Title

Bibliometric analysis of the 100 most-disruptive articles in ophthalmology

Journal

Clinical and Experimental Ophthalmology, 50(6)

ISSN

1442-6404

Authors

Patel, Parth A

Patel, Prem N

Becerra, Adan Z

et al.

Publication Date

2022-08-01

DOI

10.1111/ceo.14109

Peer reviewed

A Bibliometric Analysis of the 100 Most-Disruptive Articles in Ophthalmology

Short Title: 100 Most-Disruptive Articles in Ophthalmology

Parth A. Patel[1], Prem N. Patel[2], Adan Z. Becerra, PhD[3], Mitul C. Mehta, MD[4]

[1]Medical College of Georgia, Department of Ophthalmology, Augusta University, Augusta, GA

[2]University of Texas Southwestern Medical Center, Department of Ophthalmology, Dallas, TX

[3]Rush University Medical Center, Department of Surgery, Chicago, IL

[4]Gavin Herbert Eye Institute, University of California, Irvine, CA

Corresponding Author:

Parth A. Patel

Medical College of Georgia

1120 15th Street Augusta, GA 30912

Email: papatel1@augusta.edu

Phone Number: 678-956-3861

Conflicts of Interest: None

Funding: None

Key Words: Disruption, Bibliometrics, Innovation, Ophthalmology, Citations

Over the past two decades, bibliometrics have gained importance for the evaluation of research output in ophthalmology.[1] Traditionally, citation count has been employed for the purpose of measuring an article's scientific influence; however, there have been extensive criticisms levied against the metric.[2]

~~Provided~~ Related to these concerns, new tools have been developed to identify an article's impact. One such example is the recently validated disruption score, which quantitatively assesses the extent to which an article "introduces something new that eclipses attention to previous work upon which it has built."[3]

Disruption scores range from -1 to +1, with scores closer to the latter representing more *disruptive* publications. Comparatively, *developmental* publications (with scores closer to -1) are those that promote citation of preexisting literature. Scores are defined as a ratio: the numerator is calculated as the number of future articles that cite the primary article, but none of its references minus the number of articles that cite the primary article and at least one of its references; the denominator is calculated as the cumulative number of citations for the primary article plus the number of future articles that cite at least one of the primary article's references, but not the primary article itself.[3]

As ophthalmology is characterized by a long history of innovation, we sought to identify the most disruptive articles to potentially elucidate the shifts in thinking that altered the field. Towards that end, we used a validated dataset of PubMed-indexed papers published 1954–2014 to select the 100 most-disruptive ophthalmology articles among the top-50 ophthalmology journals by 2020 impact factor.

From the 116,010 publications with available data, the 100 most-disruptive articles are presented in **Table 1**. Each of these articles was more disruptive than 99.9% of all PubMed-indexed papers (**Figure 1**). General ophthalmology (22%), vitreoretinal surgery (15%), and cornea and anterior segment (14%) were commonly represented areas. To provide data on more contemporary publications, the 100 most-disruptive articles published 2000–2014 are detailed in **Supplemental Table 1**.

Citations counts ranged from 4 to 1445. A weak correlation coefficient of 0.12 was observed between citation counts and disruption scores, indicating the latter bibliometric examines alternative aspects of scientific influence relative to the former. Disruption does not merely capture impact or significance. Instead, disruption awards papers that have displaced the previous literature by highlighting new avenues, techniques, and/or observations. The most disruptive article (score = +1) would be one in which none of its references were ever cited following its publication.

Review of the disruptive articles revealed a breadth of influential and innovative papers that have supplanted former ways of thinking and guided

the field into new directions. The paper with the second highest disruption score ("Biometry of 7,500 cataractous eyes") was published by Kenneth J. Hoffer in 1980. This retrospective analysis provided the hitherto largest dataset of biometric measurements among patients with cataracts, which *replaced* previously accepted values.[4] Another interesting paper ("Enhanced depth imaging spectral-domain optical coherence tomography"), published by Richard F. Spaide et al. in 2008, had the 57th highest disruption score and largest citation count. That investigation defined the *first* relatively simple and clinically accessible methodology to obtain images of the choroid, an essential leap towards improved evaluation of retinal and choroidal conditions.[5]

Notably, the studies described by disruptive articles were primarily case series/case reports (29%), innovations/surgical techniques (19%), and experimental investigations (17%). No randomized controlled trials (RCTs) were included. This observation is unsurprising considering an RCT rarely displaces the literature it references. Instead, there is significant progression towards an RCT's development, whereby the preexisting findings (e.g., from basic science investigations) remain relevant following publication of the RCT. Therefore, smaller-scale studies, despite possessing inherent biases, can be vital in facilitating innovation and novelty, particularly in a field such as ophthalmology that is characterized by a necessity for operative enhancements among an increasingly aging population.

It is ~~imperative to comment~~important to note that the disruption score should not be used exclusively when assessing a paper's importance. This index captures one aspect of a publication's influence and should be understood as a bibliometric that coexists with, but does not replace, traditional measures. Additionally, developmental articles are no less important than their disruptive counterparts; rather, both are essential for the advancement of science.[3] Indeed, as with other bibliometrics, the disruption score does not appraise a publication's clinical significance, but its scholarly influence relative to the existing and future literature. Some papers that were identified resulted in changes to clinical practice while others highlighted an interesting clinical observation without much significance to practicing ophthalmologists.

In conclusion, our investigation provides a list of the 100 most-disruptive articles in ophthalmology, thereby contributing a unique historical perspective into the literature that has shaped the field. We hope this novel method of organizing and evaluating research in ophthalmology will be a useful adjunct to preceding bibliometric analyses in the field.

Acknowledgements: None

References

1. Chou CY, Chew SS, Patel DV, Ormonde SE, McGhee C. Publication and citation analysis of the Australian and New Zealand Journal of Ophthalmology and Clinical and Experimental Ophthalmology over a 10-year period: the evolution of an ophthalmology journal. *Clin Exp Ophthalmol* 2009; **37**: 868-73.
2. Aksnes DW, Langfeldt L, Wouters P. Citations, citation indicators, and research quality: An overview of basic concepts and theories. *Sage Open* 2019; **9**: 2158244019829575.
3. Wu L, Wang D, Evans JA. Large teams develop and small teams disrupt science and technology. *Nature* 2019; **566**: 378-82.
4. Hoffer KJ. Biometry of 7,500 cataractous eyes. *Am J Ophthalmol* 1980; **90**: 360-8.
5. Spaide RF, Koizumi H, Pozzoni MC. Enhanced depth imaging spectral-domain optical coherence tomography. *Am J Ophthalmol* 2008; **146**: 496-500.

Figure Legends:

Figure 1 Kernel density plot of disruption scores for all PubMed-indexed papers and all papers from top-50 ophthalmology journals (by 2020 impact factor) published 1954–2014. Negative values indicate developmental papers, whereas positive values indicate disruptive papers. 1% of PubMed-indexed papers had a disruption score >0.100.