

Content and bibliometric analyses of the Journal of Manual & Manipulative Therapy

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Background: Article characteristics and trends have been elucidated for other physical therapy-focused journals using content and bibliometric analysis. These findings are important for assessing the current state of a journal and for guiding future publication of research. To date, these analyses have not been performed for the Journal of Manual & Manipulative Therapy (JMMT).

Objective: To describe content and trends for articles published in JMMT over a 20-year period (1993–2012).

Methods: Journal articles were coded using previously-established domains (article type, participant type, research design, study purpose, and clinical condition). Total publications and proportion of publications based on domain were described. Articles specific to manual therapy intervention were examined and compared to data from other physical therapy-focused journals. Impact by citation and author was examined using bibliometric software.

Results: Journal of Manual & Manipulative Therapy was found to have a recent acceleration in the number of articles published annually. Over time, topical reviews have decreased in favor of research reports. However, rigorous study designs have represented only a small portion of total journal content, and case reports have maintained a consistent publication presence. Manual therapy intervention articles in JMMT are predominantly case designs, however are similar in characteristics to manual therapy intervention articles published in other physical therapy-focused journals. For JMMT articles overall and manual therapy intervention articles across journals, young to middle-aged symptomatic adults with low back and/or neck pain were the most common study participants.

Discussion: Increases in the number of papers and a move toward research reports were observed in JMMT over the 20-year period. Considerations for the future were outlined, including the publication of articles with more rigorous research designs. Manual therapy research for adolescents and older adults and for upper and lower extremity conditions should also be considered as priorities for the future.

Keywords: Content, Bibliometric, Analysis, Trends, Manual therapy, Intervention

Introduction

The Journal of Manual & Manipulative Therapy (JMMT), currently the official journal of five international manual therapy associations,¹ is an important journal for disseminating manual therapy-related research in physical therapy. The mission of JMMT is to publish '*original research, case reports, and reviews of the literature that contribute to the advancement of knowledge in the field of manual therapy, clinical research, therapeutic practice, and academic training*'.² Although articles have been published quarterly each year since 1993, the extent to which research has

evolved, or aligns with the journal's mission, is currently uninvestigated. Determining the state of a journal is possible by using metric tools such as content and bibliometric analyses.

Content analyses examine proportions and trends for systematically coded domains of a research article, such as research design, study purpose, and study participant characteristics. Bibliometric analyses calculate rankings of various factors of journal publication, including citation, author, and clinical condition. These analyses have been performed recently by our group and others in physical therapy-focused journals, including the Journal Orthopaedic & Sports Physical Therapy (JOSPT),³ the journal, Physical Therapy (PTJ),⁴ and Pediatric Physical Therapy (PPT).⁵ Each of these studies provided

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information about publication strengths and weaknesses which, in turn, may help drive future research and journal content. To our knowledge, however, a comprehensive bibliometric study has not been performed in a journal devoted to manual therapy. While both JOSPT and PTJ publish manual therapy articles, our analyses of these journals were not confined to manual therapy content.^{3,4} Moreover, neither journal is specific to manual therapy research. A recent study descriptively quantified manual therapy content across multiple manual therapy journals, however data were limited, particularly for JMMT, and publication trends were not reported.⁶

Therefore, the primary purpose of this study was to comprehensively describe content and identify content trends in JMMT. The first aim was to perform a content and bibliometric analysis of all articles in JMMT over a 20-year period, which would provide information regarding journal content published over the entire history of JMMT up to 2012. A secondary purpose was to describe content specific to manual therapy intervention articles published in JMMT during the same period, and to compare to manual therapy content published in JOSPT and PTJ. Articles focused on intervention are particularly important for evidence-based patient care and the application of manual therapy. Studies that critically appraise manual therapy efficacy and effectiveness are common,⁷⁻⁹ however, studies assessing specific study characteristics are less common. Comparing manual therapy intervention articles in JMMT to JOSPT and PTJ will indicate the extent to which JMMT content aligns with articles in other physical therapy-focused journals.

Methods

JMMT content analysis

Eligibility criteria

Available journal content at the journal website (<http://www.ingentaconnect.com/content/maney/jmt>) was screened by the primary author. Individual papers were included in this study if they were published in print between 1993 and 2012 and were classified as a research report, topical review, or case report (see Table 1 for definitions). These categories of papers were chosen to align with the journal mission. If the primary author could not determine the eligibility of specific content, a second reviewer (RAC) was included in the screening process. In total, 823 documents were screened, 375 of which met the inclusion criteria. Number and type of articles excluded are detailed in Table 2.

Article coding

We used the same coding system developed by Coronado *et al.*^{3,4} to examine article characteristics important for determining publication trends. Characteristics are categorized into four domains: article type, participant type, research design, and study purpose. Table 1 provides a comprehensive list

of definitions for the four domains. Each domain was dichotomously coded (0: No, 1: Yes) for each article and entered into a Microsoft® Excel® Database (2010, © 2010 Microsoft Corporation. All rights reserved). Number of participants, mean age, studied pathology, and intervention(s) were also collected and entered in the database. Two raters (CBS, WAW) completed the coding manually by reading each eligible article.

Coding reliability

Raters were experienced in this procedure from coding articles for previous studies.^{3,4} Moreover, reliability analyses in these studies found good agreement between raters. To determine inter-rater agreement for JMMT content, 25 articles were randomly chosen for coding by both raters, and analyzed by an independent assessor (RAC) for percentage agreement between the two raters, Cohen's kappa coefficient and 95% confidence interval for the kappa coefficient. Article type and participant type domains had perfect agreement (100%, 1.0 kappa, 95% CI: 1.0); research design domain had excellent agreement (92%, 0.89 kappa, 95% CI: 0.75–1.0); and study purpose domain had good agreement (80%, 0.72 kappa, 95% CI: 51–93). These findings are similar to the extent of agreement reported in our previous reliability analysis for JOSPT³ and PTJ.⁴

JMMT bibliometric analysis

Previous bibliometric studies by our group utilized ISI Web of Science Database (WOS, <http://apps.webofknowledge.com>) and Histcite™ Bibliometric Analysis and Visualization Software (2004–2009, Histcite Software LLC) for analysis. However, JMMT is not WOS indexed, which is required to use Histcite software. Therefore, we performed an abbreviated bibliometric analysis using Harzing's Publish or Perish 4 Software (POP4, 1990–2013, Tarma Software Research Pty Ltd).¹⁰ Collected information included journal impact (total citations and citations per paper) and author impact (citations per paper and papers per author). A search query of JMMT in POP4 yielded 584 total papers. Publication date search term limits (1993–2012) yielded 564 papers, which were cross-referenced and matched with articles included in JMMT content analysis ($n=375$). Five articles were not found using POP4,^{11–15} and one article was found to have an inflated citation count due to discrepancies in citation of the original paper.¹⁶ We were, however, able to use these six papers to calculate papers published per author. A total of 369 articles were included in the remaining bibliometric calculations.

Manual therapy intervention articles in JMMT, JOSPT, and PTJ

Eligibility criteria

Data from manual therapy articles with an intervention study purpose (Table 1 for definition) were

collected to examine content and trend differences based on journal specificity. Manual therapy was defined as ‘*clinician-delivered soft tissue, joint, or nerve-based stretching; mobilization or manipulation aimed at improving range of motion, relaxation, or tissue extensibility and reducing pain or swelling*’.¹⁷ Examples of such interventions included, but were not limited to, thrust and non-thrust joint mobilization, nerve-based mobilization techniques, and trigger-point therapy. Mechanical traction (machine-delivered) and self-mobilization (patient-delivered) were not considered manual therapy since these techniques are not manually applied by the clinician. Passive range of motion, although technically a manual therapy intervention when clinician-delivered, was categorized separately (stretching and ROM¹⁷); and, therefore, not included in this analysis.

Compared against JMMT data ($n=375$) were articles published between 1993 and 2012 in the JOSPT ($n=1405$) and the journal, PTJ ($n=1723$). The majority of data were from previous studies by our group.^{3,4} However, since these data sets were limited to the years 1993–2009, a single rater (CBS) coded remaining articles from 2010 to 2012 to match time frames for the three journals. Approximately 3503 articles comprised the data from all three journals, 358 (10.2%) of which were related to manual therapy. Intervention articles comprised nearly 80% of this sample, with a smaller subset attributed to anatomy/physiology (11%), diagnosis (3%), prognosis (3%), metrics (2%), and quality (1%). The final sample of 280 manual therapy intervention articles over the 20-year period included 125 articles from JMMT, 99 articles from JOSPT, and 56 articles from PTJ.

Table 1 Definitions for the four domains included in the content analysis coding system

Article type	
Research	Includes collection and/or analysis of primary data. Includes clinical and laboratory trials and systematic reviews.
Topical	Includes non-systematic literature reviews and topical perspectives.
Case	Includes case series and case studies.
Participant type	
Symptomatic adult	Adults (aged 18 years and older) with clinical condition.
Asymptomatic adult	Adults (aged 18 years and older) who are healthy.
Combined adult	Symptomatic and asymptomatic adult cohort.
Practitioner	Medical- or health-related individuals, including students, assessed in a professional capacity.
Symptomatic children	Children (aged 17 years and younger) with clinical condition.
Asymptomatic children	Children (aged 17 years and younger) who are healthy.
Combined children	Symptomatic and asymptomatic child cohort.
Animal	Awake or anesthetized non-human animal.
Tissue	Removed tissue or fluid (i.e. biopsy, blood, cadaver, synovium, and urine).
Research design	
Meta-analysis	Systematic search conducted and reported; data pooled to test effectiveness of results (e.g. effect size).
Systematic review	Systematic search conducted and reported.
Non-systematic review	Review without conducting or reporting a systematic search.
Randomized-controlled trial	Experimental design, participants randomly assigned to groups in parallel.
Within-subjects	Experimental design, within-subject randomization to groups; includes cross-over design.
Prospective	Quasi-experimental design, outcomes determined some time after exposure or intervention (longitudinal data).
Cross-sectional	Quasi-experimental design, outcomes determined at the same time as exposure or intervention.
Retrospective	Quasi-experimental design, outcomes determined before exposure determined.
Survey	Descriptive study using questionnaires for data collection.
Case series	Descriptive study of a participant sample involving 2–100 persons.
Case study	Descriptive study of a participant sample involving 1 person.
Study purpose	
Anatomy/physiology	Studies examining new or existing information on foundational and theoretical information (e.g. basic anatomy, pathoanatomy, kinesiology, motor behavior/learning, and physical, emotional, psychological, physiological or pathophysiological processes, and responses). Includes studies examining aspects of interventions on asymptomatic subjects in non-clinical or laboratory settings.
Etiology	Studies involving incidence, prevalence, risk factors, and impact of a particular disease or disorder.
Prognosis	Studies involving prediction of the clinical course or natural history of a disease or condition.
Diagnosis	Studies involving diagnostic process or specific aspects of diagnosis (e.g. condition screening, characterization, symptoms, and classification).
Intervention	Studies examining potential mechanisms, utilization, or effects of a given intervention. Includes studies performed in clinical settings with symptomatic subjects.
Prevention	Studies examining potential mechanisms, utilization, or effects of preventative measures.
Metric	Studies involving the development, utilization, reliability, validity, or responsiveness of a measurement or therapeutic tool, scale, questionnaire, and/or technique.
Quality	Studies examining quality improvement of physical therapy services through the description or investigation of factors such as continuing medical education, acquisition of evidence, pre- or post-professional education, mentorship, professional behaviors, problem solving, and critical thinking.
Economics	Studies examining economics of a health care disease, condition, problem, or of physical therapy practice.

Content/bibliometric analysis for three journals

Coded manual therapy intervention articles from the three journals were combined in a Microsoft Excel Database (2010). As with the JMMT content analysis, domains were chosen to provide characteristic information and trends. These domains included article type, participant type, research design, and clinical condition. Bibliometric analysis of JMMT data was performed using Harzing's Publish or Perish 4 Software (POP4, 1990–2013, Tarma Software Research Pty Ltd),¹⁰ and for JOSPT and PTJ, Histcite Bibliometric Analysis and Visualization Software (2004–2009, Histcite Software LLC). Analysis identified authors most commonly represented in manual therapy intervention research (papers per author), and impact (citations per paper) of articles using research designs that rank highest on the evidence hierarchy (e.g., randomized clinical trials, systematic reviews, and meta-analyses).¹⁸

Statistical analysis

Descriptive analyses for both aims were performed using Microsoft Excel (2010). Content percentages (content to total number of articles annually) for JMMT, JOSPT, and PTJ data were computed to control for annual publication fluctuations, which may be caused by extraneous factors (e.g. financial, administrative). IBM® SPSS® Statistics software, Version 21 (2012, IBM Corp; Armonk, NY, USA) was then used to assess trends specific to JMMT annual publications in each of the four domains (article type, participant type, research design, and study purpose). Based on previous studies, we hypothesized content trends across years to be linear.^{3,4} Linearity was assessed by: (1) visual estimation of scatter plots and (2) hierarchical regression, whereby the independent variable and squared

independent variable were entered in a first and second block, respectively. Curvilinear effects were present if the *F*-change value in the second block was significant ($P < 0.05$), since variance explained was above and beyond that explained by a linear relationship (first block). If present, linear and curvilinear effects were reported by noting R^2 and R^2 change, respectively. If curvilinear effects were not present, content trends were examined using simple ordinary least squares regression models. Article type, participant type, research design, and study purpose were entered as the independent variables, and year as the dependent variable. Alpha level was set at 0.05 for all analyses. A low probability value ($P < 0.05$) determined the presence of an association between year of publication and the independent variable, and both R^2 and the standardized beta coefficient were reported to describe the strength and/or direction of that trend.

Results

JMMT content analysis

A total of 375 JMMT articles, from 1993 (inception) until 2012, were included in this analysis. Mean articles per year was 18.75. Journal of Manual & Manipulative Therapy has always been a quarterly journal and the mean articles per issue were found to be 4.69, with 2012 being JMMT's peak publication year ($n=28$). Visual inspection revealed a negative publication trend up to 2006, and an accelerated positive trajectory starting in 2007. A 40% increase in publications occurred from 2007 to 2009 (10 articles per year increase), and one article per year increases have continued since that time. Trend analysis confirmed curvilinear effects (R^2 change=0.319, $P < 0.01$) above and beyond the overall linear trend (standardized beta=0.529; $R^2=0.280$; $P < 0.05$) from 1993 to 2012. The decreased publication number from 1993 to 2006 was examined in *post hoc* analysis, and a negative linear trend was confirmed (standardized beta=-0.760; $R^2=0.578$; $P < 0.01$). Overall JMMT annual publication totals are illustrated in Fig. 1A. Curvilinear effects were not present for the remainder of analyses.

Research reports comprised 169 of the 375 total articles (45.1%), while topical reviews and case reports totaled 131 (34.9%) and 75 (20%) articles, respectively. A positive linear trend existed for research reports (standardized beta=0.744; $R^2=0.553$; $P < 0.001$) and case reports (standardized beta=0.453; $R^2=0.205$; $P < 0.05$), indicating linear increases in the rate of research papers over time. Conversely, a negative linear trend existed for topical reviews (standardized beta=-0.849; $R^2=0.721$; $P < 0.001$), indicating reduced rates over time. Article type trends are illustrated in Fig. 1B.

Table 2 Inclusion versus exclusion of JMMT content

Total journal content, <i>N</i> (%)	823 (100)
Journal content excluded	448 (54.4)
Editorial	69 (15.4)
Man Ther awards	69 (15.4)
Abstracts	65 (14.5)
Man Ther announcement	48 (10.7)
Book, tape, CD review	45 (10.0)
Articles-online only	35 (7.5)
Letters	24 (5.3)
Information for authors	15 (3.3)
Thesis reviews	12 (2.7)
Invited commentary	10 (2.2)
Author index	10 (2.2)
Subject index	10 (1.8)
In memorium	8 (1.8)
Author response	7 (1.6)
International news	6 (1.3)
Conference report	5 (1.1)
Keynote summary/award speech	4 (0.8)
Technical	2 (0.4)
Erratum	2 (0.4)
Other	2 (0.4)
Journal articles included	375 (45.6)

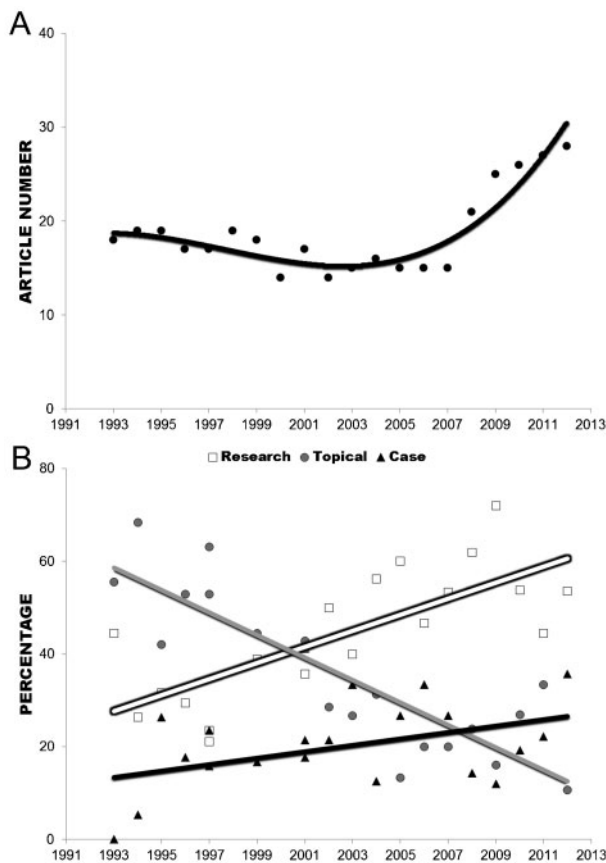


Figure 1 JMMT publication trends. JMMT (A) overall publications (polynomial trend); (B) proportion trends by article type.

For participant type (Fig. 2A), the majority of articles used either no subjects (39.5%) or symptomatic adults (38.1%). A grand total of 17 603 participants were included in all research reports over the 20-year period. Of the 173 articles reporting the sex of the participant, 57.6% were female. The mean age (for 193 studies reporting age) was 39.1 years ($SD=13.46$). Approximately 2% ($n=5$) of articles included children (<18 years), 51% young adults (18–39 years), 39% middle-aged adults (40–59 years), and 8% older adults (≥ 60 years). Frequency of use of symptomatic adults trended upward (standardized beta=0.829; $R^2=0.688$; $P<0.001$) while use of asymptomatic adults trended downward (standardized beta=-0.578; $R^2=0.334$; $P<0.01$).

The predominant research design (Fig. 2B) was non-systematic review (34.9%), followed by cross-sectional studies (20%), and case reports (16.8%). Less than 10% of articles were RCTs and 4.5% ($n=17$) were systematic reviews and/or meta-analyses. Systematic review papers trended upward (standardized beta=0.594; $R^2=0.353$; $P<0.01$) as did prospective (standardized beta=0.460; $R^2=0.212$; $P<0.05$) and retrospective (standardized beta=0.615; $R^2=0.378$; $P<0.01$) studies. Based on the negative trend of topical reviews, non-systematic reviews have expectedly decreased (standardized beta=-0.849; $R^2=0.721$; $P<0.001$). No trend was observed for RCTs.

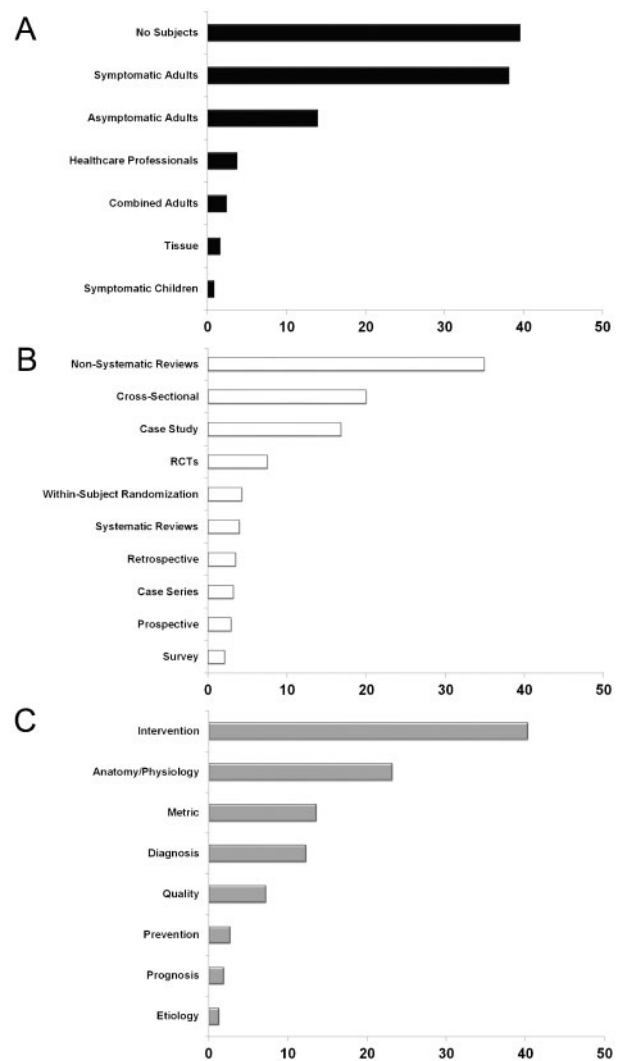


Figure 2 JMMT publication proportion by content domain. Proportion of total articles by (A) subject type; (B) research design; (C) study purpose.

Study purpose (Fig. 2C) for JMMT articles has been largely focused on either intervention (40.3%) or anatomy/physiology (23.2%). While intervention articles demonstrated a positive trend (standardized beta=0.472; $R^2=0.223$; $P<0.05$), anatomy/physiology articles demonstrated a negative trend (standardized beta=-0.648; $R^2=0.420$; $P<0.01$). All other subdomains accounted for less than 15% of total content and had no measurable trends over time.

JMMT bibliometric analysis

Journal of Manual & Manipulative Therapy articles from 1993 to 2012 included in this analysis ($n=369$) were cited 2764 times, with mean and median citations per article of 7 and 4, respectively. Articles most cited were Dommerholt *et al.*¹⁹ review of myofascial trigger points ($n=66$) and Kamper *et al.*²⁰ review of global rating of change scales ($n=60$) (Table 3). Cook and colleagues have published the most articles ($n=20$) followed by Huijbregts *et al.* ($n=19$) (Table 4A). Low back pain ($n=69$) and neck pain ($n=37$) were the most common

conditions in JMMT. Other commonly reported conditions are provided in Table 4B.

JMMT, JOSPT, and PTJ manual therapy intervention articles

Content analysis

Table 5 describes subject demographics, article type, participant type, and research design across the three journals. Case reports comprised the majority of manual therapy intervention articles in JMMT and JOSPT, while those published in PTJ were predominantly research reports. However, the case study was the most common research design published in all three journals. Most manual therapy intervention articles involved symptomatic adults, and four articles across journals included symptomatic children. Further, 6% of all manual therapy intervention articles involved older adults (≥ 60 years; JMMT, $n=6$; JOSPT, $n=5$; PTJ, $n=5$).

Bibliometric analysis

From 1993 to 2012, JMMT manual therapy intervention articles were cited 828 times, with a mean and median citations per article of 7 and 4, respectively. During the same time, JOSPT manual therapy intervention articles were cited 1308 times (mean=13; median=8), while PTJ manual therapy intervention articles were cited 1475 times (mean=26; median=13). Examination of manual therapy intervention clinical trials revealed three with over 100 citations: Delitto *et al.*²¹ (PTJ, $n=145$), Bang and

Deyle²² (JOSPT, $n=120$), and Erhard *et al.*²³ (PTJ, $n=118$). The most commonly cited systematic reviews were Di Fabio's²⁴ review of cervical spine manipulation ($n=92$), Ellis *et al.*²⁵ review of neuromobilization efficacy in RCTs ($n=47$), and Medlicott and Harris'²⁶ review of multi-modal treatment (including manual therapy) for temporomandibular disorder ($n=38$). Authors with the most manual therapy intervention articles published in the three journals were Cleland and colleagues ($n=35$), Fernández-De-Las-Peñas *et al.* ($n=11$), and Fritz *et al.* ($n=9$). The most prevalent conditions for all three journals were low back pain (JMMT, $n=27$; JOSPT, $n=20$; PTJ, $n=19$) and neck pain (JMMT, $n=21$; JOSPT, $n=14$; PTJ, $n=9$). The most prevalent extremity condition was shoulder impingement/pain for JMMT ($n=9$) and JOSPT ($n=12$), and knee pain for PTJ ($n=6$).

Discussion

Our study characterized the state of manual therapy research published in JMMT. To that end, JMMT articles were examined via content and bibliometric analysis over a 20-year period beginning with the journal's inception. In addition, content for JMMT manual therapy intervention articles were compared to those published in two other physical therapy-focused journals, JOSPT, and the journal, PTJ. This provided a perspective on commonly published article domains, trends in publication, and areas for potential future priority. To our knowledge, this is

Table 3 Articles most cited in the Journal of Manual & Manipulative Therapy, 1993–2012

Article	Times cited
Dommerholt J, <i>et al.</i> Myofascial trigger points: an evidence-informed review. 2006;14(4):203–221.	66
Kamper SJ, <i>et al.</i> Global rating of change scales: a review of strengths and weaknesses and considerations for design. 2009;17(3):163–170.	60
Huijbregts PA. Spinal motion palpation: a review of reliability studies. 2002;10(1):24–39.	58
Haughie LJ, <i>et al.</i> Relationship of forward head posture and cervical backward bending to neck pain. 1995;3(3):91–97.	51
Ellis RF, <i>et al.</i> Neural mobilization: a systematic review of randomized controlled trials with an analysis of therapeutic efficacy. 2008;16(1):8–22.	47
Vicenzino B, <i>et al.</i> Sudomotor changes induced by neural mobilization techniques in asymptomatic subjects. 1994;2(2):66–74.	42
McPartland JM, <i>et al.</i> Myofascial trigger points: translating molecular theory into manual therapy. 2006;14(4):232–239.	42
O'Sullivan PB, <i>et al.</i> Dysfunction of the neuro-muscular system in the presence of low back pain – implications for physical therapy management. 1997;5(1):20–26.	42
Slater H, <i>et al.</i> 'Sympathetic Slump': the effects of a novel manual therapy technique on peripheral sympathetic nervous system function. 1994;2(4):156–162.	41
DonTigny RL. Mechanics and treatment of the sacroiliac joint. 1993;1(1):3–12.	37
Bron C, <i>et al.</i> Interrater reliability of palpation of myofascial trigger points in three shoulder muscles. 2007;15(4):203–215.	37
Krauss J, <i>et al.</i> The immediate effects of upper thoracic translatoric spinal manipulation on cervical pain and range of motion: a randomized clinical trial. 2008;16(2):93–99.	36
Schenk RJ, <i>et al.</i> A randomized trial comparing interventions in patients with lumbar posterior derangement. 2003;11(2):95–102.	33
Placzek JD, <i>et al.</i> The influence of the cervical spine on chronic headache in women: a pilot study. 1999;7(1):33–39.	33
Hanten WP, <i>et al.</i> The effectiveness of CV-4 and resting position techniques on subjects with tension-type headaches. 1999;7(2):64–70.	32

the first study to provide a comprehensive examination of manual therapy content and trends within and across journals.

Content and bibliometric summary

While an overall decrease in the rate of JMMT articles occurred for the first decade and a half, the journal has demonstrated accelerated growth over the past 5 years. Topical reviews were the most prevalent in JMMT's early years, but have also had the steepest decline of all the article types since that period. Research reports have had positive publication growth rates over time and are currently the largest proportion of article type in the journal. The majority of participants studied have been young to middle-aged symptomatic adults, while children or older adults have participated in only a handful of studies. Low back and neck pain were found to be the most prevalent conditions published. Closer examination of manual therapy intervention articles across three journals found the majority to be either case reports (JMMT, JOSPT) or research reports (PTJ). However, all three journals were similar in most published

research design (case studies), participant characteristics (middle-aged adults), and treatment condition (low back pain and neck pain).

Future considerations

An exponential increase in the number of JMMT annual publications over the past 5 years is an encouraging trend for future growth of the journal. However, there are other factors not controlled for in this analysis that may have influenced the directional change in publication number. One specific example is the editorial board change that occurred around 2007. Future studies should explore meaningful influences from factors such as journal leadership, which would help identify causes for future changes in journal content. While annual output has improved, JMMT averaged less than half the annual number of papers compared to JOSPT or PTJ over a similar time frame.^{3,4} Journal of Manual & Manipulative Therapy also had fewer articles per publication, which may suggest a within-issue capacity for continued growth. However, being a quarterly journal, JMMT may not have the ability to produce the same number of publications annually as JOSPT or PTJ, which are published monthly. Moreover, number of articles per issue may be dictated by publisher page count restrictions and not necessarily by content availability or the editorial board. Finally, journal citation differences may not necessarily be an indication of impact differences.

Table 4 Publication ranking by clinical condition and author

A	
Author	Publications
Cook, CE	20
Huijbregts, PA	19
Cleland, JA	16
Brismée, JM	10
Creighton, DS	8
Hall, T	8
May, S	8
Sizer, PS	8
Hegedus, EJ	7
Krauss, J	7
Oostendorp, RA	7
Schenk, RJ	7
Fernández-De-Las-Peñas, C	6
Horn, C	5
Makofsky, HW	5
Mulligan, BR	5
Oldreive, WL	5
Paris, SV	5
B	
Clinical condition	Publications
Low back pain	69
Neck pain	37
Headache	21
Shoulder impingement/pain	16
Radiculopathy	9
Sacroiliac joint dysfunction	9
Myofascial pain syndromes	8
Osteoarthritis	7
Whiplash associated disorder	7
Ankle sprain/pain	7
Adhesive capsulitis	6
Lateral epicondylalgia	6

(A) Ranking by author for total publications, JMMT; (B) ranking by clinical condition for total publications, JMMT.

Table 5 Manual therapy intervention article characteristics by journal

	JMMT	JOSPT	PTJ
Total articles	125	99	56
Subjects (reported)	1571	2010	19 496
Mean age (reported)	39.9	37.8	43.1
% Female (reported)	62	48	54
Article type			
Research	41 (0.33)	39 (0.39)	34 (0.61)
Topical	32 (0.26)	17 (0.17)	1 (0.02)
Case	52 (0.42)	43 (0.43)	21 (0.38)
Participant type			
Symptomatic adult	82 (0.66)	76 (0.77)	47 (0.84)
Symptomatic children	1 (0.01)	1 (0.01)	2 (0.04)
Combined adult	0 (0.00)	2 (0.02)	0 (0.00)
Practitioner	1 (0.01)	0 (0.00)	1 (0.02)
No subject	40 (0.32)	20 (0.20)	6 (0.11)
Research design			
Meta-analysis	1 (0.01)	1 (0.01)	0 (0.00)
Systematic review	8 (0.06)	2 (0.02)	5 (0.09)
Non-systematic review	32 (0.26)	17 (0.17)	1 (0.02)
RCT (parallel)	16 (0.13)	21 (0.21)	15 (0.27)
Within-subjects	4 (0.03)	2 (0.02)	1 (0.02)
Cross-sectional	4 (0.03)	3 (0.03)	2 (0.04)
Prospective	4 (0.03)	6 (0.06)	6 (0.11)
Retrospective	3 (0.02)	3 (0.03)	1 (0.02)
Survey	1 (0.01)	0 (0.00)	4 (0.07)
Case series	10 (0.08)	16 (0.16)	4 (0.07)
Case studies	42 (0.34)	28 (0.28)	17 (0.30)

Number of manual therapy intervention articles for JMMT compared to JOSPT and PTJ (proportion of articles to total manual therapy intervention articles by journal in parentheses).

Although beyond the scope of this study, it is likely that access to journal content played a role in determining the number of times each manual therapy intervention article was cited. *Journal of Manual & Manipulative Therapy* is not currently indexed on Thompson-Reuters Web of Science (ISI) or Medline, and was not indexed on PubMed until 2008. In contrast, *JOSPT* and *PTJ* are indexed on all three databases. Future studies may provide insight on citation pathways and the implications for being indexed on specific databases.

Growth in research reports and declining topical reviews may indicate an increasing shift toward higher levels of evidence-based research in JMMT. However, we note that rigorous designs, including RCTs, have not demonstrated similar growth and represent only a small portion of total content. It has been argued that prospective cohort studies may be a more ideal design than RCTs for manual therapy intervention studies, given the generalizability to patient care.^{27,28} However prospective-cohort studies comprised less than 10% of JMMT content. Moreover, the proportion of JMMT manual therapy intervention-based RCTs or prospective cohort designs were small and accounted for approximately half of those published in *JOSPT* or *PTJ*. Finally, case reports have maintained a constant presence within the journal, both overall and for manual therapy interventions studies. However, it is also important to note other factors that may have influenced the observed trends in article type. For example, a relative lack of systematic review guidelines existed in the early phases of the journal, which may at least partly explain why reviews were predominantly topical. Additionally, the journal's current mission is to publish all article types, including reviews and case reports.²

The impact of less rigorous article types on practice, however, is debatable. Case reports (case studies or case series) provide value to journal readership through informative description of rare conditions, initiation of clinically applicable research questions, and involvement of student or novice physical therapists in evidence-based practice and/or publication. Yet, case reports are also considered to be a low form of evidence.¹⁸ Mahajan and Hunter²⁹ point out that case reports are often the most commonly read type of article, yet they are rarely among the most cited. Similarly, Patsopoulos *et al.*³⁰ suggested case reports have little impact in health science literature based on number of times cited. We contend that case reports have a role in the manual therapy literature but steps should be taken to further increase research reports, which may reduce the proportion of case reports in print. Alternatively, separate print or an online outlet could be considered,

which have been created by other publishers, and was even used for a brief period (2007–2010) by JMMT. This would allow continued access to case report content, albeit in an alternative format.^{31–33}

Final considerations for improving the impact of future manual therapy research relate to clinical conditions and study participants. Low back pain and neck pain were overwhelmingly the conditions of choice for manual therapy research that we observed. Spinal conditions are complex and prevalent problems,^{34,35} and it should, therefore, not be surprising that these conditions are of primary focus in the manual therapy literature. Perhaps as a consequence, however, manual therapy research conducted on other body regions was significantly less common in all three journals. The impact of this imbalance remains uninvestigated, but our data suggest that manual therapy research conducted on upper and lower extremity conditions may be under-represented.

Future studies should also aim to examine a more representative sample of individuals across the life-span. For example, few articles in JMMT, *JOSPT*, or *PTJ* studied adolescents. These findings parallel Vaughn *et al.*'s³⁶ recent systematic review, which found a paucity of evidence for spinal manual therapy interventions in children. Similarly, limited research exists on manual therapy effects in the geriatric population. We found that less than 10% of all JMMT articles, or manual therapy intervention articles in the three journals, had an average age over 60 years. This is important since the majority of older adults experience musculoskeletal pain^{37–39} and the utilization of pain management services by older adults is rising.^{40,41} Moreover, future growth analyses have the population of older adults doubling over the next 30 years.⁴² With a growing population and growing pain management utilization, there is a greater need for research to determine effective and efficient manual therapy interventions for older adults.

Limitations

There are several important limitations to this study. First, the limited sample of manual therapy intervention articles across the three journals prohibited us from assessing trends over time as was performed for JMMT's total content. We therefore relied on descriptive analyses for these comparisons. Second, previous bibliometric analyses by our group were performed using ISI-indexing, however, the JMMT is not currently indexed on Thompson-Reuters Web of Science (ISI). Therefore, we were unable to derive comprehensive bibliometric results outside of citations, author, and condition ranking. Further, Harzing's Publish or Perish 4 Software (POP4, 1990–2013, Tarma Software Research Pty Ltd),¹⁰

has not (to our knowledge) been compared metrically to Histcite Bibliometric Analysis and Visualization Software (2004–2009, Histcite Software LLC).

This study should also not be considered an ‘all inclusive’ characterization of manual therapy research. Articles in this analysis represent a fairly substantial body of existing manual therapy evidence related to physical therapy. However, there are journals not included in this analysis (e.g. the journal, *Manual Therapy*) that are well established and have also provided a body of evidence to the field. Moreover, as Costa *et al.*⁴³ recently highlighted, research important to physical therapy exists beyond physical therapy-focused journals. Therefore, future studies would be well served to incorporate evidence from multiple regions and disciplines. Finally, a major limitation is that trends we identified in article and research design do not provide indicators of study quality. A high priority for future analyses is to incorporate research quality into the characterization of manual therapy articles, both within and across journals.

Conclusion

Journal of Manual & Manipulative Therapy has been a source for manual therapy evidence since 1993. Journal production has increased during the last 5 years, and publication focus appears to have shifted toward research reports. While case reports have maintained a steady presence in the journal, this may be a product of JMMT’s mission to also publish case reports. Specific to manual therapy intervention studies, characteristics of articles published in JMMT are similar to the profile of manual therapy intervention publications in *JOSPT* and *PTJ*. Future priority should be on improving the proportional growth of papers with high quality research designs, while at the same time, assessing the impact of case reports on advancing manual therapy practice. Further consideration should be given to increasing publication of manual therapy studies that examine extremity conditions, and manual therapy studies involving children and older adults.

Disclaimer Statements

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