Narrative Review

Three Decades of Citation Classics: The Most Cited Articles in the Field of Physical Medicine and Rehabilitation

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With the American Academy of Physical Medicine and Rehabilitation recently celebrating its 75th anniversary, it is an opportune time to assess the impact and influence that physiatric articles and research have had on the field, as well as the greater scientific community. One useful metric of scientific impact is citation count, which is the most common method for analyzing the magnitude of scientific recognition of an individual article. This study presents 2 reading lists of influential physiatric academic journal articles drawn from the Web of Science index based on citation count. The first list contains the top 25 most-cited articles during the last 3 decades from the *American Journal of Physical Medicine and Rehabilitation*, the *Archives of Physical Medicine and Rehabilitation*, and *PM&R*. The second list contains the top 10 articles in 20 different physiatric topical areas. This topical list was generated via an expanded search without limitation of time span or journal. This allowed for the identification of influential physiatric articles not found in the field's 3 major publications from the United States. Although citation index is not a direct measure of quality or importance, it offers one form of quantitative assessment of scientific impact. This assessment contributes to the identification of trends, which illustrate the evolution of scope and focus of physiatry research. The lists of most-cited articles presented in this review can be used to provide historical context to physiatry's existing body of research, direct future evidence-based research efforts, and help guide educators as they select resident reading lists or journal club materials.

PM R 2014;6:828-840

As the Academy of Physical Medicine and Rehabilitation reaches its 75th year, it is important to assess the impact and influence that physiatric articles and research have had on the field, as well as the greater scientific community. Bibliometrics (methods for quantitatively analyzing scientific literature) provide techniques for such analysis. One useful metric is citation count, which is the most common method for analyzing the magnitude of scientific recognition of an individual article [1]. This should not be confused with slightly more complex algorithms that are also based on citation count—such as the impact factor and H-index—but used to analyze individual journals or authors, respectively.

In 1961, one of the founders of bibliometrics, Dr. Eugene Garfield, in an attempt to "track citations and understand trends in context," created the Science Citation Index [1]. This index grew into the Web of Science, which provides online access to the Science Citation Index as well as indices for other fields of Arts, Humanities, and Social Sciences via 7 online databases: Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, Index Chemicus, Current Chemical Reactions, Conference Proceedings Citation Index, and Book Citation Index. The Web of Science encompasses open-access journals and covers 10,000 of the highest-impact journals, with indexing coverage from the year 1900 to the present [2].

Two additional indices were released in the early 2000s: Google Scholar, a product of Google Inc., and Scopus, a product of Elsevier B.V. publishing groups. Google Scholar has yet to reveal the source content, indexing, relevance algorithms, or time period through which Scholar searches. It is a subset of the larger Google search index and includes

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Disclosure: nothing to disclose

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Disclosure: nothing to disclose

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Disclosure: nothing to disclose

Submitted for publication July 29, 2013; accepted May 31, 2014.

PM&R
1934-1482/14/$36.00
Printed in U.S.A.

Vol. 6, 828-840, September 2014
http://dx.doi.org/10.1016/j.pmrj.2014.05.019

websites, print publications, foreign translations, and books. The search also includes access to "gray literature," such as preprint archives, conference proceedings, institutional repositories, student handbooks, administrative notes, and links to the online collections of some academic libraries. Google Scholar is free, fast, and easy to access and lends itself to unconventional search topics not easily retrieved from more traditionally academic resources [3]. Scopus is available by subscription. It includes books, conference proceedings, web sites, reports, and patents from the US, European, and Japanese Patent Offices. Scopus is easy to navigate and comprehensive, including more journals but over fewer years [4].

All 3 indices have been compared in detail, with mixed results reported [5-7]. One well-described limitation to the Web of Science, compared with these other indices, is that it does not include citations from as many publication sources, which results in a substantial underestimation of citation counts. Regardless, the Web of Science remains the standard database for generating article lists by citation count analysis, likely because of historical reasons as well as its wide acceptance and recognition in the scientific community [8-11].

This article seeks to objectively identify the most influential and impactful articles from the field of physical medicine and rehabilitation. It is the authors' intention that the resulting list will prove useful for physiatrists and trainees by reminding us of our past, highlighting our contributions to the scientific community, and informing directions for future research. This article presents the 25 most-cited articles dating back 3 decades (1984-2013), from the 3 major physiatric journals from the United States (*Archives of Physical Medicine and Rehabilitation* [published since 1953], *American Journal of Physical Medicine and Rehabilitation* [published since 1922], and *PM&R* [published since 2009]). In addition, because many influential articles to the field of physiatry are not necessarily published in these 3 major publications, we also generated a list of articles within certain key physiatric topic areas ranked by citation count.

METHODS

Within the Web of Science, the 3 major physiatric journals were queried individually with time parameters of 1984 through 2013 for articles ranked by citation count. The years 1984 to 2013 were chosen because they span the last 3 decades of work and because the time frame also overlaps with the most recent compilation of top physiatric articles, which will be described in the Discussion section [12]. These 3 lists were then merged into a single list of the overall top 25 cited articles. This ranking list will be referred to as the Top 25 List. Similar lists were generated with Google Scholar and Elsevier Scopus.

Finally, 20 physiatric topic areas were chosen by a board-certified physiatrist (D.G.C.), based on review of the American Academy of Physical Medicine and Rehabilitation website on conditions and treatment [13], textbooks [14,15], and handbooks [16,17]. This list of topical keywords was presented to the various American Academy of Physical Medicine and Rehabilitation Membership Council representatives to ensure the keywords provided adequate representation of the major scopes of practice within the field. These topics were then searched via the Web of Science by title without parameters of time or journal and the top 10 cited articles in each category were compiled. This ranking list will be referred to as Top 200 List.

RESULTS

The 25 most cited articles from the last 30 years of publications for the *Archives of Physical Medicine and Rehabilitation*, *American Journal of Physical Medicine and Rehabilitation*, and *PM&R* (Top 25 List) are shown in Table 1. Twenty topical keywords were generated and are displayed in Table 2. The top 10 articles within these 20 topical keywords (Top 200 List) also were compiled and are shown in Table 3.

We highlight the following observations concerning the Top 25 List.

1. Investigators from the United States, United Kingdom, Canada, Denmark, and Taiwan were represented in the top 25 list.
2. Of the Top 25, 8 articles were published in the 1980s, 11 in the 1990s, and 6 in the 2000s.
3. There were several authors with multiple articles in the Top 25. Granger, Linacre, Wright, Jørgensen, Nakayama, Raaschou, and Olsen all had 3 articles; and Hamilton, and Heinemann, Cicerone, Dahlber, and Ottenbacher had 2 articles.
4. Among the authors, the following professional degrees were represented (and percentage at which they were represented): PhD (38%), MD (27%), OTR (11%), MD/PhD (6%), MS (5%), MA (5%), PT (3%), OTS (3%), and PhD/PT (2%).
5. Not one of the current Top 25 articles was written by an individual author.
6. The oldest article was published in 1984 and the most recent in 2005.

The following are interesting points regarding the Top 200 articles in 20 topical areas:

1. The oldest article was published in 1950, and the 2 most recent articles were printed in 2010.
2. Only 12 articles were from 1 of the 3 major physiatric journals.
3. Only 22 articles were printed before 1984.
4. Only one article from our Top 25 List from the 3 major physiatric journals was represented (Lum et al) [18].