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## A Bibliometric Analysis of Highly Cited and High Impact Occupational Therapy Publications by American Authors

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### ABSTRACT

A bibliometric analysis was completed of peer-reviewed literature from 1991–2015, written by American occupational therapists, to examine US high impact scholarship with “occupational therapy” and “occupational therapist(s)” used as keywords to search journal articles’ publication title, abstract, author details, and keywords. Results included 1,889 journal articles from 1991–2015 published by American occupational therapists as first or corresponding author. Sixty-nine articles attained a  $TotalCitation_{2015} \geq 50$  and 151 attained a  $Citation_{2015} \geq 5$  indicating that they were the most highly cited literature produced in this period. Although the majority (58%) of this literature was published in occupational therapy-specific journals, 41% was published in interdisciplinary journals. Results illustrate that the volume of highly cited American occupational therapy peer-reviewed literature has grown over the last two decades. There is need for the profession to strategize methods to enhance the publication metrics of occupational therapy-specific journals to reduce the loss of high quality publications to external periodicals.

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### KEYWORDS

Authors; bibliometric; journals; publications; SCI-Expanded; SSCI

The primary goals of professions are to (a) generate knowledge that can be applied in practice, (b) assess the effectiveness of practice through quantitative and qualitative methods, and (c) assess the psychometric properties of evaluation and screening instruments (Gutman, 2008). Occupational therapy scholars and researchers generate practice-based evaluations that can be assessed for validity and reliability, and intervention guidelines that can be assessed for effectiveness with specific patient and client groups. The venue for a profession’s research and scholarship has traditionally taken the form of refereed periodicals, books, and conference abstracts. In the larger scientific and health care communities, publication in peer-reviewed journals has become the gold standard for the dissemination and knowledge translation of high quality research and scholarship (Brown, 2011). In the competitive world

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of science and health care, peer-reviewed journals have traditionally been ranked by readership number, national and international distribution, and the prestige of published authors and their affiliations.

With the advent of electronic databases in the 1990s, a new method of quantifying publication performance and the impact of journals, articles, authors, institutions, and countries emerged, known as *bibliometrics*. Bibliometrics are a set of methods used to quantitatively analyze publications and their citation counts, and have been used to appraise the impact or perceived merit of specific journals, articles, researchers, institutions, and subject areas (Bellis, 2009). The most commonly applied publication metric to analyze the value, quality, and prestige of peer-reviewed journals is the Impact Factor (IF). IFs refer to the average number of citations that journal articles receive in 2- and 5-year periods.

IFs are calculated annually by a for-profit database company known as Thomson Reuters' *Journal Citation Reports* ([JCR] 2008). For a journal to have a calculated IF, it needs to be indexed in one of two Thomson Reuters' databases: Science Citation Index Expanded (SCI-Expanded) or Social Sciences Citation Index (SSCI). SCI-Expanded and SSCI are both accessible through the Web of Science Core Collection (WSCC). To be accepted into *JCR*, journals must apply and meet specific criteria (e.g., peer-review, ethical publishing standards, timeliness, international publishing conventions, English full-text availability, international focus, and citation analyses). Thomson Reuters reports that it annually reviews approximately 3,500 journal applications for *JCR* inclusion but only accepts 10% of applications. IFs have become the barometer for a journal's relative stature within its field, with higher IF journals considered more significant than those with lower scores (Brown, 2012). Although other publication metrics exist (e.g., Eigenfactor scores, Article Influence scores, *h* index, SCImago Journal Rank, Source Normalized Impact per Paper), universities and grant funders commonly use IF scores in tenure, promotion, and grant award decisions (Brown, 2011).

As of 2017, nine occupational therapy-specific journals have been indexed in SCI-Expanded or SSCI and have calculated IF scores (see Table 1). In 2009, the *American Journal of Occupational Therapy* (*AJOT*) and *OTJR: Occupation, Participation, and Health* were the first two occupational therapy journals to receive IFs (Holguin, 2009). Although the profession has since seen an increase in the number of discipline-specific journals indexed in WSCC with calculated IFs, 12 notable English-language occupational therapy journals currently are not included in SCI-Expanded or SSCI and do not have calculated IFs. Many prospective authors make decisions about manuscript submission based on whether a journal has a calculated IF (Gasparyan, 2013). Faculty scholars and researchers are increasingly pressured to publish only in IF journals by universities and grant funders who use this publication metric in promotion and grant award decisions (Jarwal, Brion, & King, 2009). For example, some universities have placed minimum performance requirements for faculty members in relation to their annual 'cumulative impact factor.' Cumulative impact factors refer to the overall sum of journal IFs in which an author has

**Table 1.** List of occupational therapy-specific journals with and without WSCC indexing and impact factors.

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WSCC-indexed Occupational Therapy Journals with Impact Factors
American Journal of Occupational Therapy
Australian Occupational Therapy Journal
British Journal of Occupational Therapy
Canadian Journal of Occupational Therapy
Hong Kong Journal of Occupational Therapy
Occupational Therapy International
OTJR: Occupation, Participation, and Health
Physical and Occupational Therapy in Pediatrics
Scandinavian Journal of Occupational Therapy
Occupational Therapy Journals Without WSCC Indexing and Impact Factors
Asian Journal of Occupational Therapy
Indian Journal of Occupational Therapy
Irish Journal of Occupational Therapy
Journal of Occupational Therapy, Schools & Early Intervention
New Zealand Journal of Occupational Therapy
Occupational Therapy in Health Care
Occupational Therapy in Mental Health
Open Journal of Occupational Therapy
Philippine Journal of Occupational Therapy
Physical and Occupational Therapy in Geriatrics
South African Journal of Occupational Therapy
World Federation of Occupational Therapists Bulletin

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published over a specified span of time (usually 12 months). Authors have recently begun to challenge the idea that IFs are genuinely representative of high quality scholarship (Callaway, 2016).

Although several databases index English-language occupational therapy journals—including CINAHL, Ovid MEDLINE, PsycInfo, OTDBase, Scopus, WSCC, and Embase—WSCC is the most robust indexing system capable of generating bibliometric profiles of individual researchers, research institutions, journals, research subject areas, and countries. Acknowledged limitations of WSCC include the fact that 12 occupational therapy journals are not currently indexed, the application process for acceptance into WSCC is rigorous and at times idiosyncratic, and the data used to calculate IFs can be manipulated and is sourced only from other journals listed in WSCC (Callaway, 2016). While WSCC has its acknowledged limitations, it is currently the most respected database that generates IFs—the bibliometric datum that has become most used by western institutions of higher education (Brown, 2011; Callaway, 2016).

Although several occupational therapy citation analyses and literature mapping studies have been performed (Johnson & Leising, 1986; Potter, 2010; Reed, 1999; Rodger, McKenna, & Brown, 2007), only one study examined occupational therapy literature using Thomson Reuters' bibliometric calculations (Holguin, 2009). In 2009, Holguin analyzed the body of literature published in *AJOT* and *OTJR* from 1996–2005 and found that while the mean *JCR* ranking for both journals remained above the 50th percentile, both journals' IFs experienced a downward trend. This trend has since been reversed in the period from 2009–2015 (Gutman, 2014); however, no systematic analysis of the literature has been completed since Holguin's

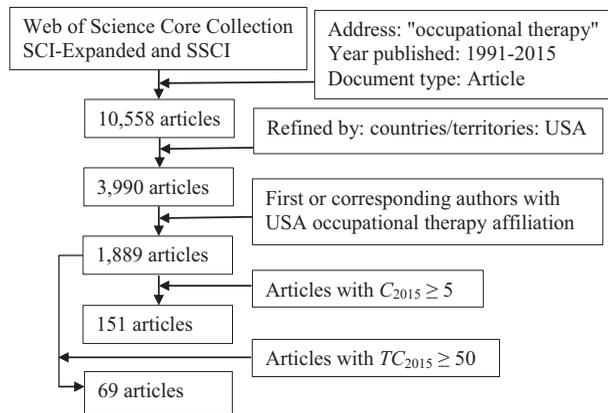
study. Because universities and grant funders use IF scores to gage faculty performance when making tenure, promotion, and grant award decisions, the profession must examine its performance through publication metrics. The viability of the profession depends in part on the recognition of the influence of bibliometrics on the perceived merit of the profession's scholarship and research.

The purpose of this review was to present the results of a bibliometric analysis of the peer-reviewed literature indexed in WSCC and published by American occupational therapy authors from 1991–2015. It is hoped that this review will begin to document the caliber of American occupational therapy scholarship as judged by commonly used bibliometric practices. Although we address US occupational therapy authors in this paper, subsequent papers will examine the contributions of occupational therapy authors from other countries.

## Method

Data were obtained from Thomson Reuters' SCI-Expanded and SSCI databases (updated October 19, 2016). *JCR* 2015 indexes 11,990 journals, including 8,864 journals in 177 WSCC categories and 3,245 journals in 57 WSCC categories in SCI-Expanded and SSCI, respectively. "Occupational therapy" and "occupational therapist(s)" were searched in terms of topic including publication titles, abstracts, and author keywords within the publication year limitation from 1991–2015. A second filter, "front page" (Fu, Wang, & Ho, 2012), allowed searching of keywords on article front pages, including article titles, abstracts, and author keywords. A final filter identified articles in which first or corresponding authors had a US occupational therapy affiliation. Once articles were identified, authors were determined to be occupational therapists based on their professional credentials and affiliations. When professional credentials were not available in an article, authors' credentials were determined through an online search of their professional profile (posted on institution-affiliated websites).

Full records were downloaded into Microsoft Excel 2013 and additional coding was manually performed. Journal articles were the only document type analyzed. Impact factors ( $IF_{2015}$ ) were retrieved from *JCR* 2015. The total number of times an article was cited in WSCC from its initial publication until the end of 2015 was recorded as  $TotalCitation_{2015}$  (Ho & Ho, 2015). Citations per publication (CPP),  $TotalCitation_{2015}/\text{number of publications}$ , were also calculated (Ho, 2013). Additionally,  $Citation_{2015}$ —total citations in 2015 per journal article indexed in WSCC—was applied (Ho, 2012). The advantage of  $TotalCitation_{\text{year}}$  and  $Citation_{\text{year}}$  is that they are invariable and ensure repeatability compared with the citation index from WSCC (Fu et al., 2012). In the WSCC database, the corresponding author is designated as the "reprint author;" we instead used the term "corresponding author" (Ho, 2012). In single author articles, the author was designated as both first and corresponding author. The term 'author' refers to an occupational therapy clinician, educator, researcher, manager, student or faculty member.



**Figure 1.** Search strategy to retrieve American authored occupational therapy articles with  $TotalCitations_{2015} \geq 50$  and  $Citations_{2015} \geq 5$ .

## Results

In total 10,558 occupational therapy related articles in SCI-Expanded and SSCI were identified in a search that was further refined to yield 3,990 articles written specifically by American authors. The search was then additionally refined to extract 1,889 articles in which the first or corresponding author had a US occupational therapy affiliation. From the 1,889 retrieved articles, 151 were identified with a citation count  $\geq 5$  in 2015 alone ( $Citation_{2015} \geq 5$ ) and 69 were identified with a total citation count  $\geq 50$  since publication ( $TotalCitation_{2015} \geq 50$ ) (see Figure 1). Articles with  $Citation_{2015} \geq 5$  and  $TotalCitation_{2015} \geq 50$  indicate articles with high citation and impact (Ho, 2012).

### Publication outputs

The total number of occupational therapy journal articles with  $TotalCitation_{2015} \geq 50$  published by American authors during 1991–2015 in SCI-Expanded or SSCI indexed journals was 69.  $TotalCitation_{2015} \geq 50$  articles per year ranged from 1–6 without any discernable trend over time. Each article had an average of 3.3 authors, 42 references, 9.5 pages, and 90 citations.

The total number of occupational therapy journal articles with  $Citation_{2015} \geq 5$  published by American authors during 1991–2015, in SCI-Expanded or SSCI indexed journals, was 151.  $Citation_{2015} \geq 5$  articles per year ranged from 0–18, with a low of 0 articles published in 1995 and a peak of 18 articles in 2011. Each article had an average of 4.4 authors, 42 references, 10 pages, and 45 total citations.

### Citation rates of occupational therapy journal articles written by American authors

Nineteen articles had a  $TotalCitation_{2015} \geq 100$  (see Table 2) indicating that they were the most highly cited occupational therapy articles published from 1991–2015. These articles ranged from  $TotalCitation_{2015} = 235$  (Clark et al., 1997)


**Table 2.** American authored occupational therapy articles with *TotalCitations*<sub>2015</sub> ≥ 100, 1991–2015.

Rank ( <i>TC</i> <sub>2015</sub> )	Rank ( <i>C</i> <sub>2015</sub> )	Rank ( <i>C</i> <sub>0</sub> )	Rank ( <i>TCPY</i> )	References	Article Title and Journal
1 (235)	5 (17)	11 (1)	4 (12)	Clark et al. (1997)	Occupational Therapy for Independent-Living Older Adults—A Randomized Controlled Trial ( <i>JAMA</i> )
2 (190)	34 (6)	11 (1)	11 (8.3)	Ottenbacher & Jannell (1993)	The Results of Clinical-Trials in Stroke Rehabilitation Research ( <i>Archi Neurolo</i> )
3 (164)	2 (30)	27 (0)	1 (18)	Schmid et al. (2007)	Improvements in Speed-Based Gait Classifications are Meaningful ( <i>Stroke</i> )
4 (152)	9 (15)	11 (1)	14 (8)	Kientz & Dunn (1997)	A Comparison of the Performance of Children With and Without Autism on the Sensory Profile ( <i>AJOT</i> )
5 (148)	4 (18)	27 (0)	16 (7.8)	Dunn (1997)	The Impact of Sensory Processing Abilities on the Daily Lives of Young Children and Their Families: A Conceptual Model ( <i>Infants Young Child</i> )
6 (147)	13 (13)	2 (3)	4 (12)	Davies et al. (2004)	Development of Response-Monitoring ERPs in 7- to 25-Year-Olds ( <i>Develop Neuropsychol</i> )
7 (139)	29 (7)	27 (0)	27 (6)	Hunt et al. (1993)	Driving Performance in Persons with Mild Senile Dementia of the Alzheimer Type ( <i>JAGS</i> )
8 (138)	5 (17)	27 (0)	6 (11)	Goldreich & Kanics (2003)	Tactile Acuity is Enhanced in Blindness ( <i>J of Neuroscience</i> )
9 (135)	18 (10)	11 (1)	10 (8.4)	Everard et al. (2000)	Relationship of Activity and Social Support to the Functional Health of Older Adults ( <i>J of Gerontology</i> )
10 (133)	3 (27)	27 (0)	2 (17)	Hammel et al. (2008)	What does participation mean? An Insider Perspective From People with Disabilities ( <i>Disabil Rehabil</i> )
11 (123)	29 (7)	11 (1)	30 (5.6)	Dunn et al. (1994)	The Ecology of Human-Performance: A Framework for Considering the Effect of Context ( <i>AJOT</i> )
12 (122)	23 (9)	27 (0)	23 (6.4)	Hunt et al. (1997)	Reliability of the Washington University Road Test: A Performance-Based Assessment for Drivers with Dementia of the Alzheimer Type ( <i>Archi Neurolo</i> )
13 (121)	8 (16)	27 (0)	12 (8.1)	Dunn (2001)	The 2001 Eleanor Clarke Slagle Lecture: The Sensations of Everyday Life: Empirical, Theoretical, and Pragmatic Considerations ( <i>AJOT</i> )
14 (120)	45 (4)	2 (3)	35 (5.2)	Fisher (1993)	The Assessment of IADL Motor Skills: An Application of Many-faceted Rasch Analysis ( <i>AJOT</i> )
15 (114)	48 (3)	27 (0)	39 (5)	Clark (1993)	The 1993 Eleanor Clarke Slagle Lecture: Occupation Embedded in a Real Life: Interweaving Occupational Science and Occupational Therapy ( <i>AJOT</i> )
15 (114)	39 (5)	27 (0)	45 (4.6)	Clark et al. (1991)	Occupational Science: Academic Innovation in the Service of Occupational Therapy's Future ( <i>AJOT</i> )
16 (104)	62 (1)	27 (0)	43 (4.7)	Clayton & Chubon (1994)	Factors Associated with the Quality of Life of Long Term Spinal Cord Injured Persons ( <i>APMR</i> )
17 (103)	18 (10)	27 (0)	8 (10)	Finlayson et al. (2006)	Risk Factors for Falling Among People Aged 45 to 90 Years with Multiple Sclerosis ( <i>APMR</i> )
18 (100)	45 (4)	27 (0)	40 (4.8)	Trombly (1995)	The 1995 Eleanor Clarke Slagle Lecture: Occupation: Purposefulness and Meaningfulness as Therapeutic Mechanisms ( <i>AJOT</i> )

*TotalCitations*<sub>2015</sub>: total citations since publication to the end of 2015; *Citations*<sub>2015</sub>: citations in 2015 only; *Citations*<sub>0</sub>: citations in publication year only; *TCPY*: citations per year, *TotalCitations*<sub>2015</sub>/year

to  $TotalCitation_{2015} = 100$  (Trombly, 1995). Several first and corresponding authors appeared in this list multiple times: (1) Dunn (Dunn, 1997; Dunn, 2001; Dunn, Brown, & McGuigan, 1994; Kientz & Dunn, 1997); (2) Clark (Clark et al., 1991; 1993; 1997); and (3) Hunt (Hunt, Morris, Edwards, & Wilson, 1993; Hunt et al., 1997). Two of these 19 articles were intervention effectiveness studies (Clark et al., 1997; Ottenbacher & Jannell, 1993), three were instrument development studies (Fischer, 1993; Hunt et al., 1997; Kientz & Dunn, 1997), eight were basic research studies (Clayton & Chubon, 1994; Davies et al., 2004; Everard, Lach, Fisher, & Baum, 2000; Finlayson, Peterson, & Cho, 2006; Goldreich & Kanics, 2003; Hammel et al., 2008; Hunt et al., 1993; Schmid et al. 2007), three were model or theory development articles (Clark et al., 1991; Dunn, 1997; Dunn et al., 1994), and three were Eleanor Clarke Slagle Lectures (Clark, 1993; Dunn, 2001; Trombly, 1995). Practice areas addressed by these papers were pediatrics ( $n = 5$ ), rehabilitation ( $n = 4$ ), geriatrics ( $n = 4$ ), and nonspecific ( $n = 8$ ). Of the 19 articles, 6 were published in one occupational therapy-specific journal (*AJOT*). Interdisciplinary journals in which 13 of the articles were published included *Journal of the American Medical Association (JAMA)*, *Archives of Neurology*, and *Stroke*. All 19 articles with  $TotalCitation_{2015} \geq 100$  were published from 1991–2008, with the majority ( $n = 13$ ) published in or before 2000.

Eighteen articles, published in WSCC-indexed journals and authored by American occupational therapists, had a  $Citation_{2015} \geq 13$  indicating that they were cited multiple times in 2015 alone (see Table 3). These high impact articles ranged from  $Citation_{2015} = 30$  (Schmid et al., 2007) to  $Citation_{2015} = 13$  (Davies et al. 2004; Watling, Deitz, & White, 2001). Several first and corresponding authors appeared in this list multiple times: (1) Clark (Clark et al., 1997; 2012), (2) Dunn (Dunn 1997, 2001), (3) and Coster (Coster et al. 2011; Coster & Khetani, 2008). Eight articles with  $Citation_{2015} \geq 13$  also attained  $TotalCitation_{2015} \geq 100$ : Clark et al., 1997; Davies et al., 2004; Dunn, 1997, 2001; Goldreich & Kanics, 2003; Hammel et al., 2008; Kientz & Dunn, 1997; and Schmid et al., 2007. Six of these 18 articles were basic research studies (Davies et al., 2004; Hammel et al., 2008; Goldreich & Kanics, 2003; Pineda et al., 2014; Schmid et al., 2007; Watling et al., 2001), four were intervention effectiveness studies (Foster et al., 2013; Case-Smith & Arbesman, 2008; Clark et al., 1997, 2012), five were instrument development studies (Coster et al., 2011; Kientz & Dunn, 1997; Malcolm et al., 2006; Raina, Callaway, Rittenberger, & Holm 2008; Shechtman, Classen, Awadzi, & Mann, 2009), one was a theoretical development paper (Dunn, 1997), one was a clinical commentary (Coster & Khetani, 2008), and one was an Eleanor Clarke Slagle Lecture (Dunn, 2001).

Practice areas addressed by these papers were pediatrics ( $n = 9$ ), rehabilitation ( $n = 5$ ), geriatrics ( $n = 2$ ), and nonspecific ( $n = 2$ ). Of the 18 articles, three were published in one occupational therapy-specific journal (*AJOT*). Fifteen articles were published in interdisciplinary journals including *Stroke*, *Disability and Rehabilitation*, and *Archives of Physical Medicine and Rehabilitation (APMR)*. All 18 articles with  $Citation_{2015} \geq 13$  were published from 1997–2014, with the majority ( $n = 10$ ) published in or after 2006.



**Table 3.** American authored occupational therapy articles with  $Citation_{2015} \geq 13$ , 1991–2015.

Rank (%) ( $C_{2015}$ )	Rank (%) ( $TC_{2015}$ )	Rank (%) ( $C_0$ )	Rank (%) (TCPY)	Reference	Article Title and Journal
1 (30)	3 (164)	68 (0)	1 (18)	Schmid et al. (2007)	Improvements in Speed-Based Gait Classifications Are Meaningful ( <i>Stroke</i> )
2 (27)	10 (133)	68 (0)	2 (17)	Hammel et al. (2008)	What Does Participation Mean? An Insider Perspective from People with Disabilities ( <i>Disabil Rehabil</i> )
3 (18)	5 (148)	68 (0)	21 (7.8)	Dunn (1997)	The Impact of Sensory Processing Abilities on the Daily Lives of Young Children and Their Families: A Conceptual Model ( <i>Infants Young Child</i> )
4 (17)	85 (28)	10 (3)	13 (9.3)	Foster et al. (2013)	Community-Based Argentine Tango Dance Program Is Associated with Increased Activity Participation among Individuals with Parkinson's Disease ( <i>APMR</i> )
4 (17)	43 (50)	68 (0)	39 (6.3)	Case-Smith & Arbesman (2008)	Evidence-Based Review of Interventions for Autism Used in or of Relevance to Occupational Therapy ( <i>AJOT</i> )
4 (17)	8 (138)	68 (0)	7 (11)	Goldreich & Kanics (2003)	Tactile Acuity Is Enhanced in Blindness ( <i>J of Neuroscience</i> )
4 (17)	1 (235)	24 (1)	4 (12)	Clark et al. (1997)	Occupational Therapy for Independent-Living Older Adults—A Randomized Controlled Trial ( <i>JAMA</i> )
8 (16)	46 (47)	7 (5)	4 (12)	Clark et al. (2012)	Effectiveness of a Lifestyle Intervention in Promoting the Well-Being of Independently Living Older People: Results of the Well Elderly 2 Randomised Controlled Trial ( <i>J of Epidemiol Community Health</i> )
9 (16)	14 (121)	68 (0)	16 (8.1)	Dunn (2001)	The Sensations of Everyday Life: Empirical, Theoretical, and Pragmatic Considerations ( <i>AJOT</i> )
10 (15)	54 (40)	24 (1)	65 (5)	Raina et al. (2008)	Neurological and Functional Status Following Cardiac Arrest: Method and Tool Utility ( <i>Resuscitation</i> )
10 (15)	4 (152)	24 (1)	18 (8)	Kientz & Dunn (1997)	A Comparison of the Performance of Children with and without Autism on the Sensory Profile ( <i>AJOT</i> )
12 (14)	101 (21)	2 (7)	7 (11)	Pineda et al. (2014)	Alterations in Brain Structure and Neurodevelopmental Outcome in Preterm Infants Hospitalized in Different Neonatal Intensive Care Unit Environments ( <i>J of Pediatrics</i> )
12 (14)	57 (39)	24 (1)	21 (7.8)	Coster et al. (2011)	Psychometric Evaluation of the Participation and Environment Measure for Children and Youth ( <i>DMCM</i> )
12 (14)	42 (52)	68 (0)	24 (7.4)	Shechtman et al. (2009)	Comparison of Driving Errors between On-the-Road and Simulated Driving Assessment: A Validation Study ( <i>Traffic Inj Prev</i> )
12 (14)	20 (87)	24 (1)	7 (11)	Coster & Khetani (2008)	Measuring Participation of Children with Disabilities: Issues and Challenges ( <i>Disabil Rehabil</i> )
12 (14)	30 (67)	24 (1)	27 (6.7)	Malcolm et al. (2006)	Reliability of Motor Cortex Transcranial Magnetic Stimulation in Four Muscle Representations ( <i>Clin Neurophysiol</i> )
17 (13)	6 (147)	10 (3)	4 (12)	Davies et al. (2004)	Development of Response-Monitoring ERPs in 7- to 25-Year-Olds ( <i>Dev Neurophysiol</i> )
17 (13)	20 (87)	68 (0)	48 (5.8)	Watling et al. (2001)	Comparison of Sensory Profile Scores of Young Children with and without Autism Spectrum Disorders ( <i>AJOT</i> )

*TotalCitations*<sub>2015</sub>: total citations since publication to the end of 2015; *Citations*<sub>2015</sub>: citations in 2015 only; *Citations*<sub>0</sub>: citations in publication year only; *TCPY*: citations per year, *TotalCitations*<sub>2015</sub>/year

### WSCC subject categories and journals

Based on the classification of subject categories in *JCR* 2015, the publication output data for American authors of occupational therapy articles was distributed across 15 WSCC categories in SCI-Expanded and SSCI. The top WSCC subject category was *rehabilitation* with 65 journals in SCI-Expanded and 71 journals in SSCI. The *rehabilitation* category included 92 of the designated  $Citation_{2015} \geq 5$  articles and 48 of the designated  $TotalCitation_{2015} \geq 50$  articles written by American authors from 1991–2015. In other words, 61% of 151  $Citation_{2015} \geq 5$  articles, and 70% of 69  $TotalCitation_{2015} \geq 50$  articles, fell into the WSCC *rehabilitation* category. The second most frequent WSCC category was *sports sciences* with 25 (17%)  $Citation_{2015} \geq 5$  articles and 10 (14%)  $TotalCitation_{2015} \geq 50$  articles (see Table 4).

Table 5 reports the top 15 journals in which American occupational therapy authors published highly cited and high impact occupational therapy articles. Of these 15 journals, only two were occupational therapy-specific periodicals: *AJOT* and *OTJR*. The remaining 13 were interdisciplinary journals that were subject-specific (e.g., *Stroke*, *APMR*, *Brain Injury*) and had IF scores greater than 1.6. The majority of  $Citation_{2015} \geq 5$  and  $TotalCitation_{2015} \geq 50$  articles were published in *AJOT*, with 44 articles (29%) and 31 articles (45%), respectively. *APMR* also published a large number of  $Citation_{2015} \geq 5$  and  $TotalCitation_{2015} \geq 50$  articles, with 21 (14%) articles and eight (12%) articles, respectively; followed by *Disability and Rehabilitation*, with four (2.6%)  $Citation_{2015} \geq 5$  articles and two (2.9%)  $TotalCitation_{2015} \geq 50$  articles.

Journals with the highest  $IF_{2015}$  in SCI-Expanded or SSCI that published  $Citation_{2015} \geq 5$  and  $TotalCitation_{2015} \geq 50$  occupational therapy articles written by American authors were *Stroke* ( $IF_{2015} = 5.787$ ) with two  $TotalCitation_{2015} \geq 50$  articles, *Multiple Sclerosis* ( $IF_{2015} = 4.671$ ) with two  $Citation_{2015} \geq 5$  articles and two  $TotalCitation_{2015} \geq 50$  articles, and *Developmental Medicine and Child Neurology (DMCN)* ( $IF_{2015} = 3.615$ ) with three  $Citation_{2015} \geq 5$  articles.

**Table 4.** Top WSCC subject categories of highly cited occupational therapy articles.

WSCC Category	Number of $Citation_{2015} \geq 5$ Articles	Number of $TotalCitation_{2015} \geq 50$ Articles
Rehabilitation	92 (61%)	48 (70%)
Sports Sciences	25 (17%)	10 (14%)
Clinical Neurology	16 (11%)	9 (13%)
Developmental Psychology	11 (7.3%)	2 (2.9%)
Neurosciences	12 (7.9%)	5 (7.2%)
Pediatrics	7 (4.6%)	5 (5.8%)
Public, Environmental, & Occupational Health	7 (4.6%)	3 (4.3%)
Gerontology	6 (4%)	4 (5.8%)
Psychology	5 (3.3%)	2 (7.9%)
Special Education	4 (2.6%)	2 (2.9%)
Orthopedics	4 (2.6%)	2 (2.9%)
Geriatrics and Gerontology	3 (2%)	3 (4.3%)
Clinical Psychology	3 (2%)	1 (1.4%)
Experimental Psychology	3 (2%)	1 (1.4%)
Multidisciplinary Psychology	3 (2%)	1 (1.4%)

### Institutional publication performance

Table 5 reports the top 15 American institutions ranked by number of published occupational therapy articles. The top five institutions were Washington University St. Louis, which ranked first in both number of  $TotalCitation_{2015} \geq 50$  and  $Citation_{2015} \geq 5$  articles; University of Kansas ranked second in number of  $TotalCitation_{2015} \geq 50$  articles and fourth in  $Citation_{2015} \geq 5$  articles; University of Illinois ranked third in  $TotalCitation_{2015} \geq 50$  articles and second in  $Citation_{2015} \geq 5$  articles; University of Southern California ranked fourth in  $TotalCitation_{2015} \geq 50$  articles and second in  $Citation_{2015} \geq 5$  articles; Boston University ranked fourth

**Table 5.** Journals and institutions of high impact American occupational therapy scholarship indexed in SCI-Expanded or SSCI, 1991–2015.

Journal	TP (%) $TC_{2015}$	TP (%) $C_{2015}$	$IF_{2015}$	Web of Science Category
<i>American J of Occupational Therapy</i>	31 (45)	44 (29)	1.806	rehabilitation
<i>Archives of Physical Medicine and Rehabilitation</i>	8 (12)	21 (14)	3.045	rehabilitation, sport sciences
<i>Archives of Neurology Disability and Rehabilitation</i>	2 (2.9)	2 (1.3)	N/A	clinical neurology
<i>Journal of the Am Geriatrics Society</i>	2 (2.9)	4 (2.6)	1.919	rehabilitation
<i>Multiple Sclerosis</i>	2 (2.9)	2 (1.3)	3.842	geriatrics and gerontology, gerontology
<i>Social Science &amp; Medicine</i>	2 (2.9)	2 (1.3)	4.671	clinical neurology, neurosciences
<i>Stroke Infants &amp; Young Children</i>	2 (2.9)	0	2.814	public, environmental & occupational health, biomedical social sciences
	1 (1.4)	0	5.787	clinical neurology, peripheral vascular disease special education, developmental psychology, rehabilitation
	$TC_{2105} \geq 50$		$C_{2105} \geq 5$	
Institution	Rank (FP)	Rank (RP)	Rank (FP)	Rank (RP)
Washington University St. Louis	1 (10)	1 (10)	1 (18)	1 (17)
University of Kansas	2 (8)	2 (8)	4 (11)	4 (11)
University of Illinois	3 (7)	3 (7)	2 (12)	2 (12)
Boston University	4 (6)	4 (6)	5 (10)	5 (10)
University of Southern California	4 (6)	4 (6)	2 (12)	2 (12)
Colorado State University	6 (4)	6 (4)	7 (7)	7 (7)
Tufts University	7 (3)	7 (3)	6 (8)	6 (8)
University of Minnesota	7 (3)	7 (3)	18 (2)	18 (2)
University of Pittsburgh	9 (2)	9 (2)	8 (5)	8 (5)
University of St. Catherine	10 (1)	10 (1)	N/A	N/A
Duquesne University	10 (1)	10 (1)	26 (1)	26 (1)
East Carolina University	10 (1)	10 (1)	13 (3)	13 (3)
Indiana University	10 (1)	10 (1)	18 (2)	18 (2)
Medical Univ of South Carolina	10 (1)	10 (1)	26 (1)	26 (1)
Ohio State University	10 (1)	10 (1)	11 (4)	11 (4)

$TC_{2015}$ : total citations since publication to the end of 2015;  $C_{2015}$ : citations in 2015 only; TP: total publications;  $IF_{2015}$ : Impact Factor in 2015; FP: rank and number of first author articles; RP: rank and number of corresponding authored articles.

in  $TotalCitation_{2015} \geq 50$  and fifth in  $Citation_{2015} \geq 5$  articles. Ten of the 15 schools listed in Table 5 are ranked in the top 20 occupational therapy programs by *US News and World Report* (2016); eight are listed in the top 10. The majority of these occupational therapy programs employ a large faculty with doctoral research degrees, and publication and grant histories. These schools also offer post-professional clinical and research doctoral degree programs in which faculty teach and conduct research.

### **American occupational therapy author publication performance**

Forty-six American authors published SCI-Expanded and SSCI-indexed articles attaining both a  $TotalCitation_{2015} \geq 50$  and a  $Citation_{2015} \geq 5$  from 1991–2015. The performance of 16 American authors who published the most highly cited and high impact occupational therapy articles are reported in Table 6 in relation to total number of published articles, number of first author articles, number of corresponding author articles, and total number of single author articles. The top 10 ranked authors were Dunn, Clark, Mathiowetz, Bedell, Coster, Hunt, Peterson, Case-Smith, Finalayson, and Hammel. Trombly and Baum published scholarship ranking in the top 10  $TotalCitation_{2015} \geq 50$  articles and the top 25  $Citation_{2015} \geq 5$  articles. Other notable authors ranking in the top 20  $TotalCitation_{2015} \geq 50$  articles and the top 25  $Citation_{2015} \geq 5$  articles were Baranek, Clayton, Davies, Dickerson, Everard, Fleming, Goldreich, Gray, Grice, Holm, Lawlor, Ottenbacher, Park, Powell, Rogers, Schkade, Schmid, Shechtman, Stern, Velozo, and Watling. The above authors have produced the highest impact American occupational therapy scholarship in the profession to date.

## **Discussion**

### **Publication outputs**

From 1991–2015, American authors published nearly 4,000 occupational therapy articles in SCI-Expanded and SSCI indexed journals. The publication of articles in WSCC-indexed journals denotes a high level of rigor in the peer review process and indicates high quality scholarship. Approximately 1,900 of these articles were authored by occupational therapists as first or corresponding authors, indicating that an occupational therapist assumed a lead role in the generation of this research and scholarship. These data alone signify that US occupational therapy scholars have significantly contributed to the professions' enhanced status in the generation of knowledge and have responded to the call put forth by the American Occupational Therapy Association's *Centennial Vision* (2007). More critical, however, is the finding that 69 articles achieved a  $TotalCitation_{2015} \geq 50$  and 151 articles achieved a  $Citation_{2015} \geq 5$ , indicating that these 220 publications were the most highly cited American occupational therapy literature over the period of 1991–2015.

**Table 6.** Most highly cited American occupational therapy authors, 1991–2015.

Author	Affiliation	$T_{C_{2015}} \geq 50 R (FP + RP)$				$C_{2015} \geq 5 R (FP + RP)$			
		R (FP+RP)	R (FP)	R (RP)	R (SP)	R (FP+RP)	R (FP)	R (RP)	R (SP)
Dunn, W	University of Kansas	1 (13)	1 (6)	1 (7)	1 (2)	1 (17)	1 (8)	1 (9)	1 (3)
Clark, FA	University of Southern California	2 (6)	2 (3)	2 (3)	5 (1)	3 (8)	3 (4)	3 (4)	N/A
Mathiowetz, VG	University of Minnesota	2 (6)	2 (3)	2 (3)	N/A	9 (4)	8 (2)	9 (2)	3 (1)
Trombly, CA	Boston University	2 (6)	2 (3)	2 (3)	1 (2)	23 (2)	22 (1)	23 (1)	N/A
Baum, CM	Washington University	5 (4)	5 (2)	5 (2)	N/A	23 (2)	22 (1)	23 (1)	N/A
Bedell, GM	Tufts University	5 (4)	5 (2)	5 (2)	5 (1)	2 (14)	2 (7)	2 (7)	1 (3)
Coster, W	Boston University	5 (4)	5 (2)	5 (2)	5 (1)	6 (6)	6 (3)	6 (3)	N/A
Fisher, AG	Colorado State University	5 (4)	5 (2)	5 (2)	1 (2)	N/A	N/A	N/A	N/A
Hunt, LA	Washington University	5 (4)	5 (2)	5 (2)	N/A	9 (4)	8 (2)	9 (2)	N/A
Peterson, EW	University of Illinois	5 (4)	5 (2)	5 (2)	N/A	9 (4)	8 (2)	9 (2)	N/A
Case-Smith, J	Ohio State University	11 (2)	12 (1)	12 (1)	N/A	6 (6)	6 (3)	6 (3)	N/A
Finlayson, ML	University of Illinois	11 (2)	12 (1)	12 (1)	N/A	3 (8)	3 (4)	3 (4)	3 (1)
Hammel, J	University of Illinois	11 (2)	12 (1)	12 (1)	N/A	9 (4)	8 (2)	9 (2)	N/A
Jackson, J	University of Southern California	11 (2)	12 (1)	12 (1)	N/A	9 (4)	8 (2)	9 (2)	N/A
Malcolm, MP	Colorado State University	11 (2)	12 (1)	12 (1)	N/A	8 (5)	8 (2)	6 (3)	N/A
Orsmond, GI	Boston University	11 (2)	12 (1)	12 (1)	N/A	3 (8)	3 (4)	3 (4)	N/A

R(FP + RP): rank of first author articles + corresponding author articles (FP + RP); R: rank; FP: first author articles; RP: corresponding author articles; SP: single author articles; N/A: not available.

### **Journal article citation rates**

Nineteen articles achieved a  $TotalCitation_{2015} \geq 100$ , indicating that they were cited at least 100 times from 1991–2015. These highly cited articles received wide exposure and had great impact in and beyond the profession. The majority of these articles were basic research studies, model and theoretical development papers, and Slagle Lectures; only two were intervention effectiveness studies. This finding reflects the profession's evolution during the period when the majority of these articles were published, prior to 2000, when the profession was still attempting to describe its theoretical underpinnings and was not as yet focused on evidence based research and practice. While eight of these articles were published in one occupational therapy-specific journal (*AJOT*), 13 were disseminated through a variety of interdisciplinary journals, indicating that they reached a wider audience beyond the profession.

Although Hammel et al., 2008 was the most recent article to reach the 100+ citation mark, there are no specific data about the typical time length required for an article to reach 100+ citations. Some research has examined factors that impact citation rates and latency periods, or the citation window for journal articles to be referenced by other authors. Onodera and Yoshikane (2015) examined the factors that affect citation number in the professions of physics, chemistry, engineering, biology, physiology, and gastroenterology and noted that citations occur in “relatively long citation window[s] (6 and 11 years after publication)” (p. 739). An article's citation rate is influenced by several factors including subject, country of journal publication, type of article (e.g., review, short report, original manuscript), language of publication, author collaboration, author visibility, and author achievements (as measured by previous citations and publications) (Callaham, Wears, & Weber, 2002; Fanelli, 2013; Peng & Zhu, 2012; Slyder et al., 2011).

Eighteen articles achieved a  $Citation_{2015} \geq 13$ , indicating that these papers were cited at least 13 times in the single year of 2015. This level of citation denotes articles having high impact and use by other scholars. The majority of these papers were published in interdisciplinary journals (only three were published in an occupational therapy-specific journal) and reached a wide audience beyond occupational therapy. These papers were primarily research studies and focused on the description of clinical phenomena, intervention effectiveness, and instrument development. This finding reflects the profession's evolution at the time when the majority of these papers were published, after 2006, when the call for evidence based practice encouraged researchers to examine clinical effectiveness and the psychometrics of clinical evaluations.

The 37 articles with  $TotalCitation_{2015} \geq 100$  and  $Citation_{2015} \geq 13$  form the most highly cited and impactful literature that American occupational therapy authors have produced to date. This group of pinnacle articles have served to shape occupational therapy's professional literature, brought the awareness of the profession's scholarship to a larger audience, and began to provide a professional evidence base that can be used to inform practice (Potter, 2010; Reed, 1999).

### ***Journal publication performance***

While the most highly cited articles have brought awareness of occupational therapy scholarship to a larger audience, this awareness has largely been accomplished through publication in interdisciplinary journals. Publication in interdisciplinary journals with high impact factors increases readership and article citation, which in turn helps authors receive promotion and grants (Brown, 2011). The disadvantage is that such scholarship cannot be used to enhance the quality of the profession's journals and perceived merit by the larger health care community. A profession's scholarship is largely viewed by the impact of profession-specific journals. The accrued volume of articles published in professional journals forms the profession's perceived reputation as generators of scholarship, rather than a smaller group of articles published in highly cited, high impact journals (Gutman, 2010). Although it is understandable that authors wish to gain wide exposure of their work through interdisciplinary periodicals with high IFs, the lack of publication of such scholarship in our own professional journals does not serve to increase the IF scores of occupational therapy periodicals. Some balance must be achieved whereby the profession's highest quality research can be both widely disseminated but not lost to our own journals. Perhaps authors who have achieved the rank of tenured professor—and no longer need to publish solely in journals having high IFs—could reserve a portion of their scholarship for publication in occupational therapy-specific journals, with the intent of increasing the IFs of the profession's periodicals. As the profession's periodicals increase in IF score, high quality occupational therapy literature generated by junior scholars should be published within profession-specific journals to continue to enhance occupational therapy's perceived merit within the larger health care community.

Although competition to become indexed in the WSCC database is high with only 10% of all applying journals accepted each year, journal editors should perseveringly apply for WSCC indexing. The WSCC database has a preference for accepting journals with a track record of publishing funded research, a well-established manuscript review system, and an editorial board composed of individuals with a range of expertise from the respective discipline. Journal editors who are initially unsuccessful in application to the WSCC database should obtain feedback about their applications and make revisions for subsequent applications. It is not atypical for journals to make multiple applications before acceptance into the WSCC database and journal editors should persistently apply yearly until accepted.

Additionally, with the advent of electronic databases and open access journals, the ease of accessing articles has increased and is no longer dependent upon journal distribution (Gutman, 2010). Articles can now be published in any journal, particularly open access journals, and can be retrieved by anyone with Internet access. Such ease of availability could reduce the loss of high impact occupational therapy articles from publication in the profession's journals. That nine occupational therapy-specific journals are now indexed in SCI-Expanded and SSCI, and can be included

in Thompson Reuter's citation counts, should also decrease the pressure to publish in journals external to the profession.

### ***Institutional publication performance***

The majority of American institutions listed in Table 3, ranked as producing the highest number of occupational therapy articles, are universities with a strong research culture where faculty are expected to generate scholarship. These universities are often located in large urban centers or college campuses with greater opportunities for interdisciplinary research and access to needed resources (e.g., affiliated hospitals and clinics, patient participants, internal grant funding, grant office support, and biostatistical analysis). Occupational therapy programs in these schools typically offer post-professional doctorates (clinical or research) or are affiliated with interdisciplinary rehabilitation science doctoral degree programs and have become centers for the generation of knowledge. Faculty earned research doctorates and appointments at the associate and full professor levels. The awarding of tenure and promotion are directly linked to publication and grant receipt productivity levels. Many occupational therapy programs at these institutions employ a large faculty with diverse skill sets who can help each other establish research track records. Some programs employ faculty from other disciplines to bring needed skills to the department such as statistical analysis and grant writing.

### ***American occupational therapy author publication performance***

The top American authors who published  $TotalCitation_{2015} \geq 50$  and  $Citation_{2015} \geq 5$  journal articles indexed in SCI-Expanded and SSCI, are affiliated with many of the top ranked universities noted in Table 5. All of these authors are occupational therapists with associate or full professor appointments and research track records spanning three or more decades. These authors have produced the most highly cited occupational therapy literature from 1991–2015 and have served to shape our professional knowledge base. The contributions they have made to American occupational therapy literature have been wide and far reaching, and have crossed into other professions and countries. Although Table 6 only lists the top 17 authors who published articles attaining both a  $TotalCitation_{2015} \geq 50$  and  $Citation_{2015} \geq 5$ , as noted above, 46 authors were identified who fell into this category.

It should be recognized that many other authors published articles attaining either a  $TotalCitation_{2015} \geq 50$  or  $Citation_{2015} \geq 5$ , but not both, and have contributed substantially to American occupational therapy literature. Additionally, 12 occupational therapy journals are not indexed in WSCC as of this writing. The findings of this bibliometric analysis did not capture occupational therapy authors who may have contributed significantly to the profession's literature through journals that are not indexed in WSCC. Journals indexed in WSCC, however, tend to have greater exposure and thus articles that are more highly cited.

## **Limitations**

Data for this bibliometric analysis were obtained only from the online databases of SCI-Expanded and SSCI. As of 2017, only 9 out of 21 English-language occupational therapy-specific journals have been indexed in WSCC. Although Thomson Reuters (2008) reports that journals accepted into WSCC databases are of the highest quality and must meet specific publication standards, occupational therapy researchers and practitioners—rather than a for-profit publication database company—should designate the scholarship that has significantly contributed to the profession's body of knowledge and growth. Publication metrics such as IFs and total citation counts are now heavily used by universities and grant funders in decisions regarding academic promotion and grant awards. To more fully document those institutions, authors, and specific articles that have significantly contributed to occupational therapy's knowledge base, a future bibliometric analysis should be completed with occupational therapy-specific journals regardless of WSCC indexing status.

Only the WSCC document type labeled “article” was considered. Other document categories (e.g., conference abstracts, book reviews, letters to the editor, editorials) were excluded since they did not report sufficient study details. Scholarly contributions made by occupational therapy authors in the forms of books, conference abstracts, and editorials were not considered in this analysis and are an acknowledged limitation.

Only the words “occupational therapy” and “occupational therapist(s)” were used as key search terms for journal article publications in SCI-Expanded and SSCI. When authors' professional credentials were not listed in journal articles, an online search was performed to determine if authors were occupational therapists. However, if American occupational therapists did not specify that they were occupational therapists or did not indicate occupational therapy affiliations on journal publications they had written, it is possible that their articles were missed by the search strategy.

A final limitation of this bibliometric analysis was the sole consideration of citation counts as an indicator of impact. Although citation counts reflect the extent to which an article is used by other researchers and scholars, it should not be assumed that citation counts alone can provide sufficient information about scholarship impact. The number of article downloads and views may signify that an article is used by practitioners and students, which is significant in a profession that is in its early stages of research generation. Articles with high levels of views and downloads may indicate great impact and knowledge translation in the educational and clinical settings.

## **Future research**

In addition to the need to repeat this bibliometric analysis with occupational therapy-specific journals, regardless of WSCC indexing, it is recommended that a future analysis address the authors, institutions, and journals that have made

significant contributions in specific practice areas (e.g., neurology, pediatrics, mental health, geriatrics, rehabilitation, community-based care) and subject areas (e.g., health promotion, population health, activity participation, occupational performance, occupational science). Replication of this bibliometric analysis in other countries to discern the most research productive institutions and authors in occupational therapy should also be made for cross-institutional and international bench marking purposes. An additional bibliometric analysis could be implemented using the names of the members of the American Occupational Therapy Foundation's Academy of Research. Because these scholars are recognized by their peers as having contributed high impact scholarship, the analysis of their collective body of work would yield important information regarding the profession's perceived status in the larger health care and academic communities.

## Conclusion

The occupational therapy-related body of peer-reviewed literature written by American occupational therapy authors has substantially increased over the last two decades. From 1991–2015, American authors published nearly 4,000 occupational therapy articles in SCI-Expanded and SSCI-indexed journals, and approximately 1,900 of these articles were authored by occupational therapists as first or corresponding authors. A small group of 220 publications were the most highly cited American occupational therapy literature over the period of 1991–2015, with 69 articles achieving a  $TotalCitation_{2015} \geq 50$  and 151 achieving a  $Citation_{2015} \geq 5$ . Nineteen articles achieved a  $TotalCitation_{2015} \geq 100$ , indicating that they were cited at least 100 times from 1991–2015. Eighteen articles achieved a  $Citation_{2015} \geq 13$ , indicating that these papers were cited at least 13 times in the single year of 2015. Although the majority of highly cited articles were published in two occupational-therapy-specific journals (*AJOT* and *OTJR*), 41% were published in interdisciplinary journals and could not serve to increase the perceived status of the profession's own journals. Because publication metrics are now heavily used in promotion and grant award decisions, the profession must strategically monitor and identify methods to enhance the metrics of occupational therapy-specific journals so that the profession can be perceived positively by the larger health care and academic communities and so that occupational therapy authors can publish in profession-specific periodicals having high impact and ease of access.

## Declaration of interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of this paper.

## Research ethics

Exempt from IRB approval.

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