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 meta-analysis 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 meta-analysis 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 13505 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
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 largest 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).
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.

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.

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

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             |

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 top-cited 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 that all 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.
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

| 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         |

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

| 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              |

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.

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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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Abbreviations

JCR: Journal Citation Report
IF: Impact factor
JAMA: The Journal of the American Medical Association
BMJ: 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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