The Journal of Foot & Ankle Surgery 54 (2015) 295–297

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Where Art Thou Diabetic Foot Disease Literature? A Bibliometric Inquiry Into Publication Patterns

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ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
amputation
diabetes
limb salvage
multidisciplinary team
peripheral vascular disease
prevention

ABSTRACT

The objective of the present investigation was to evaluate the published scientific data with respect to the diabetic foot. We specifically aimed to assess the quantity published and the specific location of the published reports. A standard PubMed® search was performed, and the returned abstracts were evaluated by a 2-person panel for their relevance to medical professionals working within the field of diabetic foot disease. We identified 1286 relevant studies published in 659 different journals in 2012. We also found a 6.94-fold increase in returned abstracts meeting our search criteria from January 1988 to December 2012. The results of our investigation provide unique information regarding the high volume and variety of published information pertaining to diabetic foot disease and perhaps highlights a need for multidisciplinary thinking with respect to publishing and data organization, in addition to patient care.

A multidisciplinary team approach to the diabetic foot has been widely recognized to lead toward increased rates of wound healing, decreased major limb amputation levels, lower healthcare costs, and improved patient care (1–11). When communicating efficiently as a team, each individual specialty can bring to the patient unique training, experience, and perspective. Although this can be beneficial for patient care, it could potentially lead to fragmentation of the scientific data specific to the diabetic foot if each member of the team seeks to publish within their own specialty. The objective of the present observational bibliometric investigation was to examine the diabetic foot medical data, with the specific aims of assessing the quantity published on the diabetic foot and the specific locations of the published reports.

Materials and Methods

We performed a MEDLINE® PubMed® (US National Institutes of Health, National Library of Medicine, available at: http://www.nlm.nih.gov/bsd/pmresources.html) search on March 1, 2013, using the following search terms: "diabetes" or "diabetic" and "toe" or "foot" or "ankle" or "leg" or "limb" or "infection" or "ulcer" or "wound" or "osteomyelitis" or "salvage" or "amputation," with a publication date range of January 1, 2012 to December 31, 2012. The returned article abstracts were then reviewed and judged by a 2-person panel regarding whether the report was "relevant to a medical professional working within the field of diabetic foot disease." The panel consisted of 1 board-certified foot and ankle surgeon and 1 podiatric surgical resident. The term *relevant* was obviously rather broad, but this was our intention. We made an attempt to be relatively open minded with respect to article relevance and to include, as opposed to exclude, potential studies. A basic definition of article relevance was any study that had the possibility of being beneficial or improving diabetic foot patient care. Any disagreement with respect to article "relevance" was deferred to the discretion of the senior author (A.J.M.).

Those articles deemed to be "relevant" were further categorized by the journal in which the article had been published and the specialty and/or primary readership of that journal. We then performed searches with identical search terms but varying the publication date ranges for each year (January through December) from 1988 through 2012.

Results

A total of 3392 articles were returned within the inclusion criteria for 2012, and the abstracts for these were reviewed. The articles included 528 "reviews" (15.57%), 247 "clinical trials" (7.28%), 242 "comparative studies" (7.13%), 157 "systematic reviews" (4.63%), 101 "randomized controlled trials" (2.98%), 38 "meta-analyses" (1.12%), and 11 "practice guidelines" (0.32%), according to the PubMed® classification of article type. The other 2068 articles (60.97%) were classified as any number of the other "types" (PubMed® includes 50 or more types). Only those "types" that interested us the most were detailed. A total of 1129 articles (33.28%) had free full text availability, and 3115 (91.83%) were published in the English language. Of these 3392 abstracts, 1286 (37.91%) were deemed by our panel to be relevant. The 1286 "relevant" articles had been published in a total of

Financial Disclosure: None reported.
Conflict of Interest: None reported.

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http://dx.doi.org/10.1053/j.jfas.2014.04.010

659 different journals (range 1 to 41 relevant publications/journal/yr). Overlap was present between the categorizations of some of the studies, such as between "clinical trials" and "randomized controlled trials."

Of the 528 articles (15.57% of 3392) classified as "reviews," we deemed 197 (37.31% of 528) to be relevant. These 197 had been published in 112 different journals. Of the 247 articles (7.28% of 3392) classified as "clinical trials," we deemed 124 (50.20% of the 247) to be relevant, and these had been published in 88 different journals. Of the 242 articles (7.13% of 3392) classified as "comparative studies," we deemed 100 (41.32% of 242) to be relevant. These had been published in 75 different journals. Of the 157 (4.63% of 3392) classified as "systematic reviews," we deemed 82 (52.23% of 157) to be relevant. These had been published in 47 different journals. Of the 101 (2.98% of 3392) classified as "randomized controlled trials," we deemed 58 (57.43% of 101) to be relevant. These had been published in 46 different journals. Of the 38 "meta-analyses" (1.12% of 3392), we deemed 14 (36.84% of 38) to be relevant. These had been published in 9 different journals. Of the 11 "practice guidelines" (0.32% of 3392), we deemed 7 (63.64% of 11) to be relevant. These had been published in 4 different journals.

The specialty or primary readership of the 659 identified journals that had published at least 1 relevant article during 2012 is listed in Table 1. Of the 659 journals, articles had been published in 250 (37.94%) different journals we would classify as "general medicine/endocrinology," 114 (17.30%) as "basic science/research," 58 (8.80%) as "other surgery," 37 (5.61%%) as "infectious disease," 33 (5.01%) as "vascular medicine/surgery," 26 (3.95%) as "podiatric/orthopedic," 23 (3.49%) as "diabetes-specific," 12 (1.82%) as "wound-specific," 11 (1.67%) as "radiology/imaging," 11 (1.67%) as "plastic surgery," and 84 (12.75%) that did not fit into the former categories.

The 26 different journals we identified that had published at least 10 relevant articles during 2012 are listed in Table 2. Of these 26 journals, 8 (30.77%) we would classify as "diabetes-specific," 5 (19.23%) as "vascular medicine/surgery," 5 (19.23%) as "podiatric/orthopedic," 4 (15.38%) as "wound-specific," and 1 (3.85%) each in our "general medicine/endocrinology," "basic science/research," "other surgery," and "other/miscellaneous" categories.

The Fig. shows the results of the number of returned abstracts within our search criteria from January 1988 through December 2012. The number of publications consistently increased from 489 in 1988 to 3392 in 2012 (a 6.94-fold increase).

Discussion

We are unaware of any other bibliometric investigation into the field of diabetic limb salvage, and we believe our results provide unique data with respect to both the high volume and the surprising variety of the published data. To put these results in a more applicable light, medical professionals working with the diabetic foot in 2012 would have had to have read an average of 3.5 articles each day and reviewed nearly 13 different journals per week to stay up to date on what we considered to be "relevant" new published data. As foot and ankle surgeons, we were personally surprised at the quantity of published data within what we would define as "general medicine/endocrinology" and "basic science/research" publications (>350 different journals within these 2 categories alone). It would be interesting to know whether any reader of the medical literature in 2012 routinely read every journal listed in Table 2.

We also believe that the present results represent a challenge to the diabetic limb salvage community in terms of data (information) organization. We think it is reasonable to conclude that it would be advantageous to control this potential publishing fragmentation and to develop an effective method to disseminate newly published relevant information to the average practitioner working with the diabetic foot. On a more individual level, we personally changed our practice in accordance with these results by holding monthly multispecialty journal clubs, in which the different medical specialties that constitute our diabetic limb salvage team present recent data published within their respective fields to the group.

We appreciate and embrace that all scientific investigations have limitations, and the present study had several to consider. We chose to use only 1 medical literature search engine and made no attempt to search through other nonindexed and open access forms of information. We would expect, however, that expanding the search base for information would have only reinforced the large quantity and variety that was found. One might also disagree with our specific search terms and our definition of the term *relevant*. We realize that some bias influenced our inclusion of articles and our definition of their relevance. We made an attempt to be relatively broad and open minded with these to include, as opposed to exclude, potential studies.

In conclusion, we believe that the results of the present investigation provide unique information with respect to the high volume and variety of published data within the field of diabetic limb salvage and, perhaps, highlight the need for multidisciplinary thinking with

Table 1
Classification of 659 journals according to their specialty or primary readership

Category of Journal Specialty or Readership	Different Journals (count [%])
General medicine/endocrinology	250 (37.9)
Basic science/research	114 (17.3)
Other surgery	58 (8.8)
Infectious disease	37 (5.6)
Vascular medicine/surgery	33 (5)
Podiatric/Orthopedic	26 (4)
Diabetes-specific	23 (3.5)
Wound-specific	12 (1.8)
Radiology/imaging	11 (1.7)
Plastic surgery	11 (1.7)
Other/miscellaneous	84 (12.8)

We identified 1286 "relevant" articles published in 659 different journals during 2012.

Table 2
Alphabetical listing of 26 journals that published at least 10 "relevant" articles during 2012

Journal Name
Advances in Clinical and Experimental Medicine
Angiology
Atherosclerosis
Chinese Journal of Burns
Diabetic Foot and Ankle
Diabetic Medicine
Diabetes
Diabetes Care
Diabetes/Metabolism Research and Reviews
Diabetes Research and Clinical Practice
Diabetes Technology and Therapeutics
Diabetologia
European Journal of Vascular and Endovascular Surgery
The Foot
Foot and Ankle International
International Journal of Lower Extremity Wounds
International Wound Journal
Journal of the American Podiatric Medicine Association
Journal of Cardiovascular Surgery
Journal of Diabetes and Its Complications
Journal of Foot & Ankle Surgery
Journal of Vascular Surgery
Journal of Wound Care
PLOS One
Seminars in Vascular Surgery
Wound Repair and Regeneration

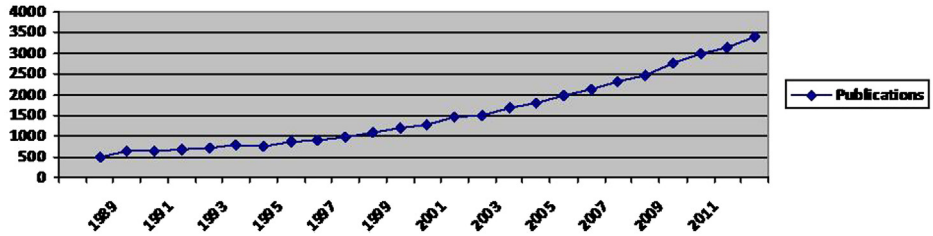

Fig. Number of returned abstracts with identical search criteria within a PubMed® search from January 1988 through December 2012 (N = 38,571 total articles).

respect to publishing and data organization, in addition to patient care. Our findings also make clear the volume of information available to readers interested in the diabetic foot and bring to mind the commitment in terms of time and effort that would be required for any individual to read and use all the information.

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