Ophthalmic Perspective

Trends in impact factors of ophthalmology journals

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Purpose: To test whether there is an association between the growth in the number of ophthalmic journals in the past years and their mean and maximum impact factor (IF) as a common sign of scientific proliferation. **Methods:** Using data from the 2013 Journal Citation Report database a study of the major clinical medical fields was conducted to assess the correlation between the number of journals and maximum IF in a given field in the year 2013. In the field of ophthalmology, we examined the correlation between year, number of journals, mean IF and maximum IF in the field of ophthalmology throughout the years 2000–2013. **Results:** In the major medical fields, a positive correlation was found between the number of journals and the maximum IF (quadratic $R^2 = 0.71$, $P < 0.001$). When studying the field of ophthalmology a positive correlation between the number of journals and mean IF ($R^2 = 0.84$, $P < 0.001$) and between number of journals and maximum IF ($R^2 = 0.71$, $P < 0.001$) was detected. **Conclusions:** Our findings suggest that the variation in the IF can be explained by the number of journals in the field of ophthalmology. In the future, the formation of additional ophthalmology journals is likely to further increase the IFs of existing journals.

Key words: Impact factor, ophthalmic journals, statistical analysis, trends

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The impact factor (IF) is a concept originally introduced by Garfield[1] and subsequently developed in the 1960s. Its purpose is to measure the importance and influence of a journal, author, or research area based on the number of citations over a specific period. Subsequently, the IF has often been used as a proxy for ranking the quality of scientific journals,[2] such that an increase in the IF of a journal is perceived as an increase in its ranking and quality.[3]

The field of ophthalmic research has seen a large increase in the number of journals over the years 2000–2013 (from 41 to 58 journals) in particular since the appearance of open-access journals.[4] In fact, a gradual increase in the literature of several ophthalmic disease processes has been witnessed as well[5,6] and production varies significantly by country of origin.[7]

In a recent study, an increase in the number of dermatology journals between the years 1991–2000 was accompanied by a concurrent increase in IF of the dermatology journals, presumably due to higher opportunity for citation.[8]

A similar paper by Mansour *et al*. reported that the phenomenon of ophthalmic journal proliferation has had a profound effect on the IF.[9]

We, therefore, designed the following study to test the hypothesis that there is an association between the increase in the number of ophthalmic journals in the past years and increased IF as a sign of scientific proliferation.

Methods

The database of the Journal Citation Reports (JCR) throughout the years 2000–2013 was accessed on August 31, 2014. We first conducted a bibliometric analysis to assess the correlation between the number of journals available in different fields of medicine and the top IF of each field.

Furthermore, we compared the field of ophthalmology with other surgical subspecialties to investigate the correlation between the number of journals versus the mean and maximum IF. A list of surgical journals was extracted from the JCR database and subdivided by the category tags of the journal to its corresponding surgical subspecialty and mean, and maximum IFs were calculated.

We then conducted a further assessment of the field of ophthalmology by listing all ophthalmology journals in each individual year and retrieving their corresponding IFs.

We identified the group of ophthalmic journals that appeared in the year 2000 JCR database and calculated the maximum ("maximum IF") and mean ("mean IF") IFs of this core group of journals throughout the years 2000–2013. Core journals were defined as journals that existed in the JCR 2000 database and remained listed throughout all consecutive years up until and including the year 2013.

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We then examined the correlation between year and number of journals, year and mean IF, year and maximum IF, number of journals and mean IF, and number of journals and maximum IF.

Minitab version 16.1 (State College, PA, USA) was used for statistical analyses. Data are presented as mean ± standard deviation or median (range) as appropriate for continuous variables or as *n* (%) for categorical variables. Spearman's ranked test was used for analyses of correlation. Stepwise backward elimination regression analyses with the calendar year, and number of journals as independent factors and mean\ maximum IF was performed. R^2 values presented are adjusted. For all tests, $P < 0.05$ was considered statistically significant.

Results

The results of the survey for the general medical field are depicted in Table 1. A significant correlation was found (quadratic $R^2 = 0.714$, $P < 0.001$) between the number of journals and maximum IF [Fig. 1].

Table 2 lists the number of total ophthalmology journals listed in each calendar year in the JCR database along with the maximum IF and mean IF of the core journals. Briefly, the number of journals significantly increased in the field of ophthalmology from 41 in the calendar year 2000 to 58 in the calendar year 2013 ($R^2 = 0.86$, $P < 0.001$). Similarly, the maximum IF significantly increased as well from 4.68 to 9.897 ($R^2 = 0.76$, $P < 0.001$) as well as the mean IF which increased from 1.37 to 2.42 ($R^2 = 0.97$, $P < 0.001$) [Fig. 2].

A significant positive correlation was found between the total number of journals and mean IF ($R^2 = 0.84$, $P < 0.001$) as well as the total number of journals and the maximum IF ($R^2 = 0.71$, $P < 0.001$) and finally between the mean IF and maximum IF ($R^2 = 0.8$, $P < 0.001$) [Fig. 3].

In stepwise regression analyses with calendar year and number of journals as independent factors and mean IF and maximum as dependent factors, the number of journals remained significant ($P < 0.001$).

When comparing the mean IF of ophthalmology to other surgical subspecialties ophthalmology, it was ranked 3 out of the 13 in 2000 while ranking 6 out of 13 in 2013 [Table 3].

Discussion

To the best of our knowledge, this is the first study to investigate the correlation between the IF and the number of journals listed for all journals in the field of ophthalmology as a sign of scientific proliferation.

We first showed that there is a significant positive correlation between the number of journals in a given medical field (general survey) and the maximum IF in this specific field.

Table 1: Survey of the maximum impact factor (2013) in several fields of medicine

Field	Maximum IF	Number of journals
Oncology	162.50	202
Medicine (general)	54.42	150
Immunology	41.39	144
Cell biology	36.46	185
Medicine (experimental)	28.05	122
Biochemical research methods	25.95	78
Microbiology	23.32	119
Pathology	22.13	76
Endocrinology	19.36	123
Cardiology	15.34	125
Psychiatry	15.15	135
Gastroenterology and hepatology	13.93	74
Allergology	11.25	21
Hematology	11.10	68
Rheumatology	10.25	30
Ophthalmology	9.90	58
Mycology	9.30	23
Dermatology	6.37	61
Pediatrics	6.35	117
Anesthesiology	6.17	29
Orthopedics	4.70	67
ENT	3.00	43

ENT: Ear nose and throat, IF: Impact factor

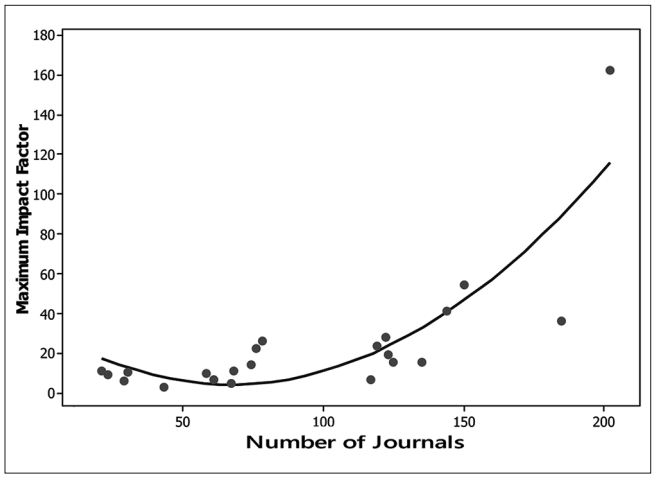

Figure 1: Maximum impact factor versus the number of journals in clinical medical fields

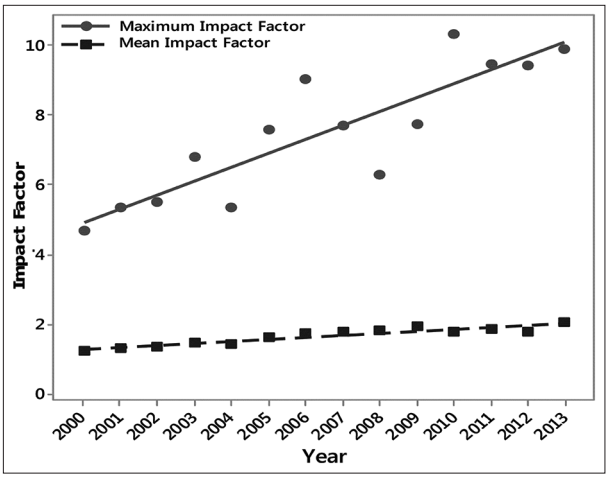

Figure 2: Mean impact factor and maximum impact factor of ophthalmology journals throughout the study period

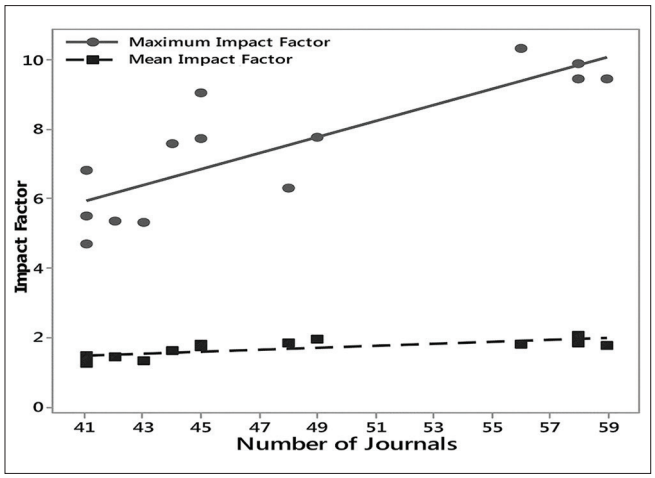

Figure 3: Mean impact factor and maximum impact factor versus the number of journals in ophthalmology

This finding confirms those of Jemec, who reported a similar correlation between number of journals and maximum IF, in a general medicine survey conducted between the years 1991 and 2000.[8] Our general survey showed that the more journals in a specific field of medicine, the higher the maximum IF. For instance, there were 202 oncology journals with a maximum IF of 162.5 compared to 43 ear nose and throat journals with a maximum IF of 3.0.

The increase in ophthalmic mean and maximum IF in the survey of surgical subspecialties supports our general survey findings and suggests that the number of journals may have an influence on the IF. Although one must remember that it is problematic to compare IF between different fields of medicine.[10]

In our more specific scope of ophthalmic journals, we found similar relationships. During the period considered (2000–2013), there were concurrent increases in total number of ophthalmology journals, their mean IF and their maximum IF. A recent study by Moverley *et al*. reported similar findings in the field of orthopedics, where an increase in the number of orthopedics journals was accompanied by an increase in the mean IF.[11]

We speculate that when a specific field has more journals, then more print space is made available leading to more citations and higher IFs in that specific field by providing a greater pool for citation.

Another explanation is that medical fields with a wider scope such as oncology and internal medicine are more likely to be cited by other fields with a more narrow scope such as ophthalmology or orthopedics.[12] This may explain, in part, why journals in oncology, general medicine, immunology, cell biology, and experimental medicine have a higher maximum IF while papers in journals of relatively specialized fields of medicine are cited less often. Some authors have even suggested a "scope-adjusted" IF to compensate for this phenomenon.[13] Indeed, Mansour *et al*. found that Ophthalmic journals publishing reviews, basic science, or large volume on broad range of topics ranked at the top for journal IF (JIF), while subspecialty journals tended to have low JIF.[9]

Table 2: Impact factor characteristics of core ophthalmology journals

Year	Maximum IF	Mean IF	Number of journals
2000	4.68	1.37	41
2001	5.33	1.48	43
2002	5.50	1.44	41
2003	6.81	1.56	41
2004	5.35	1.53	42
2005	7.58	1.72	44
2006	9.04	1.87	45
2007	7.73	1.96	45
2008	6.31	1.96	48
2009	7.76	2.04	49
2010	10.34	2.14	56
2011	9.46	2.22	58
2012	9.44	2.17	59
2013	9.90	2.42	58

IF: Impact factor

Table 3: Maximum and mean impact factor in surgical subspecialties

Surgical subspecialty	Maximum IF		Mean IF	
	2000	2013	2000	2013
Cardiothoracic	1.83	5.61	0.93	2.07
Dermatology	1.65	2.77	1.10	1.92
ENT	1.92	3.01	1.03	1.55
General	5.99	7.19	1.27	1.75
Maxillofacial	0.93	2.6	0.78	1.55
Neurosurgery	2.92	3.28	0.88	1.49
Oncology	2.80	3.94	1.54	2.49
Ophthalmology	2.07	2.78	1.64	1.89
Orthopedics	2.22	4.31	0.92	1.94
Pediatrics	1.22	1.94	0.72	1.16
Plastic	1.42	3.33	0.66	1.32
Transplantation	4.04	6.19	2.15	2.65
Vascular	3.28	3.99	1.81	1.88

ENT: Ear nose and throat, IF: Impact factor

Other studies have reported an increase in IF over the years in other fields of medicine such as general medical journals,[14] internal medicine,[15] emergency medicine,[16] and rheumatology.[17] We speculate that this increase was associated with a significant increase in the number of journals as evidenced from our study.

A limitation of our study is that it is highly dependent on data from the JCR database, thus its results may not apply to ophthalmology journals not listed in the JCR. In addition, our study's results and conclusions are limited to the core journals that were selected from the JCR's full journal list in the field of ophthalmology. Finally, due to the retrospective nature of this study, there may be other confounders which we have not investigated that may play a significant role in determining the trends in IF over the years.

Conclusions

In summary, as judged from the data presented, it appears that while the IF is a measure of a journal's scientific value, the actual IF score is also to a large extent related to external factors such as the number of journals in that discipline, a sign of scientific proliferation.

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Conflicts of interest

There are no conflicts of interest.

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