A bibliometric analysis of systematic review/meta-analysis on dry eye disease

Yonggang Zhang (✉ jebm_zhang@yahoo.com)

Sichuan University West China Hospital <https://orcid.org/0000-0002-5251-3815>

An Ping

West China Hospital

Shuyuan Lyu

West China Hospital of Sichuan University

Research

Keywords: Bibliometric analysis, Dry eye disease, Systematic review, Meta-analysis

Posted Date: December 26th, 2019

DOI: <https://doi.org/10.21203/rs.2.19572/v1>

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Abstract

Background There was no citation analysis about systematic review/meta-analysis published on dry eye disease (DED). The objective of this study was to identify the citations of systematic review/meta-analysis published on DED and to provide information on the achievement and development of evidence-based dry eye research.

Methods Web of Knowledge Core Collection was searched for all systematic review/meta-analysis relevant to DED. The number of citations, authorship, year, journal, country, and institution were analyzed for each study.

Results A total of 29 systematic reviews/meta-analyses on DED published between 2009 and 2017 were included. The number of citations ranged from 0 to 63, with a medium of 8 citations. These systematic reviews/meta-analyses were from 10 countries, and 15 of them were from China. They were published in 21 journals. *Ocular Surface* published most studies ($n=4$), followed by *International Journal of Ophthalmology* ($n=3$). The journal with highest impact factor was *Nutrition Reviews* (IF=5.291 in 2016).

Conclusion The citations of systematic reviews/meta-analyses on DED are still low. Further systematic reviews/meta-analyses are needed for providing more evidence for DED.

Introduction

Dry eye disease (DED), also called keratoconjunctivitis sicca, is defined as a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface(1-4). Epidemiological studies in different parts of the world had reported in the range of 8 to 34%(5-8). In recent years, there has been an increasing research interest in DED, as it is one of the main reasons that people visit the clinic(2, 3, 9). It leads to a negative impact on patients' daily life and social functioning and making it an important public health problem(10). The United States announced the economic burden of DED that the average cost of 11,302 USD per patient and 55.4 billion USD overall(11). The growth of DED is reflected in the emerging research in this field. In the last 10 years, the growth of DED literature averaged 12.18%(4, 8, 12, 13).

Qualitative and quantitative assessment of the published literature in a particular field is called bibliometric analysis (14). Bibliometric analysis has a range of applications and its impact continues within the scientific community (15). The citation analysis is the most common bibliometric analysis method which focuses on citation number (16). It has been widely used to quantify the relative importance of a scientific paper. A number of such studies have been published in different sub-specialties of tuberculosis(16, 17), diabetes(15), emergency medicine(14), and anesthesiology(18). Recently, similar methods have been applied to DED. Schargus *et al.* reported the 100 most cited papers in dry eye and found that 55% of these studies were published from the USA(19). Boudry *et al.* reported the international publication trends in dry eye disease research(20). These two studies had provided the evidence of publication trends and most important DED studies. However, the situation of different types

was still unknown, especially for systematic reviews. Because systematic reviews are regarded as the strongest form of medical evidence, it is worthy to perform a bibliometric analysis of systematic reviews on DED research. Thus, we performed the current study.

Method

Study search

We conducted a search of the Web of Science Core Collection on April 5th, 2018. The database indexes more than 12000 most-cited journals in the world and has been commonly used for conducting a literature search in bibliometric study (16). We used the following search phrase in a “topic” search, without restriction of language or publication year: (dry eye OR keratoconjunctivitis sicca OR xerophthalmia) AND (systematic review OR meta-analysis).

Inclusion and exclusion criteria

Inclusion criteria were: a) the study should be a systematic review and/or meta-analysis in the field of DED and published in a peer review journal; b) the publication type should be articles and reviews. The exclusion criteria were as follows: a) abstracts, editorial, correction; b) study that mentioned the word “dry eye,” but did not deal with DED; c) DED was studied as a postoperative complication or symptom of Sjogren syndrome; d) Cochrane review.

Study selection and data extraction

Two authors screened eligibility studies and independently extracted data. The following information was extracted from each study: number of citations, authors, corresponding authors (contact authors), authors’ address, journal, year, country of origin, number of references, and number of the page. The country and institution were determined on the basis of the address of the corresponding author. If the first author and corresponding author had more than 1 addresses, the first address was used in data analysis. Any disagreement about screening and extracting was resolved by discussion or decided by the third author.

Results

The main characteristics of the included studies

Figure 1 shows the process of including studies. A total of 29 systematic reviews/meta-analyses were included(1-3, 5-13, 21-37). Table 1 shows characteristics of all the studies in descending order of citations. The number of citations of these studies varies from 63 to 0, with a total citation of 338. The

study with most citations (n=63) was about DED treatment and was published in *Ophthalmic and Physiological Optics* in 2009(27). The second most cited study was about DED treatment, published in *Ocular Surface* in 2013(1). The third most cited study was about topical cyclosporine in the treatment of DED, it was published in *Cornea* in 2014(6). The page numbers for the included studies were from 6 to 24, with a medium of 8 pages.

Table 1 Main characteristic of the 29 meta-analyses/systematic reviews

Ranking	Study title	Citations
1	Efficacy of different dry eye treatments with artificial tears or ocular lubricants: a systematic review(27)	63
2	Dry Eye Disease Treatment: A Systematic Review of Published Trials and a Critical Appraisal of Therapeutic Strategies(1)	39
3	Topical Cyclosporine A in the Treatment of Dry Eye: A Systematic Review and Meta-analysis(6)	30
4	Efficacy and Safety of Topical 0.05% Cyclosporine Eye Drops in the Treatment of Dry Eye Syndrome: A Systematic Review and Meta-analysis(24)	25
5	Associations between signs and symptoms of dry eye disease: a systematic review(8)	24
5	Lipid-Containing Lubricants for Dry Eye: A Systematic Review(30)	24
7	Omega-3 Essential Fatty Acids Therapy for Dry Eye Syndrome: A Meta-Analysis of Randomized Controlled Studies(9)	20
8	Economic and Humanistic Burden of Dry Eye Disease in Europe, North America, and Asia: A Systematic Literature Review(11)	18
9	Systematic review of randomised clinical trials on topical ciclosporin A for the treatment of dry eye disease(37)	16
10	Acupuncture for treating dry eye: a systematic review(5)	14
11	Novel hydroxypropyl-guar gellable lubricant eye drops for treatment of dry eye(32)	11
12	Efficacy of polyunsaturated fatty acids for dry eye syndrome: a meta-analysis of randomized controlled trials(7)	10
13	Efficacy and Safety of Topical Diquafosol Ophthalmic Solution for Treatment of Dry Eye: A Systematic Review of Randomized Clinical Trials(25)	8
13	Fluorescein-Tear Breakup Time as an Assessment of Efficacy of Tear Replacement Therapy in Dry Eye Patients: A Systematic Review and Meta-Analysis(2)	8
13	Prevalence of dry eye disease in visual display terminal workers: a systematic review and meta-analysis(33)	8
16	Acupuncture Therapy Is More Effective Than Artificial Tears for Dry Eye Syndrome: Evidence Based on a Meta-Analysis(22)	7
17	Depression and anxiety in dry eye disease: a systematic review and meta-analysis(10)	4
18	Metabolic syndrome risk factors and dry eye syndrome: a Meta-analysis(31)	2
18	Smoking and the risk of dry eye: a Meta-analysis(13)	2
18	Sodium hyaluronate's effect on xerophthalmia: a meta-analysis of randomized controlled trials(35)	2

21	Alcohol consumption and dry eye syndrome: a Meta-analysis(23)	1
21	Efficacy of Carboxymethylcellulose and Hyaluronate in Dry Eye Disease: A Systematic Review and Meta-Analysis(26)	1
21	The Effect of Hormone Replacement Therapy on Dry Eye Syndrome Evaluated with Schirmer Test and Break-Up Time(12)	1
24	Acupuncture for dry eye syndrome: a meta-analysis of randomized controlled trials(21)	0
24	Efficacy of nutritional supplementation with omega-3 and omega-6 fatty acids in dry eye syndrome: a systematic review of randomized clinical trials(28)	0
24	Prevalence of and Risk Factors for Dry Eye Symptom in Mainland China: A Systematic Review and Meta-Analysis(3)	0
24	Sodium Hyaluronate in the Treatment of Dry Eye Syndrome: A Systematic Review and Meta-Analysis(34)	0
24	The efficacy of traditional Chinese medicine for treatment of dry eye symptom: a meta-analysis(29)	0
24	The systematic review of Comorbidities with dry eye syndromes(36)	0

Distribution of published journals

All studies were published in 21 journals (Table 2). The journal with the largest number of the systematic reviews/meta-analyses was *Ocular Surface* ($n=4$), followed by *International Journal of Ophthalmology* ($n=3$). The journal with the highest impact factor was *Nutrition Reviews*, with an impact factor of 5.291 in 2016. Four journals do not have an impact factor in 2016, including *Clinical Ophthalmology*, *International Journal of Advanced Biotechnology and Research*, *Journal of Acupuncture and Tuina Science*, and *Korean Journal of Family Medicine*.

Table 2 Journals for 29 systematic reviews/meta-analyses

Journal	Number of Studies	IF 2016
Acta Ophthalmologica	2	3.157
Advances In Therapy	1	2.709
BMJ Open	1	2.369
British Journal of Ophthalmology	1	3.806
Clinical Ophthalmology	1	None
Cornea	2	2.01
Current Medical Research and Opinion	1	2.757
Evidence-Based Complementary and Alternative Medicine	1	1.74
Eye	1	2.275
International Journal of Advanced Biotechnology and Research	1	None
International Journal of Clinical And Experimental Medicine	1	1.069
International Journal of Ophthalmology	3	1.177
Journal of Acupuncture and Tuina Science	1	None
Journal of Ophthalmology	2	1.712
Korean Journal of Family Medicine	1	None
Medical Science Monitor	1	1.585
Nutrition Reviews	1	5.291
Ocular Surface	4	4.383
Ophthalmic and Physiological Optics	1	2.302
Optometry and Vision Science	1	1.409
Scientific Reports	1	4.259

Distribution of published years

Year distribution of the 29 studies is listed in Table 3. These studies were published from 2009 to 2017. The year with most studies was 2016 ($n= 8$), followed by 2014 ($n= 6$). The year with most citations was 2009 ($n=63$), followed by 2013 ($n=39$).

Table 3 Published year of 29 systematic reviews/meta-analyses

Year	Number of studies	Total citation	Average citation
2009	1	63	63
2010	1	11	11
2011	1	14	14
2012	1	24	24
2013	1	39	39
2014	6	84	14
2015	5	65	13
2016	8	37	5
2017	5	1	0

Distribution of countries

The systematic reviews/meta-analyses were from 10 countries (Brazil, China, France, Iran, Italy, Scotland, Singapore, South Korea, Spain, and the USA). The country published most studies was China ($n=15$), followed by USA ($n=3$), Scotland ($n=2$), Singapore ($n=2$), and South Korea ($n=2$). The country with the most citations was China ($n=112$), followed by Brazil ($n=39$). The country with the most average citations was Brazil ($n=39$), followed by Scotland ($n=35$) (Table 4).

Table 4 Countries origin of 29 systematic reviews/meta-analyses

Country	Number of studies	Total citation	Average
Brazil	1	39	39
China	15	112	7
France	1	8	8
Iran	1	0	0
Italy	1	16	16
Scotland	2	71	35
Singapore	2	24	12
South Korea	2	15	7
Spain	1	0	0
USA	3	53	17

Distribution of authors and Institutions

For the 29 studies, only two authors have published more than 1 study as the first author, including Michael J. Doughty from Glasgow Caledonian University, and Kelvin H. Wan from Chinese University in Hong Kong. Only 3 authors have published more than 1 study as contact author, including Michael J. Doughty from Glasgow Caledonian University, Alvin L. Young Chinese University Hong Kong, and Tong, Tong Louis Hak Tien from Singapore Eye Research Institution. Base on the contact authors, a total of 6 institutions published at least 2 studies, including Zhejiang University ($n=2$), Tianjin Medical University ($n=2$), Chinese University Hong Kong ($n=2$), Shanghai Jiao Tong University ($n=2$) from China, Glasgow Caledonian University ($n=2$) from Scotland, and Singapore Eye Research Institution ($n=2$) from Singapore.

Discussion

This bibliometric analysis investigated the publication performance of systematic reviews/meta-analyses on DED, provided information about research trends and advance the field. Briefly, a total of 29 systematic reviews/meta-analyses published between 2009 and 2017 were included, with citations ranging from 0 to 63 times.

The most cited study, published by Doughty MJ in 2009, received 63 citations([27](#)). When compared with other research areas, such as tuberculosis([17](#)), diabetes, the citation number was relatively low. The low citation might be associated with the small number of researchers working in DED. This meta-analysis was cited 63 times by 59 articles from Web of Science Core collection. Many articles in other research areas cited it, including ophthalmology (71.186%), pharmacology pharmacy (8.475%), surgery (8.475%), biophysics (5.085%), oncology (5.085%) and transplantation (5.085%). The study was cited by 3 languages, mainly by papers in English ($n=57$), German ($n=1$) and Portuguese ($n=1$), which indicated the article had an effect worldwide. With the development of DED research, the impact of this study will definitely increase, and it might become a classic paper (citations more than 400 times)([15](#), [17](#)).

Our results indicated that most of the systematic reviews/meta-analyses on DED were published in relative low impact factor journals, which was quite different from other fields. This situation was associated with the relatively low impact factors of ophthalmology journals. China published most of these studies, which was associated with increasing publications from China in recent years.

It was important to note that, we did not include Cochrane reviews. Cochrane reviews were systematic reviews of primary research in human health care and health policy and were published online in The Cochrane Library. There were three Cochrane reviews, including '*punctal occlusion for dry eye syndrome*'(38, 39), 'autologous serum eye drops for dry eye'(40, 41) and 'over the counter (otc) artificial tear drops for dry eye syndrome'(42). The first dry eye Cochrane review was *Punctal occlusion for dry eye syndrome*(39), which was first published in 2010, and had got 19 citations, the second was *Punctal occlusion for dry eye syndrome*, which was first published in 2013(41), and had got 12 times. Both the two reviews published their update version in 2017, and these versions were also indexed by Web of Science(38, 40). The third was *Over the counter (otc) artificial tear drops for dry eye syndrome*(42), which was published in 2016, and has been cited by 7 times. Because there were two versions of two Cochrane reviews, and it might bias the comparisons with other studies, so we did not include Cochrane reviews.

There were several limitations of this study. First, it was based on the Web of Science Core Collection alone. WOS does not index all journals, and we might have missed journals in other databases such as Google Scholar and Scopus. Second, journals published in recent years had less chance to be cited, which might bias our reporting of the ranking. Third, the study was restricted to the word "dry eye" or in the topic. Some significant DED systematic reviews might not have been included. Fourth, the origin of the authors might be biased, because based on the publications, we could only identify the countries and institutions where the authors were employed when the research was done or where the article was written.

In conclusion, the current study is the first bibliometric analysis for systematic reviews/meta-analyses on DED, revealing a number of characteristics related to these influential publications, including the country of origin, type of study, journal, and authorship. The citations for these studies are still low. Most of these studies were published in relative low impact factor journals.

Declarations

Ethics approval and consent to participate: None applicable.

Consent for publication: Yes.

Availability of data and material: None.

Competing interests: None.

Funding: None.

Authors' contributions: Yonggang Zhang and Shuyuan Lyu designed the study, draft the manuscript; An Ping searched the data.

Acknowledgements: None.

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Figures

Figure 2

Flow diagram for including studies

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