any of the authors coauthoring the "source" paper.
† Number of citations received from papers whose corresponding author address is not from Spain.

journal, including the article type or the time since publication, whereas others do not have any influence (publication language or number of authors). There are few experiences on citation analysis of public health journals [7]. Non-Spanish authors tend to cite papers in English, with special predilection if it is a review. The variability explained by the regressions performed (Nagelkerke R^2 statistic) is low, that is, around 20%, suggesting that there may be other variables that have not been measured that could influence in citation practices to the analyzed journal. Nevertheless, a high degree of uncertainty may be possible with the introduction of more explicative variables because citation practices could have an important random, component.

When comparing the number of citations of papers within a journal, it is expected that these depend on the quality of the study, its newsworthiness, the results obtained, and on sample size [8]. Assuming that, if papers are accepted they fulfill these criteria to a greater or lesser extent, there are other factors that could influence the number of citations received. It is reasonable that year since publication increases the possibility of citing a paper. In this sense the "induction period" for citations increases, with papers published 4 years before having a nine-fold greater probability of being cited.

There are other unexpected findings that merit further explanation. Papers in English should be, in principle, more visible, readable, and therefore cited than papers in the native language of the journal (Spanish). This has not been the case in this research. Papers in English have received a similar number of citations as those in Spanish. One explanation is that the majority of citations come from Spanish authors, who may prefer to cite papers in Spanish than in English owing to language limitations. Another explanation could be that subscribers are mostly Spanish and it is easier to cite a paper published in a journal with immediate access [9]. The fact that *Gaceta Sanitaria* has a printing of 3800 hard copies distributed by regular mail to subscribers reinforces this explanation. The unexpected low number of citations of papers in English could reflect a low rate of diffusion of the studied journal in other

Table 2
Variables influencing the probability of citation

Analyzed variable	Papers cited, n (%)	Papers not cited, n (%)	Odds ration	95% confidence interval
Publication year				
2010	16 (12.5)	46 (41.8)	1.0	—
2009	39 (30.5)	30 (27.3)	3.9*	1.9–8.4
2008	34 (26.6)	20 (18.2)	5.4*	2.4–12.2
2007	39 (30.4)	14 (12.7)	9.0*	3.8–21.6
Authors' number			1.1	0.9–1.2
Language				
Spanish	117 (91.4)	98 (89.1)	1.0	—
English	11 (8.6)	12 (10.9)	0.7	0.3–1.7
Type of article				
Original	91 (78.0)	84 (76.4)	1.0	—
Brief original	28 (15.6)	18 (16.4)	1.1	0.5–2.2
Review	9 (6.4)	8 (7.2)	0.7	0.2–2.1

* $P < .05$.

Table 3
Variables influencing the probability of citation excluding self-citations

Analyzed variables	Cited papers, n (%)	Papers not cited, n (%)	Odds ratio	95% confidence interval
Publication year				
2010	9 (8.8)	53 (39.0)	1.0	—
2009	30 (29.4)	39 (28.7)	4.4*	1.9–10.4
2008	30 (29.4)	24 (17.6)	6.9*	2.8–17.0
2007	33 (32.4)	20 (14.7)	9.1*	3.7–22.8
Authors' number			1.1	0.9–1.2
Language				
Spanish	91 (89.2)	124 (91.2)	1.0	—
English	11 (10.8)	12 (8.8)	0.4	0.4–2.5
Publication type				
Original	69 (67.6)	106 (77.9)	1.0	—
Brief original	24 (23.5)	22 (16.2)	1.3	0.6–2.6
Review	9 (8.8)	8 (5.9)	1.1	0.4–3.1

* $P < .05$.

Table 4
Probability of receiving two or more citations excluding self-citations

Analyzed variable	Cited papers, n (%)	Not cited papers, n (%)	Odds ratio	95% confidence interval
Publication year				
2010	2 (4.7)	14 (16.4)	1.0	—
2009	10 (23.3)	29 (34.1)	2.1	0.4–11.2
2008	15 (34.9)	19 (22.4)	5.9*	1.1–31.3
2007	16 (37.2)	23 (27.1)	4.4	0.8–23.7
Authors' number			1.1	0.9–1.3
Language				
Spanish	38 (88.4)	79 (92.9)	1.0	—
English	5 (11.6)	6 (7.1)	1.0	0.2–4.8
Article type				
Original	31 (72.1)	60 (70.6)	1.0	—
Brief original	5 (11.6)	23 (27.1)	0.4	0.1–1.1
Review	7 (16.3)	2 (2.4)	5.7	0.9–34.5

Only cited papers included in the analysis.
* $P < .05$.

Table 5
Probability of receiving citations from non-Spanish authors depending on publication language and article type

Analyzed variable	Cited papers, n (%)	Not cited papers, n (%)	Odds ratio	95% confidence interval
Language				
Spanish	35 (85.4)	180 (91.4)	1.0	—
English	6 (14.6)	17 (8.6)	1.5	0.5–4.4
Publication type				
Original	27 (65.9)	148 (75.1)	1.0	—
Brief original	7 (17.1)	39 (19.8)	1.0	0.4–2.4
Review	7 (17.1)	10 (5.1)	3.6*	1.2–10.4

* $P < .05$.

countries, or at least in countries whose native language is English. Some studies have shown that there is a tendency to cite papers from the same country as the authors of the citing paper [9,10]. When analyzing the probability of being cited by non-Spanish authors, it seems that, for papers in English, have a higher probability of being cited. The probability of being cited by authors from abroad increases with reviews and this suggest some kind of interaction for the probability of being cited from abroad between language and publication type. On average, papers in English have one more citation compared with papers in Spanish when cited by non-Spanish authors, although this difference is not significant. Some authors have found that journals in English have a higher number of citations and therefore BIF; however, BIF is not dependent on the country of the journal [11]. Some journals have changed their publication language to English to increase the citation track and therefore BIF. The results have been unexpected in some cases. *Experimental Psychology*, a German journal that changed into English in 2002 noticed an increase of non-German authors but also surprisingly a slightly decrease on the total number of citations after the change [2].

Regarding the publication type, review papers are more cited, whereas brief originals tend to be less cited compared with original papers. This finding is consistent with other works [12–14]. Review papers have 5.7 higher probabilities of having two citations or more than original papers. The explanation is that a review can be cited by many more papers because it can serve as an update to the work of many authors. Authors can cite a review independently on the results obtained, and sometimes this is not so for other original publications if the results contradict their findings. Other article types such as methodology papers have been proposed to have a higher number of citations and have been used by journals as a way to increase their BIF [15]. Among reviews, systematic reviews are more cited than narrative reviews [14] and this is important when making editorial decisions since systematic reviews usually fulfill the highest methodologic standards. Some journals decide to exclude some publication types owing to poor citation rates, thereby increasing the number of citable items; this policy is stated explicitly [16]. The effect of these decisions on healthcare is unknown [17].

The number of authors does not seem to influence on the number of citations received by papers published in *Gaceta Sanitaria*. We found two papers that have observed an association between number of authors and number of citations; if authors belong to different institutions, the probability of being cited increases even more [18,19]. Nevertheless, those studies have been published in journals published in English and we do not know if their results are applicable to non-English journals. In principle, it seems logical that those papers with more authors tend to have more citations because more researchers are aware of the work and should cite it. Furthermore, self-citation is a way to increase the visibility of the research of an author and authors are usually conscious that citations received favor the research track and increase prestige [2]. The lack of association among the number of authors and citations received suggests that there could be some degree of gift authorship on the published papers of *Gaceta Sanitaria*. Although the median number of authors was five, 25% of the included papers had six or more authors, and 10% had nine authors or more. The possibility of gift authorship increases because very few of the included papers were multicenter studies, which usually have a higher number of authors.

There are 30% self-citations in the period considered. The fact that 70% of papers are cited by different authors could be interpreted that the journal is widely spread among readers, mainly Spanish authors. Authors tend to self-citation to increase the diffusion of their research and also because the higher the number of citations received the higher the prestige of the author. Although we have not been able to compare this figure with other journals, we think that it is not very high.

Gaceta Sanitaria self-citations have not been analyzed in this paper. Thomson Reuters provides this information annually when the BIF is launched. *Gaceta Sanitaria* has had a 22% of self-citations for papers published in 2008 and 2009 (2010 BIF) and this figure was 32% the previous years (2009 BIF; ISI Web of Knowledge database). This percentage of self-citations is similar to other national journals of public health (ISI Web of Knowledge database). Garfield proposed the phenomenon of the 80/20, where 20% of articles account for 80% of citations [20], and this seems to be the case for *Gaceta Sanitaria* citations, where 24.3% of papers account for 75.6% of the citations (including self-citations). Nevertheless there were no papers highly cited, only two received more than 10 citations.

Although journals citing *Gaceta Sanitaria* have not been analyzed, we observed a great heterogeneity on the citing disciplines. This may be because of the diverse fields of knowledge that applied public health and epidemiologic methods. In an analysis of citations of the *American Journal of Public Health*, Rethlefsen et al [7] found that among the seven journals having at least a 2% of total citations, five did not belong to a public health area of knowledge.

This paper has some advantages, such as having studied citations received by papers within a journal. This is a strength because BIF is the same and does not affect the probability of a paper for being cited, excluding confusion owing to this variable. BIF has been shown as the main predictor for citation [21]. Another advantage is the statistical approach that has been used. Multivariable logistic regression allows for constructing a predictive model for citations through adjusting for the included variables. This modeling has been sparsely used in journalology, although there are some experiences trying to predict citations associated with paper quality [21].

The present study has some drawbacks. Perhaps the most important is that the number of years included and therefore the number of papers is low. This is because *Gaceta Sanitaria* was included for the first time in the ISI-WoK database in 2007. Nevertheless, we think that the period analyzed gives a quite accurate picture of what is happening with the citations to the papers published in *Gaceta Sanitaria*. We only included three types of papers and excluded other types such as editorials, special articles, debates, or commentaries because they do not appear in all the issues of the journal and would add some “noise” to this analysis.

We think that the results of the present paper are applicable to national journals published in another language different than English although we can only make conjectures. Along with English, Spanish, French, German, Portuguese, Russian, and Chinese are live science languages nowadays. There is a published experience of a psychology German journal comparing citations before and after became an English language journal with results very

similar to ours [2]. It is also possible that the citations to a journal formerly not published in English need an "induction" period for the scientific community to consider and cite the journal in question. Researchers prefer to cite known (and recognized) journals than unknown journals independently of the quality of the cited paper. Editors also prefer citations to prestigious and renowned journals. Finally, citations to papers published in English depend on this language skill of the national scientific community. Although young scientists can manage well in English, there is still a great number of researchers with mid or senior career whose English knowledge is basic. This fact is common to many non–English-speaking countries. The aforementioned comments are applicable to non–open-access national journals. Open access journals usually need a fee to publish there to enable an open access of the paper. Potent research groups have the funds to pay for this fee, but small research groups cannot afford this payment in many times.

What are the consequences of these findings? Sometimes, editors think that papers in English are worthwhile, even if their quality is lower than other papers because of an a priori high citation rate that would increase the BIF of their journal. In journals with a diffusion that is mainly at a national level, this assertion could be unfounded and language should not be used as a criterion to increase the BIF. This fact could be different for national journals highly cited by foreign authors. The high number of citations only remains true for review papers, which were much more cited when they are in English than in Spanish. Furthermore, national public health journals offer knowledge to contextualize some public health practices, outbreaks management and so on. Because we are not sure on the skills in English of our readership, this service to our readers could be lost if all the papers were written in English. If this is true, BIF could probably increase (citations from abroad versus no citations from Spain) to the cost of not being useful to the Spanish Public Health workers.

Although we can have some clues on which papers deserve a high number of citations, editors face the challenge of what to do with this information. Should publication be guided only for a pre-publication probability of citation? What's about an excellent paper on a neglected disease that would be cited by the 4 different research groups working on it worldwide? If we apply the criteria aforementioned, this paper probably would be never published [17]. Editors have therefore the responsibility of putting before the real contribution of a research on well-being of people instead of publishing a paper only because they think it will raise the BIF of their journal. As Richard Smith pointed out, "Journals could be designed for citing rather than reading and for authors (who cite articles) rather than readers (who cannot)" [1]. Editors, the scientific societies publishing journals, and authors push more and more to raise the BIF of journals where they are engaged, have published, or desire to publish. Managing citations trying to raise the BIF is a dangerous temptation with unpredictable results.

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