Research Article

The 100 Top-Cited Systematic Reviews/Meta-Analyses on Diabetic Research

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Objective. The objective of this study was to analyze the 100 top-cited systematic reviews/meta-analyses on diabetic research. *Methods.* The Science Citation Index Expanded database was searched to identify top-cited studies on diabetic research up to March 4th, 2020. Studies were analyzed using the following characteristics: citation number, publication year, country and institution of origin, authorship, topics, and journals. *Results.* The 100 top-cited diabetic systematic reviews/meta-analyses were published in 43 different journals, with *Diabetes Care* having the highest numbers (n = 17), followed by *The Journal of the American Medical Association* (n = 14) and *Lancet* (n = 9). The majority of studies are published in the 2000s. The number of citations ranged from 2197 to 301. The highest number of contributions was from the USA, followed by England and Australia. The leading institution was Harvard University. The hot topic was a risk factor (n = 33), followed by comorbidity (n = 27). *Conclusions.* The 100 top-cited systematic reviews/meta-analyses on diabetic research identify impactful authors, journals, institutes, and countries. It will also provide the most important references to evidence-based medicine in diabetes and serve as a guide to the features of a citable paper in this field.

1. Introduction

According to the WHO, diabetes had been identified as one of the four major noncommunicable diseases [1–3], and the number of deaths due to diabetes increased by 31.1% between 2006 and 2016 [4, 5]. Currently, about 382 million adults (8.3%) are living with diabetes, and it will be over 592 million by 2035 [4, 5]. As a consequence, many diabetic studies have been published during the past few decades [6–9]. Along with the increasing of the literature in original diabetic articles [10, 11], the systematic reviews/meta-analyses on diabetic research are also increasing. Assessment quality and quantity of literature has become much more important in the scientific area, and bibliometrics analysis is the most important involved method [12–14]. Fixing citation thresholds (100-400 citations) and choosing the top-cited studies (top 25 to 100) from a list [15] were the most common bibliometrics analysis method. Up to now, there have been several top-cited studies on various clinical specialties, including anesthesiology [16], tuberculosis [17], orthopedic surgery [18], gastric cancer [19], and gastroenterology [20]. There were also two such studies about diabetes [6, 7]; however, they did not report about the systematic review/meta-analysis.

Systematic reviews/meta-analyses use systematic methods to collect secondary data, critically appraise research studies, and synthesize studies [11, 21–27]. They are designed to provide a complete, exhaustive summary of current evidence relevant to a research question and are the key to the practice of

evidence-based medicine and have always been used in practice guideline [28–30]. Assessment of quality and quantity of diabetic systematic reviews/meta-analyses by bibliometrics analysis should be very important for diabetic research. Analyzing the top-cited systematic reviews/meta-analyses will help us to know the hottest topic and contribute future works in such a field. However, there was no such study. Thus, we performed the current study to assess the 100 top-cited systematic reviews/meta-analyses in diabetic research.

2. Methods

2.1. Inclusion and Exclusion Criteria. The inclusion criteria were as follows: (a) the study design should be a systematic review or meta-analysis or a systematic review and metaanalysis or a Cochrane review; (b) the study should be on diabetes, for example, if the review analyzed the changes in the blood glucose level in old diabetes mellitus patients, it could be included; if the review analyzed how to detect blood glucose by using blood glucose meters, it should not be included. The exclusion criteria used were (1) abstracts or reviews and (2) study focusing on the diabetes-associated issues, such as investigating the mechanism of antidiabetic drugs or investigating nondiabetic issues.

2.2. Identification of the 100 Top-Cited Studies. A retrospective bibliometric analysis was performed on March 4th, 2020 to identify studies using the Web of Science Core Collection. The following search strategy was used: "diabetes or diabetic" and "systematic review or meta-analysis", in combination with "diabetes or diabetic" and "PUBLICATION NAME: (Cochrane database of systematic reviews)". The search results were subsequently ranked according to the number of citations. Two authors screened the titles and abstracts and identified the 100 top-cited studies on diabetic research. In cases of discrepancy, the consensus was achieved with the help of a third independent author.

2.3. Analysis of the 100 Top-Cited Studies. The following information was extracted from each article: authorship, source journal, year of publication, geographic origin, scientific research institution, number of citations, and research topics. If the author belonged to different institutions, the first institution for the author was used for data analysis. If there was only one author, the first author was simultaneously recognised as the corresponding author. Impact factors (IF) from the Journal Citation Report (JCR) reported published in 2019. If the journal has changed its name, the IF was identified based on its current name. Two authors independently identified the research topics as six topics, including drug therapy, complication, comorbidity, related treatment, risk factors, and others. The following definitions were used: drug therapy studies were defined if the study focused on drug therapy of any types of diabetes; complication studies were identified if the study focused on diabetic complications; comorbidity studies were defined if the study focused on comorbidities related to diabetes; related treatment studies were defined if the study focused on associated treatments, such as exercise and self-management; risk factor studies were identified if the study focused on investigating potential risk factors for diabetes; if a study cannot be clarified into the above 5 topics, it will be defined as the other topics. To avoid potential studies which could be identified into two topics, each study was identified in the following orders, drug therapy, complication, comorbidity, related treatment, risk factors, and others. In cases of discrepancy, the consensus was achieved with the help of a third independent author. VOSviewer 1.6.6 (http://www.vosviewer.com/, Leiden University Centre for Science and Technology Studies) was used to analyze the cocitation of the top 100 studies.

3. Results

3.1. The Main Characteristics of the Included Studies. Supplement table 1 shows the characteristics of the 100 top-cited studies in descending order. The citation times of these studies varied from 2197 to 301, with a total citation time of 60180. The most cited study with 2197 citation times was a meta-analysis of the prevalence of comorbid depression in adults with diabetes, which was published in Diabetes Care [31]. The second study was a metaanalysis named "Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies," which was published in Lancet and cited 1726 times [32]. The third study was a meta-analysis of weight and type 2 diabetes after bariatric surgery, which was published in the American Journal of Medicine and cited 1540 times [33].

3.2. Distribution of Authors. The authors published at least two studies as first authors or corresponding authors are shown in Table 1. Two authors published three studies as the first author or corresponding author, including Rob M. van Dam and Anastassios G. Pittas. For the first authors, all three authors were experts in the field of public health. While for the corresponding authors, five authors were experts in the field of public health, only 1 was an expert in the field of diabetes.

3.3. Distribution of Countries. The 100 top-cited studies on diabetes were from 19 countries, including USA, England, Australia, Netherlands, Canada, Sweden, Germany, Scotland, China, Brazil, Switzerland, South Korea, Denmark, France, Greece, Iran, Italy, Japan, New Zealand, and North Ireland. The countries produced the most significant number of studies were the USA (n = 40), England (n = 20), and Netherlands (n = 6). The studies produced most citations were from the USA, with 26450 citation times, followed by England with 13305 citation times. The country with the most average citation was Scotland with 1108 citation times, followed by Denmark with 963 citation times (Table 2).

3.4. Distribution of Institutions. A total of 16 institutions with more than two studies were included (Table 3). The institutions with the most of studies were Harvard University in the USA (n = 11), followed by the University of Cambridge (n = 3) and University of Leicester (n = 3) in England, University of Sydney (n = 3) in Australia, Johns Hopkins

	Name	Number of study	Affiliation	Professional
	Rachel Huxley	2	University of Sydney	Public health
First author	Susan L. Norris	2	Centers for Disease Control and Prevention	Public health
	Larsson C. Susanna	2	Karolinska Institutet	Public health
	Huxley Rachel	2	University of Sydney	Public health
	Susan L. Norris	2	Centers for Disease Control and Prevention	Public health
	Anastassios G. Pittas	3	Tufts-New England Medical Center	Diabetes
Corresponding author	Larsson C. Susanna	2	Karolinska Institutet	Public health
	Rob M. van Dam	3	VU University Medical Center	Public health
	Hu. Frank B	2	Harvard University	Public health

TABLE 1: Authors with more than one study as first or corresponding authors included in the 100 top-cited systematic reviews/meta-analyses for diabetes.

TABLE 2: Country of origin of the 100 top-cited systematic reviews/meta-analyses for diabetes (based on the country of the corresponding author).

Ranking	Country	Number of study	Total citation	Highest times of citation	Lowest times of citation	Average citation
1	USA	40	26450	2197	301	661
2	England	20	13305	1726	311	665
3	Netherlands	6	3212	1052	350	535
3	Australia	6	2470	885	312	542
5	Canada	4	2048	960	344	512
5	Sweden	4	1788	631	304	447
7	Germany	3	1116	434	324	372
8	Scotland	2	2215	1393	822	1108
8	Brazil	2	873	531	342	437
8	China	2	674	359	315	337
8	Switzerland	2	971	667	304	486
12	South Korea	1	365	365	365	365
12	Denmark	1	963	963	963	963
12	France	1	372	372	372	372
12	Greece	1	412	412	412	412
12	Iran	1	617	617	617	617
12	Italy	1	523	523	523	523
12	Japan	1	329	329	329	329
12	New Zealand	1	387	387	387	387
12	North Ireland	1	307	307	307	307

University (n = 3), University of Michigan (n = 3) and Tufts University (n = 3) in the USA, and Karolinska Institutet (n = 3) in Sweden.

3.5. Distribution of Published Years. Year's distribution of the 100 top-cited studies is shown in Table 4. These studies were published from 1996 to 2015. The year with most studies was 2007 with 18 studies, followed by 2008 with 11 studies. The year with most citations was 2007 with 10488 citations, followed by 2008 with 6675 citations. The year with most average citation was 2001 with 1153 citations, followed by 2002 with 843 citations.

3.6. Distribution of Published Journals. The 100 studies were published in 42 journals (Table 5). The journal with the larg-

est number of articles cited was *Diabetes Care* (n = 17), followed by *JAMA* (n = 14) and *Lancet* (n = 9).

3.7. Distribution of Research Topics. Topic distribution of the 100 top-cited studies is shown in Table 6. The hottest topic was the risk factor (n = 29); the most average citation was drug therapy.

3.8. Cocitations. The cocitation of the 100 top-cited studies is shown in Supplement Figure 1. The most frequent cocitation study was about quantifying heterogeneity in a meta-analysis (n = 15) published by Higgins JP in 2002. The most frequent cocitation source was *Diabetes Care* (n = 239). Jürgen Rehm from the University of Toronto was the most frequent cocitation author (n = 36).

Institution	Country	Number of study	Total citation	Highest citation	Lowest citation	Average citation
Harvard University	USA	11	5029	669	304	457
University of Cambridge	England	3	2874	1726	324	958
University of Sydney	Australia	3	1975	885	401	652
University of Leicester	England	3	1995	725	621	665
Johns Hopkins University	USA	3	1913	924	474	638
University of Michigan	USA	3	2449	1189	529	816
Tufts University	USA	3	2337	1132	463	779
Karolinska Institutet	Sweden	3	1157	525	304	356
Washington University	USA	2	3192	2197	995	1596
Free University of Amsterdam	Netherlands	2	927	534	393	464
Centers for Disease Control and Prevention	USA	2	2087	1139	952	1043
University of Melbourne	Australia	2	768	456	312	384
University of Glasgow	Scotland	2	2215	1393	822	1108
University of Minnesota	USA	2	2003	1540	463	1002
University of Oxford	England	2	1638	1315	323	819

TABLE 3: Institutions with at least 2 studies based on the institution of the corresponding authors included in 100 top-cited systematic reviews/meta-analyses for diabetes.

TABLE 4: Distribution by year of publication of the 100 top-cited systematic reviews/meta-analyses for diabetes.

Year	Number of study	Total citation	Highest citation	Lowest citation	Average citation
2015	2	794	397	323	360
2014	1	529	529	529	529
2013	2	727	412	315	364
2012	7	2870	725	317	410
2011	9	3787	822	304	421
2010	9	6668	1726	314	741
2009	8	6437	1540	311	793
2008	11	6675	1315	307	607
2007	18	10448	1132	304	580
2006	10	5796	1052	304	579
2005	8	3671	671	301	459
2004	3	2090	924	434	697
2003	3	1092	454	303	364
2002	3	2530	1189	389	843
2001	5	5767	2197	480	1153
1996	1	463	463	463	463

4. Discussion

The results of our study showed that the 100 top-cited studies were cited 2197 to 301 times, which is much less than the previous studies for all diabetic researches (ranged from 10292 to 1121). When compared with tuberculosis, the number is much higher than the previous studies about tuberculosis studies [34]; the reason may be that the number of researchers in the diabetic field may more than that in the tuberculosis field. The years in which most of the top-cited diabetic studies published are the 2000s. In all, most of the studies were published between 2005 to 2012, and 18 were published in 2007, which accounted most in the years, which suggested that it might take about ten years for systematic review citation to peak, which was consistent with results from tuberculosis [34].

Our study found that most top-cited studies were from the USA, followed by England and Canada. The results were in line with the origin of the 100 most frequently cited articles in many other fields. The USA leads the world in medical researches, given its large number of researchers and generous research funding [34, 35]. Most studies were written by researchers in the USA, England, and Canada. Thus, most of the top-cited studies were from these countries.

The results from our analysis indicated that the most topcited studies were published in journals related to endocrinology and metabolism, such as *Diabetes Care*, *Diabetologia*, and *Diabetic Medicine*. Comprehensive medical periodicals have also published top-cited studies, such as *JAMA*, *Lancet*, *BMJ*, and *Annals of Internal Medicine*. We have to mention some journals in the field of cancer, public health, and cardiology, such as the *American Journal of Epidemiology*, *Cancer Epidemiology Biomarkers & Prevention*, *American Heart Journal*, and *British Journal of Cancer*. Diabetes was studied as a risk factor in these studies [36–39]. This may suggest the editors and authors to choose research topics of studies in diabetes in the future [40].

It is very interesting that the citation of the risk factor topic got the highest total citations than the other topics. The reason might be that the risk factor studies attracted more attention from other disciplines except for endocrinology. Among the 100 studies, about 1/3 studies were about the comorbidity, and this would help journals to invite or accept manuscripts.

Ranking	Name of journal	Number of study	Impact factor [#]
1	Diabetes Care	17	15.27
2	JAMA-Journal of the American Medical Association	14	51.273
3	Lancet	9	59.102
4	Nature Genetics	5	25.455
5	Diabetologia	5	7.113
6	BMJ-British Medical Journal	4	27.604
7	Annals of Internal Medicine	4	19.315
8	Diabetic Medicine	3	3.107
9	American Journal of Clinical Nutrition	2	6.568
10	American Journal of Epidemiology	2	4.473
11	Cochrane Database of Systemic Reviews	2	7.755
12	Journal of the American College of Cardiology	2	18.639
13	PLOS Medicine	2	11.048
14	American Heart Journal	1	4.023
15	American Journal of Medicine	1	4.76
16	Archives of Disease in Childhood	1	3.158
17	Archives of Internal Medicine	1	20.768
18	Biological Psychiatry	1	11.501
19	BMC Medicine	1	8.285
20	British Journal of Cancer	1	5.416
21	Canadian Medical Association Journal	1	6.938
22	Cancer Epidemiology, Biomarkers & Prevention	1	5.057
23	Cancer Prevention Research	1	3.866
24	Circulation	1	23.054
25	Clinical Gastroenterology and Hepatology	1	7.958
26	Epidemiologic Reviews	1	6.455
27	European Heart Journal	1	23.239
28	European Journal of Cancer	1	6.68
29	European Journal of Clinical Nutrition	1	3.114
30	Human Reproduction Update	1	12.878
31	Internal Medicine Journal	1	1.767
32	International Journal of Cancer	1	4.982
33	International Journal of Epidemiology	1	7.339
34	Journal of Affective Disorders	1	4.084
35	Journal of Clinical Endocrinology and Metabolism	1	5.605
36	Journal of the National Cancer Institute	1	10.211
37	Lancet Neurology	1	28.755
38	Nutrition Research Reviews	1	5.595
39	Obesity Reviews	1	8.192
40	Osteoporosis International	1	3.819
41	PLOS One	1	2.776
42	Psychosomatic Medicine	1	3 937

TABLE 5: Journals in which the 100 top-cited systematic reviews/meta-analyses for diabetes were published.

#: from the Journal Citation Report in 2016; *: QJM-an international journal of medicine; &: JAMA internal medicine; JAMA: The Journal of the American Medical Association; BMJ: British Medical Journal.

The most popular topics might be different from the hot topics on the Internet [41], and we needed to measure the number and nature of online attention around the research results. At present, altmetric attention scores, which were calculated using different weight values of different data resources, including Twitter, Facebook, and Google+, were usually used to assess the impact and contribution in many fields. A significant positive correlation between altmetric score and standardized citation might be found in some fields. However, we should also know that bibliometric and

Topic	Number of study	Total citation	Average citation
Drug therapy	22	13777	626
Complication	9	1801	300
Comorbidity	25	14660	586
Related treatment	13	7840	603
Risk factor	29	16697	576
Other	2	973	587

 TABLE 6: Distribution by topics of the 100 top-cited systematic reviews/meta-analyses for diabetes.

altmetric analyses provided important but different perspectives about study impact.

Some limitations of this study should be noted. First, this is a cross-sectional study design with a single time point. The rankings identified might change if the study was replicated in the future. Second, with the increasing launched new journals and published new papers, the papers in recent years might get more citations. Third, the citation counts differ according to the citation database under study. Although the Web of Science database was widely considered as the gold standard used in the top-cited analysis, however, we should not ignore the Google Scholar or Scopus databases. Fourth, due to the time limit of the citation index, some new studies could not be included in this study, and older manuscripts were more likely to be cited by newer manuscripts. Therefore, in future studies, we could use the citation rate index, altmetrics, or PlumX to evaluate the impact of research in this field to eliminate such interference.

In conclusion, we identified the 100 top-cited systematic reviews/meta-analyses on diabetic research. They identified the impactful authors, journals, institutes, and countries and also analyzed the most popular articles and topics in the field. It will also provide the most important references related to evidence-based medicine in diabetes and serve as a guide to the features of a citable paper in this field.

Abbreviations

JCR:Journal Citation ReportIF:Impact factorJAMA:The Journal of the American Medical AssociationBMJ:British Medical Journal.

Data Availability

The original data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Yi Yang and Yao Ma contributed equally to this work.

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Supplementary Materials

Supplementary 1. Supplement Figure 1: the cocitation between the included studies.

Supplementary 2. Supplement Table 1: the 100 top-cited systematic reviews/meta-analyses in diabetes research.

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