3-30-2016 12:00 AM

A Study to Understand and Compare Evidence Based Practice Among Health Professionals Involved in Pain Management

Vanitha Arumugam, *The University of Western Ontario*

Supervisor: Dr. Joy C MacDermid, *The University of Western Ontario*

A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Health and Rehabilitation Sciences

ABSTRACT

Pain management is a common concern of multiple health professionals. Evidence-based practice (EBP) in pain management is a recognized approach used to improve health outcomes. EBP tools can facilitate its implementation. PAIN$^+$ is a tool that provides access to pre-appraised current best research evidence on pain to support clinical decisions. It is important to understand the knowledge, attitudes and behavior of professionals towards EBP and more specifically how they access research about pain management.

The overarching purpose of this thesis is to better understand how clinicians from different professions involved in pain management view EBP and implement specific strategies to find pain related research evidence. We conducted a series of studies incorporating various methods to address these questions. Data was collected supplementary to a large randomized control trial to compare "Push" vs. "Pull" strategies for uptake of pain research. In the first study, we compared the knowledge, attitudes, outcomes expectations and behaviors of physicians, nurses, physiotherapists, occupational therapists and psychologists towards EBP in pain management using a validated knowledge attitude and behavior (KABQ) questionnaire. In the second study, we used a mixed methods approach to understand the competencies of clinicians accessing electronic databases to search for evidence on pain management. In the third study, we performed a structured classification of the abstracts that were viewed by clinicians to understand their access behaviors. In the last part of the thesis, we compared the usefulness of PAIN$^+$ with PubMed using a randomized crossover trial approach.

The results of this thesis indicate that the professionals involved in pain management have good knowledge of and attitudes towards EBP, but behavior i.e. implementation of EBP in practice and perception of outcomes of implementing EBP were low. In the second study, we found that professionals had acceptable levels of basic literature searching skills but had low levels of use of more advanced skills, and were not aware of using clinical queries in their search. In the third study, we found that all professionals accessed research evidence when provided alerts about pain research and some variations in the types of studies accessed were observed. Differences in access behaviors might reflect differences in professional approach to pain management. In our fourth study the crossover randomized controlled trial; we found PAIN$^+$ and PubMed were both rated useful in retrieving pain evidence for clinicians.

Professionals showed an interest in evidence-based pain management, but their skills for finding evidence were limited, they appeared to need training in locating and appraising pain related research evidence, and may benefit from tools that reduce this burden.
KEYWORDS: evidence-based practice, pain management, abstract coding, PAIN^{+}, KABQ, experiences of professionals in pain management

CO-AUTHORSHIP

Research question, specific objectives and individual study design were developed by Vanitha Arumugam and Joy C. MacDermid with inputs from Ruby Grewal and Robert Brian Haynes. Coinvestigators were recruited when additional raters with specific expertise were required. Thesis advisory committee members were included as co-authors for specific chapters based on their input to individual chapters in this thesis work. The authors and specific roles for each chapter of the thesis are listed below:

CHAPTER 1: INTRODUCTION

Vanitha Arumugam – sole author

CHAPTER 2: DIFFERENCE IN PERCEPTION OF PROFESSIONALS INVOLVED IN PAIN MANAGEMENT TOWARDS EVIDENCE BASED PRACTICE

Vanitha Arumugam – primary author, study design, data analysis and wrote manuscript

Joy C. MacDermid – study design, data analysis and reviewed manuscript

Robert Brian Haynes – Study design and reviewed manuscript

Ruby Grewal - Reviewed manuscript

CHAPTER 3: UNDERSTANDING THE EXPERIENCES OF CLINICIANS ACCESSING ELECTRONIC DATABASES A MIXED METHODS APPROACH

Vanitha Arumugam – primary author, study design, data analysis and wrote manuscript

Joy C. MacDermid – study design, data analysis and reviewed manuscript

Robert Brian Haynes – Study design and reviewed manuscript

Ruby Grewal - Reviewed manuscript

CHAPTER 4: A STRUCTURED CLASSIFICATION OF TYPES OF STUDIES VALUED BY DIFFERENT PROFESSIONALS INVOLVED IN PAIN MANAGEMENT

Vanitha Arumugam – primary author, study design, data analysis and wrote manuscript

Joy C. MacDermid – study design, data analysis and reviewed manuscript

Robert Brian Haynes – Study design and reviewed manuscript

Ruby Grewal - Reviewed manuscript

CHAPTER 5: COMPARING THE EFFICIENCY AND EFFECTIVENESS OF USING EITHER PAIN^{+} OR PUBMED TO ACCESS PAIN RESEARCH EVIDENCE: A RANDOMIZED CROSSOVER TRIAL

Vanitha Arumugam – primary author, study design, data analysis and wrote manuscript

Joy C. MacDermid – study design, data analysis and reviewed manuscript

Robert Brian Haynes – Study design and reviewed manuscript

Ruby Grewal - Reviewed manuscript

CHAPTER 6: GENERAL DISCUSSION

Vanitha Arumugam – sole author

ACKNOWLEDGEMENT

I would like to thank the Lord God Almighty for all the blessings that He has showered upon me all throughout my life, especially this special one.

This work was supported by through Western Graduate Research Scholarship (2011-2015) and operating grants from Canadian Institutes of Health research (CIHR): CIHR - FRN: 107539 & FRN: 123308.

I would like to thank my supervisor Dr. Joy C. MacDermid. Joy, words cannot describe how thankful I am to you for your continual unwavering support and guidance that has brought me to where I am today. Still I remember the day, I came to you with a rejection of a manuscript disappointed to the core, I remember the words you told me, "it never hurts to try" and will remember these words all through my life, you are such a positive person and thanks for being an ever encouraging and motivating supervisor, encouraging all of us to present papers and posters and sharing every information about conferences, courses and workshops and provided us with all the opportunity to grow. I have always admired you for clarifying concepts in a way that we could understand. I have always looked on to you as a mentor and as a guide. You told that you trust me with the work that I am doing and I hope that I stood up to your expectations.

I must express special acknowledgements to my advisory committee members, Dr. Ruby Grewal and Dr. Dave Walton, for their inputs into my thesis and education that were invaluable. Ruby, thank you for being a supportive person, I have admired your keen interest on details. Dave you have always been a down-to-earth person. . Dave you were always available for help when I needed them. Thank you for all the help that you have been to me during my comprehensive exams and my thesis, your invaluable suggestions have helped me to learn a lot. Ruby and Dave, I would like to express my deep appreciation for all your great work. I would also like to thank Dr. Anita Kothari for being my comprehensive examiner and helping me with my comprehensive exam milestone.

I would like to thank all my colleagues and lab mates especially Jayaprakash Raman, Margaret Lomotan, Kate Kelly, and Derek Cheung. JP I am always grateful to you for the guidance that you gave me in choosing this university and helping me with all the process to come to Canada,

and all the support you gave me along with your family. Margaret, thanks for being a wonderful friend and coordinator helping with my data collection in Hamilton. I always cherish the days, the friendly atmosphere at the Mac Hand lab, working with you. Kate thanks for all the help at HULC, Derek, thanks for being a great friend, I have enjoyed the days when we used to walk to UCC together for coffee, and assignments during course work in lab. Many thanks to my friends, Mr. Vincent Prabhakaran, Mrs. Anugraha Rajavel and Mr. Dinesh Balachandran, their presence and support made my life away from lab happier and cheerful.

Special thanks to Nancy Inchley, Cathy Collins and Amber Trent at the HRS office, Elborn College, for their support throughout the past 4 years. I would also like to thank all the participants who took part in my study, without them this thesis would not be possible.

I take great pride in thanking my dad (Mr. Arumugam Govindaswamy), and my mom (Mrs. Kala Arumugam), my sister-in-law (Mrs. Kokila Mugunthan) and my brother (Mr. Mugunthan Arumugam). Dad, mom and Mugu, because of you I am who I am today. You have been the propelling force that has made me stay in school since 2002. Mom along with Dad, you have instilled all the good values for life, and that has made me who I am today. And I know that I have brought you the joy and happiness that you deserve.

Finally, Joshua my beloved husband, I have no words to thank you for all the help that you have been with this thesis and in my life. You have been my best friend and now you are my husband, and your love has even been increasing since, and hope will continue to increase all the days of my life. I promise you that I will drive the car properly, only when you sit in the backseat. Thanks for being patient with me. And I dedicate this thesis to you along with my parents and brother.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Pain Definition and Epidemiology

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage. (1) According to International Association for the Study of Pain (IASP), approximately 60 million people endure chronic pain, 1 in 5 adults experience pain and 1 in 10 experience chronic pain. (1) Pain seriously affects a person's well-being as it can lead to functional limitation. In the United States, pain is more prevalent than any other symptoms like stiffness, deformity etc,with 27.7% of the population experiencing some kind of a pain in 2004. (2) In a population-based survey of 15 European countries and Israel, it was found that more than 20% of the population suffer from chronic pain. (3) A telephone survey to identify point prevalence of chronic pain in India found more than 13% of the population suffered from chronic pain. (4) A postal survey identified that 17.2% of Japanese are suffering from chronic pain. (5) Some of the socio-demographic factors that affect pain are as follows: sex / gender, age, socioeconomic status, geographical location, cultural background; employment status and occupational factors. (6) In the United States, women (30.4%) were more affected by pain than men (24.8%).(2)

1.2 Burden of pain management

Pain, both acute and chronic is a major burden to both the developed and the developing world. A survey on the caseload of primary care settings in America, Asia, Africa and Europe showed that 10 to 25 % of the caseload is related to pain. (7) According to a study published in 2011 based on the Medical Expenditure Panel Survey (MEPS 2008), the annual healthcare cost of pain management in the United States was $261 to $300 billion. (8) When the annual costs due to loss of productivity were added to this, the total was $560 to $635 billion. This amount was more than the annual costs of heart disease ($309 billion), cancer ($243 billion), and diabetes ($188 billion) and nearly 30 percent higher than the combined cost of cancer and diabetes. (8)

1.3 Multidisciplinary nature of pain management

Pain management is offered in a variety of context and by multiple professionals in a multidisciplinary team. (5) Traditionally, pain was viewed as a biomedical problem. Currently, pain is described using a biopsychosocial approach where the complex interactions between biological, psychological and social factors are taken into account. (9, 10) Pain is one common

symptom which is encountered by professionals in multiple disciplines like physicians, nurses, physical therapists, occupational therapists and psychologists and each discipline has specific roles in the holistic management of pain. (11) The evolution of a biopsychosocial model has contributed to psychologists becoming more involved in pain management and offering treatments for chronic pain like cognitive behavioral therapy. (12) With the evolution of the biopsychosocial model, chronic pain management has moved from a discipline-specific approach to a multidisciplinary approach to address all the factors (biological, psychological and social) related to pain. A systematic review has found moderate evidence that multi-disciplinary pain management is more effective than discipline-specific treatment options. (13)

1.4 Evidence-based Practice

Evidence-based medicine (EBM) was initially defined as the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. (14) It is integrating individual clinical expertise with the best available external clinical evidence from systematic research. This was later modified as "Evidence-based medicine is a systematic approach to clinical problem solving which allows the integration of the best available research evidence with clinical expertise and patient values**."** (15) (See Figure 1)

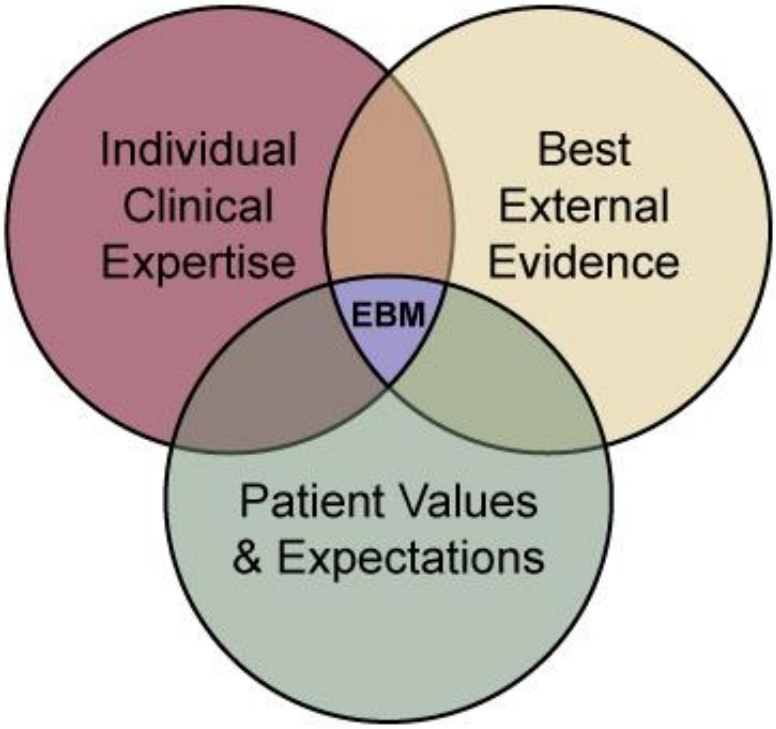


Figure 1 Evidence based practice triad. (Source: http://med.fsu.edu/index.cfm?page=medicalinformatics.ebmTutorial retrieved Aug 10, 2015)

One of the greatest innovations of this century in the field of medicine is the development of evidence-based practice (EBP).(16) Clinical research is producing new findings that contribute to effective and efficient patient care. The findings of such research will not change population outcomes unless health services and health care professionals adopt them into practice. Understanding the EBP process can help bridge the gap between current evidence and real life clinical practice patterns.

Clinical expertise is the proficiency and clinical judgment that is acquired by the experience of the clinician over time. Clinical judgment and proficiency can be supplemented by considering the preferences and the rights of the patients when making diagnostics and treatment decisions based on their expertise. Finally, the inclusion of the best external evidence would either validate their current practice or bring in new diagnostics or treatment plan which may be more accurate and efficient, overall resulting in better outcomes. A meta-analysis has found that outcomes of treatment have improved by 28% when EBP is used. (17) Unfortunately, the level of implementation of EBP is inconsistent. For example in a survey conducted in the United States where 400 quality indicators in some 6,700 patients were drawn from a dozen metropolitan areas, itsuggested that 45% were not receiving recommended care.(18, 19) Also, researchers have identified that it takes around 17 years for effective translation of research into practice.(20-22)

1.41 Evidence-based practice model

The EBP model involves five major steps: step 1 is to formulate an answerable research question; step 2 involves tracking down the best evidence; step 3 involves a critical appraisal of the evidence retrieved; step 4 involves application of the evidence in individual clinical practice and step 5 is to assess the outcome of the process and make changes as necessary. (15) With advancements in technology, evidence-based tools play a major role in step 2 which involves tracking down the best evidence.

1.42 EBP tools and resources

There are a number of tools and resources that are available for promoting EBP in clinical practice. One of these is the establishment of levels of research evidence. The Cochrane database provides systematic reviews and meta-analysis that are on the top of the pyramid,

followed by evidence guidelines and evidence summaries, RCTs and cohort studies come next; case reports and clinical references are at the base of the pyramid. (See Figure 2)

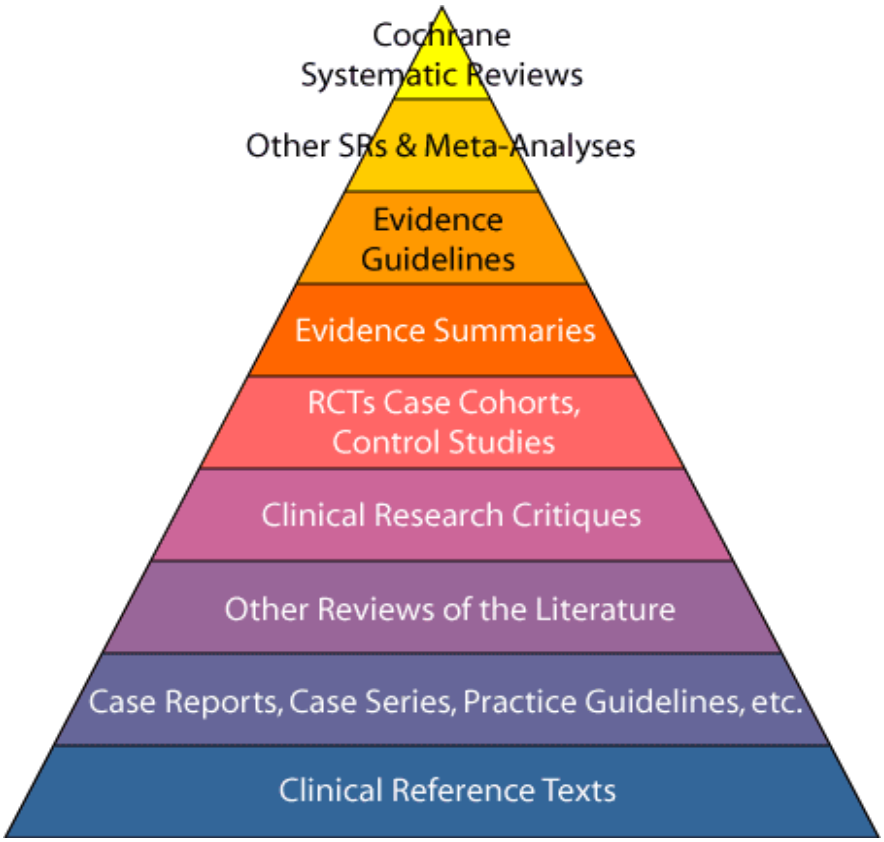


Figure 2 EBP information organized by evidence level indicated on a pyramid

(Source: http://guides.lib.uw.edu/hsl/ebptools)

Electronic databases are effective tools of EBP when used properly. There are many electronic databases that are available to retrieve evidence on pain management like, PubMed, Scopus, Up-to-date, ProQuest, EMBASE, CINAHL, Cochrane library, Psych info, Dissertation and Theses; PEDro etc. PubMed is the most commonly used database when searching for medical literature.(23). It has around 25 million citations. (24) The efficiency and effectiveness of PubMed have been tested before. (25-30)

1.6 PAIN$^+$

The latest addition to this line of EBP tools that is more focused on pain management is PAIN$^+$. PAIN$^+$ (Premium LiteratUre Service) is an electronic evidence service created by Dr. Joy MacDermid in collaboration with the Health Information Research Unit (HIRU), at McMaster University. HIRU developed the platform for the McMaster Premium Literature Service,

(McMasterPLUS^{TM})(31) that provides the technical expertise and infrastructure to support multiple push-out and evidence repositories. PAIN^{+} was designed to provide access to pre-appraised current best evidence on pain to support clinical decisions. It covers over 110 premier clinical journals that address pain. All the citations from these journals are pre-rated for evidence quality by research staff and then clinical relevance and interest are rated by at least 3 members of an international panel comprising of clinicians (physicians, nurses, physical and occupational therapists, and clinical psychologists) with a common interest in pain management. PAIN^{+} facilitates the second and third step on EBP model (retrieving evidence and appraisal of the quality of the evidence).

1.7 PUSH vs. PULL

There are two modes of transferring knowledge to target audiences. Evidence can be extracted from medical, nursing, psychology, and rehabilitation journals; appraised for quality/relevance, and then sent out (PUSH) to clinicians by email alerts. The alternate and more traditional approach is where clinician's type in keywords related to their query into cumulative electronic databases and retrieves evidence (PULL). PAIN^{+} falls under the PUSH category and databases like PubMed, SCOPUS, EMBASE etc. fall under the PULL category. Clearly these two types of evidence repositories differ. PubMed, for example, provides a much broader scope of literature; but does not evaluate the quality of the individual articles. Depending on the efficiency of the search strategy there is potential for a larger number of papers, but the relevance may be more variable when high volumes of research articles are retrieved. PAIN^{+} was designed to focus on the most relevant pain research and to provide targeted high-quality studies to practitioners interested in pain management. Because the extraction and quality appraisal processes are labour-intensive, the number of journals abstracted is limited to those that provide a consistent yield of pain related research. Hence, PAIN^{+} may miss important pain studies published in journals not targeted for extraction because pain is not a common focus. Due to these differences, it is important to understand how these two different approaches apply? When considering translation of clinically relevant research evidence on pain management.

1.8 EBP in clinical practice

To provide better EBP experience to clinicians, we have to understand some factors like the clinicians level of knowledge on EBP, their attitudes towards EBP and their behavior. Understanding the barriers to EBP will help in providing a better experience to clinicians

intending to use EBP in their routine clinical practice. Also understanding the preference for the type of information and mode of delivery that each profession requires will help in enhancing future EBP tools and training.

1.81 The knowledge, attitudes, behavior and outcome / decision

Understanding the knowledge, attitudes and behavior of clinicians towards EBP can help in determining areas needing further attention in implementing EBP. Previous studies to understand the knowledge, attitude, and behavior of clinicians towards EBP, have identified the attitudes of different professionals involved in healthcare.(32, 33) A study on the attitudes, beliefs, behavior and knowledge of physiotherapists found that they believed EBP will improve patient care, had positive attitudes towards EBP good knowledge of EBP but implementation was low. (32) Another study on the attitudes and knowledge of allied health professionals found that allied health professionals have also found that they had good attitudes and knowledge of EBP. (33) All these studies have been conducted in different clinical settings. None of these studies have tried to understand the knowledge, attitudes and behavior of clinicians involved in pain management. Also previous studies have not used a structured and validated questionnaire to understand the knowledge, attitudes, behavior and outcome/decisions of clinicians towards EBP.

The Knowledge, Attitudes and Behavior Questionnaire (KABQ) was developed originally by Johnson and colleagues(34) to evaluate EBP teaching and learning in the undergraduate medical education curriculum. With permission, authors (JMD and ML) developed a modified KAB scale, which is used in this thesis. The EBP-KABQ initially contained 33 items, but was later reduced to 26 items using confirmatory factor analysis. The EBP-KABQ has four subscales: knowledge [5 Items scored on a 7 point ordinal scale; score range= 0 – 35], attitudes [13 Items (12 scored on a 7 point ordinal scale; and 1 item on a 5-point ordinal scale; score range= 0 – 89], behavior [5 Items scored on a 5 point ordinal scale; score range= 0 – 25] and outcome/decisions [3 Items scored on a 6 point ordinal scale; score range= 0 –18].The EBP-KABQ scale has been tested for psychometric properties and has demonstrated acceptable levels internal consistency (Cronbach's alpha = 0.85), construct validity with no floor or ceiling effects.(35) Confirmatory factor analysis revealed a 4-factor structure with good fit indices. (35)

1.8.2 Barriers to EBP

Clinicians encounter barriers in performing literature searches to retrieve the best evidence, which is an important step in achieving optimal levels of EBP. Previous studies have identified a number of barriers for the successful implementation of EBP across different professional groups including, physicians (36, 37), nurses (38), and physiotherapists (PT). (39, 40) Lack of time is one of the commonly reported barriers across different professionals. (33, 36, 37, 39) Lack of confidence in EBP skills has been reported in allied health professionals. (40, 41) Lack of access to resources and organizational supports are also barriers to EBP. (40, 42)

1.83 Preference for information

To provide appropriate information to clinicians, it is important to understand their information needs and what type of knowledge they are accessing. Information needs and access behaviors of different professions have been an area that is less studied. Studying their interest and access behaviors would help create taxonomies or classifications of topics that can in turn lead to creation of informatics resources to support EBP needs of clinicians.

1.5 Thesis purpose and research questions:

The overarching purpose of this thesis was to better understand how clinicians from different professions involved in pain management view EBP and implement specific strategies to find pain related research evidence

1) What are the knowledge, attitudes, behavior and the outcomes / decisions of different health professionals involved in pain management; and do they differ by profession?
2) What are the competencies of clinicians in accessing electronic databases to search for evidence on pain management?
3) What are the access behaviors of clinicians from different health professions when exposed to evidence alerts via PAIN^{+}?
4) Is PAIN^{+} more useful than PubMed to address clinical research questions on pain management?

1.6 REFERENCES

1. Merskey H, Bogduk N. IASP Task Force on Taxonomy: Classification of Chronic Pain. Seattle: IASP Press; 2011.

2. Hardt J, Jacobsen C, Goldberg J, Nickel R, Buchwald D. Prevalence of Chronic Pain in a Representative Sample in the United States. Pain Med. 2008, 9(7):803-12

3. Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. Eur J Pain. 2006;10(4):287-333.

4. Dureja GP, Jain PN, Shetty N, Mandal SP, Prabhoo R, Joshi M, et al. Prevalence of chronic pain, impact on daily life, and treatment practices in India. Pain Pract. 2014;14(2):E51-62.

5. Inoue S, Ushida T, Inoue M. Clinical characteristics and multidisciplinary management of chronic musculoskeletal pain. Brain Nerve. 2012;64(11):1287-97.

6. van Hecke O, Torrance N, Smith BH, Colvin L, Rowbotham DJ. Chronic pain epidemiology and its clinical relevance. Br J Anaesth.. 2013;111(1):13-8.

7. Reid KJ, Harker J, Bala MM, Truyers C, Kellen E, Bekkering GE, et al. Epidemiology of chronic non-cancer pain in Europe: narrative review of prevalence, pain treatments and pain impact. Curr Med Res Opin. 2011;27(2):449-62.

8. Gaskin DJRP. The Economic Costs of Pain in the United States. In: Institute of Medicine Committee on Advancing Pain Research CaE, editor. Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research. Washington (DC): National Academies Press (US); 2011. p. Appendix C.

9. Gravitz MA, Gatchel RJ. Clinical Essentials of Pain Management. Washington, DC: American Psychological Association Press; 2005.

10. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: Scientific advances and future directions. Psychol Bull. 2007;133(4):581-624.

11. Gatchel RJ, McGeary DD, McGeary CA, Lippe B. Interdisciplinary chronic pain management: Past, present, and future. Am Psychol. 2014;69(2):119-30.

12. Morley S, Williams A, Eccleston C. Examining the evidence about psychological treatments for chronic pain: Time for a paradigm shift? PAIN. 2013;154(10):1929-31.

13. Scascighini L, Toma V, Dober-Spielmann S, Sprott H. Multidisciplinary treatment for chronic pain: a systematic review of interventions and outcomes. Rheumatol.2008;47(5):670-8.

14. Sackett DL. Evidence-based medicine. Semin. Perinatol. 1997;21(1):3-5.

15. Sackett DL. Evidence-based medicine :how to practice and teach EBM. Edinburgh ;; New York: Churchill Livingstone; 2000. 261 p.

16. Dickersin K, Straus SE, Bero LA. Evidence based medicine: increasing, not dictating, choice. Bmj. 2007;334 Suppl 1:s10.

17. Heater BS, Becker AM, OlsonRK. Nursing Interventions And Patient Outcomes: A Meta-Analysis of Studies. Nurs Res 1988;37(5):303-7.

18. Schuster MA, McGlynn EA, Brook RH. How good is the quality of health care in the United States? Milbank Q. 2005;83(4):843-95.

19. McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, et al. The quality of health care delivered to adults in the United States. N Engl J Med. 2003;348(26):2635-45.

20. Morris ZS, Wooding S, Grant J. The answer is 17 years, what is the question: understanding time lags in translational research. J R Soc Med. 2011;104(12):510-20.

21. Westfall JM, Mold J, Fagnan L. Practice-based research--"Blue Highways" on the NIH roadmap. Jama. 2007;297(4):403-6.

22. Green LW, Ottoson JM, Garcia C, Hiatt RA. Diffusion theory and knowledge dissemination, utilization, and integration in public health. Annu Rev Public Health. 2009;30:151-74.

23. National Library of Medicine (US) Key MEDLINE Indicators. 2014. https://www.nlm.nih.gov/bsd/bsd_key.html

24. List of All Journals Cited in PubMed®. 2015. https://www.nlm.nih.gov/bsd/serfile_addedinfo.html

25. Anders ME, Evans DP. Comparison of PubMed and Google Scholar literature searches. Respir Care. 2010;55(5):578-83.

26. Falagas ME, Pitsouni EI, Malietzis GA, Pappas G. Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. Faseb j. 2008;22(2):338-42.

27. Freeman MK, Lauderdale SA, Kendrach MG, Woolley TW. Google Scholar versus PubMed in locating primary literature to answer drug-related questions. Ann Pharmacother. 2009;43(3):478-84.

28. Shariff SZ, Sontrop JM, Haynes RB, Iansavichus AV, McKibbon KA, Wilczynski NL, et al. Impact of PubMed search filters on the retrieval of evidence by physicians. Can Med Assoc J. 2012;184(3):E184-E90.

29. Shariff SZ, Bejaimal SA, Sontrop JM, Iansavichus AV, Haynes RB, Weir MA, et al. Retrieving clinical evidence: a comparison of PubMed and Google Scholar for quick clinical searches. **J Med Internet Res**. 2013;15(8):e164.

30. Shultz M. Comparing test searches in PubMed and Google Scholar. J Med Libr Assoc. 2007;95(4):442-5.

31. Pain PLUS (Premium LiteratUre Service). 2015. https://plus.mcmaster.ca/painplus

32. Jette DU, Bacon K, Batty C, Carlson M, Ferland A, Hemingway RD, et al. Evidence-based practice: beliefs, attitudes, knowledge, and behaviors of physical therapists. Phys Ther. 2003;83(9):786-805.

33. Heiwe S, Kajermo KN, Tyni-Lenne R, Guidetti S, Samuelsson M, Andersson IL, et al. Evidence-based practice: attitudes, knowledge and behaviour among allied health care professionals. Int J Qual Health Care. 2011;23(2):198-209.

34. Johnston JM, Leung GM, Fielding R, Tin KY, Ho LM. The development and validation of a knowledge, attitude and behaviour questionnaire to assess undergraduate evidence-based practice teaching and learning. Med Educ. 2003;37(11):992-1000.

35. Shi Q, Chesworth BM, Law M, Haynes RB, MacDermid JC. A modified evidence-based practice- knowledge, attitudes, behaviour and decisions/outcomes questionnaire is valid across multiple professions involved in pain management. BMC Med Educ. 2014;14:263.

36. McColl A, Smith H, White P, Field J. General practitioner's perceptions of the route to evidence based medicine: a questionnaire survey. BMJ (Clinical research ed). 1998;316(7128):361-5.

37. Young JM, Ward JE. Evidence-based medicine in general practice: beliefs and barriers among Australian GPs. J Eval Clin Pract. 2001;7(2):201-10.

38. Mehrdad N, Joolaee S, Joulaee A, Bahrani N. Nursing faculties' knowledge and attitude on evidence-based practice. Iran J Nurs Midwifery Res. 2012;17(7):506-11.

39. Iles R, Davidson M. Evidence based practice: a survey of physiotherapists' current practice. Physiother Res Int. 2006;11(2):93-103.

40. Salbach NM, Jaglal SB, Korner-Bitensky N, Rappolt S, Davis D. Practitioner and organizational barriers to evidence-based practice of physical therapists for people with stroke. Phys Ther. 2007;87(10):1284-303.

41. Lyons C, Brown T, Tseng MH, Casey J, McDonald R. Evidence-based practice and research utilisation: perceived research knowledge, attitudes, practices and barriers among Australian paediatric occupational therapists. Aust Occup Ther J. 2011;58(3):178-86.

42. Scurlock-Evans L, Upton P, Upton D. Evidence-based practice in physiotherapy: a systematic review of barriers, enablers and interventions. Physiotherapy. 2014;100(3):208-19.

CHAPTER 2: DIFFERENCES IN PERCEPTIONS OF PROFESSIONALS INVOLVED IN PAIN MANAGEMENT TOWARDS EVIDENCE-BASED PRACTICE

Abstract

Background: Evidence-based practice (EBP) is an increasing expectation for professionals involved in pain management, and shares principles and methods that are used in many different sub-specialties. Healthcare professionals involved in pain management come from different disciplines, which may have different perspectives and curricula on EBP. Understanding how different professions involved in pain management view EBP is important to understand current and future uptake of pain research findings, and also to understand professionals' differences in how EBP is viewed or practiced.

Purpose: The purpose of this study was to compare different professions with respect to knowledge, attitude and behavior towards EBP and how this affects their clinical decisions and outcome using a validated and standardized questionnaire.

Study design: Cross-sectional study

Methods: The data used in this study was collected as part of the baseline assessment in a randomized control trial to evaluate the uptake of pain research evidence. The EBP-Knowledge Attitude Behavior Questionnaire (EBP-KABQ) is a 27 item questionnaire that was recently validated for use with different health professionals, and measures 4 constructs related to EBP (knowledge, attitudes, behavior and outcomes / decisions). Physicians, nurses, occupational therapists, physiotherapists and psychologists who were involved in pain management (n=675) completed the online EBP-KABQ on a single occasion. Differences between professionals were identified using a one-way between groups ANOVA in light of different samples sizes in subgroups. Post hoc analysis were conducted to estimate the magnitude of differences between professional groups (statistical significance was set at $p<0.05$; clinical significance set at a mean difference of 10%) on each of the subscales and the total.

Results: The score on 3 of the 4 subscales of the KABQ were statistically different across professions. Attitudes scores were not high, nor were they different across professions (range 57-59; ($F = 1.65$, $p = 0.16$; NS). In general knowledge scores were high (83-87%). Nurses

demonstrated statistically higher levels of EBP knowledge (87%) when compared to other groups ($F = 4.79$, $p = 0.001$), but the differences were only marginal and not deemed clinically relevant. Behaviors scores were the lowest and the most variable across professions (37-56%). Physicians had statistically, and clinically relevant, higher behavior subscale scores when compared to other professional groups ($F = 25.69$; $p = 0.001$). Physicians (73%) also had higher outcomes subscale scores ($F = 6.50$; $p = 0.001$), but this was only marginally different from other professions (65-73%).

Conclusion: The current study indicates that physicians and allied health professionals have similar patterns of responses on the KABQ-EBP questionnaire. The only clinically relevant difference was that physicians reported higher EBP behavior. Future research should investigate the differences in knowledge and behavior and underlying reasons for how implementation of EBP might be improved.

2.1 INTRODUCTION

Evidence-based practice (EBP) is defined as the integration of best research evidence with clinical expertise and patient values.[1] EBP is a means of improving the consistency and quality of healthcare that is delivered.[2] Given the importance of pain as a reason for seeking health care, EBP has the potential for substantial impact on pain management. Five steps of EBP have been described. [1, 3] The first step starts with evaluating a clinical situation and turning it into a relevant, specific and searchable clinical question. Then in the second step, the clinician locates the relevant evidence that addresses that question. This evidence is critically appraised it for its validity, clinical significance and usefulness. The clinician then integrates their experience with the obtained evidence, as well as the patient's values, circumstances, and preferences to make a shared clinical decision. In the final step, the clinician evaluates the process and outcomes with regards to practice to determine the effectiveness and efficiency of their decisions, which should contribute to ongoing continuous improvement. In this way, practice knowledge and expertise can be enhanced and accelerated through use of the EBP process.

Determinants of successful implementation of EBP in clinical practice have been described in multiple studies and relate to the individual, the clinical question, the evidence and the environment or context in which these occur. [4-8] The following have been identified as determinants of EBP: attitudes towards EBP,[4, 6] seeking research that is relevant to clinical practice,[4, 8] available knowledge sources,[8] access to knowledge resources,[4, 8] patient preferences,[6] clinical experience,[8] organisation culture,[6] nature of leadership[6] and finally, the skills required to acquire, appraise and integrate knowledge into clinical practice.[4-8] Previous studies have also identified a number of barriers for the successful implementation of EBP across different professional groups including, physicians, [9, 10] nurses [11] and physiotherapists (PT). [12, 13] Lack of time is one of the most commonly reported barriers across all professions.[9, 10, 12, 14] Lack of confidence in EBP skills have been reported in allied health professionals.[13, 15] Lack of access to resources and organizational supports are also barriers to EBP.[13, 16]

Multiple studies suggest that despite the presence of positive attitudes towards EBP, implementation can be problematic across different professions in different parts of the world. In a cross-sectional study of 419 Swedish physiotherapists, positive attitudes towards EBP were found, however, access to, and knowledge of, EBP guidelines was low.[17] A similar lack of

implementation was observed in Norwegian nurses who relied on experiential knowledge more than evidence.[5] A cross sectional study of 1521 occupational therapists from New Zealand revealed that they had positive attitudes towards EBP, moderate use of research in decision making and low levels of confidence in their ability to implement research.[18] A systematic review of knowledge, skills and behavior of physiotherapists towards EBP found that that most physiotherapists had a positive attitude towards EBP but needed to improve their knowledge, skills and behavior towards EBP.[19] This suggests that good attitude alone may not reflect excellent EBP practice behaviors.

Physicians have also reported positive attitudes towards EBP with lower implementation levels. A study on 182 primary care physicians from Qatar indicated that they had positive attitudes, but limited time and training in EBP.[20] A self-reported survey study on British primary care physicians (n=302) indicated that they had low levels of EBP knowledge and found time as a major reason for low levels of implementation.[9] A focus group study that used grounded theory approach to study attitudes [27] of Australian general practitioners towards EBP found that all of them expressed positive attitude towards EBP while expressing concerns over loss of focus on specific patient needs.[21] Psychologists were the least studied group in terms of their perceptions of EBP. In spite of having an extensive research base, implementation has been very low in mental healthcare practice [22] however; potential for effective use of EBP has been reported.[23]

A limited number of studies have compared EBP across different health professions but were not limited to a specific area of practice. A Taiwanese study that utilized a structured survey found that physicians were better than nurses in EBP utilization.[24] A British quantitative study found that nurses accessed evidence more than physiotherapists while physiotherapists had better EBP implementation than nurses.[25] A study comparing different types of allied health professionals in Australia found EBP self-efficacy, outcome, and use scores were lower for OTs when compared to other professions.[26]

Although these studies highlight that inter-professional differences may exist with respect to EBP, there are substantial limitations in the research on this issue. The studies were often underpowered for comparisons across subgroups due to low sample size. Further, most studies included health professionals focused on different areas of practice, and thus, variations may have existed due to the research evidence or context rather than differences in health

professionals' perspectives on EBP. The lack of a standardized questionnaire that has been validated for different professional groups and can accurately measure knowledge, attitude, and behaviors limits the validity of the published comparisons. The latter limitation has been resolved by recent validation of a questionnaire for assessment of different professions involved in pain management.[27] The purpose of this study was to compare different professions recruited to a study of pain management with respect to their knowledge, attitude and behaviors towards EBP and its outcome.

2.2 METHODS

2.21 Study design: Cross-sectional study

2.22 The Knowledge, Attitude and Behavior Questionnaire (EBP-KABQ)

The Knowledge, Attitude and Behavior Questionnaire (KABQ) was developed originally by Johnson and colleagues [28] to evaluate EBP teaching and learning in the undergraduate medical education curriculum. With permission, authors (JMD and ML) developed a modified KAB scale called the EBP-KABQ questionnaire, which is used in this study.[27] The EBP-KABQ initially contained 33 items but was later reduced to 26 items using confirmatory factor analysis. [27] The EBP-KABQ has four subscales: knowledge [5 Items scored on a 7 point ordinal scale; score range= 0 – 35], attitudes [13 Items (12 scored on a 7 point ordinal scale; and 1 item on a 5-point ordinal scale; score range= 0 – 89], behavior [5 Items scored on a 5 point ordinal scale; score range= 0 – 25] and outcome/decisions [3 Items scored on a 6 point ordinal scale; score range= 0 –18]. (See Table 3) The last question (Question 27) was not included in the calculation of total score or attitude subscale. Although some studies use raw scores, for this study, we calculated a percentage score for each of the subscales and the total score, to better understand the differences between the scores. The knowledge subscale covers confidence in using EBP, confidence using EBP in treatment, searching bibliographic databases, critical appraisal, and evidence based decisions. The attitude subscale with its 13 items explores attitudes of professionals towards EBP. The behavior subscale addresses areas, such as the frequency in accessing evidence from various forms such as textbooks, research papers, databases, etc. The outcome / decision subscale contains items that investigate whether EBP has influenced a change in clinical decisions.

Clinical measurement properties of the EBP-KABQ questionnaire have been studied previously.[27] The EBP-KABQ scale has achieved acceptable internal consistency (Cronbach's alpha $\alpha = 0.85$). No floor and ceiling effects were observed in the original validation study. Shi et al. [27] in their study identified that EBP-KABQ satisfied all a priori hypotheses related to theoretical constructs, supporting its construct validity. Also they conducted regression analysis that supported their a priori hypotheses that health professionals who had higher levels of education ($\beta = 4.63$, $P < 0.01$), longer years in clinical training ($\beta = 2.36$, $P < 0.01$) and possession of advanced clinical training ($\beta = 4.37$, $P < 0.01$) were more likely to use EBP. All of these supported construct validity of the EBP-KABQ. [27] Structural validity of the 26 item questionnaire has been supported through a confirmatory factor analysis, which showed acceptable goodness-of-fit statistics ($x^2 = 1056.65$; $df = 287$; $P < 0.001$; CFI = 0.89; TLI = 0.86; RMSEA = 0.06). [27]

2.23 Subject recruitment and data collection

The data used in this study were collected as part of a randomized control trial to evaluate the uptake of pain evidence.[29] The study was approved by McMaster University Research Ethics Board. Clinicians (n=675) were recruited for a clinical trial [29] assessing use of pain research. Eligible clinicians (1) were physicians, nurses, occupational therapists (OTs), physical therapists (PTs), psychologists who were currently working in clinical practice at least one day/week; (2) fluent in English; (3) have access to a computer at home or at work that has unrestricted access to the World Wide Web; and (4) have an active email account. Participants completed the online EBP-KABQ questionnaire before receiving new pain information. It was a cross-sectional study, and no additional follow-ups were required.

2.24 Statistical analysis

Data analysis was performed using the SPSS software version 22 for Windows. Descriptive statistics were used to summarize professional characteristics and check data properties. A one-way ANOVA was conducted to evaluate the differences between the five professional groups for the 4 subscales (knowledge, attitude, behavior and outcome / decisions) and for the total score, on the KABQ. Prior to conducting the ANOVA the assumption of homogeneity of variance was evaluated using Levine's test. We used Brown-Forsythe ANOVA when Levine's test is statistically significant. Post-hoc analyses were conducted using Scheffe's

test for samples that had equal variances and Games-Howell test for samples with unequal variances to identify which professions differed when statistically significant differences were observed and also to account for multiple comparison bias. To aid in interpretation of our results, we created arbitrary criteria to describe the scores obtained from the EBP-KABQ; a statistically significant difference of $\leq$ 10% was considered marginal and not clinically important and a statistically significant difference of >10% was considered clinically relevant. All assumptions for ANOVA were checked and met prior to analyses. The level of significance was set at $p < 0.05$. Our null hypothesis was the the 5 groups of healthcare professionals would be the same in their knowledge, attitude, behavior and outcomes towards EBP. The alternate hypothesis was the 5 groups of healthcare professionals would be different in their knowledge, attitude, behavior and outcomes towards EBP.

2.3 RESULTS

Participants: The sample consists of 675 clinicians from 5 different professions that were currently involved in clinical practice managing pain. (See Table 1)

2.31 EBP-KABQ Total score: For the EBP-KABQ total score, homogeneity of variances assumption was satisfied based on Levine's F test [$F(4, 670) = 1.06$; $p = 0.38$]. A one way ANOVA indicated that the differences between the professionals in the total score of EBP-KABQ was statistically significant,[$F(4, 670) = 12.08$, $p=0.001$] (See Table 2, 3) Thus the null hypothesis was rejected. To evaluate the nature of the differences between the groups, post hoc comparisons using Scheffe's test was conducted. These comparisons indicated that the mean differences between MDs and OTs (4.12); MDs and PTs (3.30); OTs and RNs (3.35); PTs and RNs (2.54) were statistically significant, but were only marginally different according to the arbitrary criteria. (See Figure 1& Table 2)

2.32 Knowledge subscale: Homogeneity of variances assumption was violated based on Levine's F test [$F(4, 670) = 3.12$; $p = 0.02$]. Since variances and sample sizes are unequal, we used a robust test of equality of means, Brown-Forsythe to calculate an F statistic. The differences between the professionals in their knowledge on evidence-based pain management was statistically significant, [$F(4, 591.2) = 4.79$, $p=0.001$] (See Table 2, 3) Thus the null hypothesis was rejected. To evaluate the nature of the differences between the groups, post hoc comparisons using Games-Howell test was conducted indicated that the difference between RNs

and OTs (mean difference = 0.83) and RNs and PTs (mean difference = 1.74) were marginally different according to the arbitrary criteria.

2.33 Attitude subscale: For the attitude subscale, homogeneity of variances assumption was violated based on a statistically significant Levine's F test [F (4, 670) = 2.71; p = 0.03]. Since variances and sample sizes are unequal, we used a robust test of equality of means, Brown-Forsythe test, to calculate an F statistic. There was no significant difference between the groups at the $p < 0.05$ level for the 5 groups of professionals [F (4, 574.8) = 1.65, p=0.16]. All the professionals scored above 50% on the attitude subscale indicating a positive attitude toward EBP across professions. (See Figure 1& Table 2)

2.34 Behavior subscale: For the behavior subscale, homogeneity of variances assumption was satisfied based on Levine's F test [F(4, 670) = 1.183; p = 0.32]. A one way ANOVA indicated that the differences between the professionals on the behavior subscale was statistically significant, [F (4, 670) = 25.69, p=0.001] (See Table 2, 3) Thus the null hypothesis was rejected. To evaluate the nature of the differences between the groups, post hoc comparisons using Scheffe's test was conducted. These comparisons indicated that the mean differences between MDs and OTs (19.21); MDs and PTs (12.87); MDs and Psychologist (12.59); MDs and RNs (10.48) were statically significant and clinically relevant. While differences between OTs and RNs (8.75); OTs and Psychs (6.63); OTs and PTs (6.35) were also statistically significant but were only marginally different according to the arbitrary criteria.

2.35 Outcome / decisions subscale: For the outcomes subscale, the homogeneity of variances assumption was satisfied based on Levine's F test [F (4, 670) = 0.432; p = 0.79]. A one way ANOVA indicated that the differences between the professionals on their perceived outcomes of evidence-based pain management was statistically significant, [F (4, 670) = 6.50, p=0.001] (See Table 2, 3), thus the null hypothesis was rejected. To evaluate the nature of the differences between the groups, post hoc comparisons using Scheffe's test was conducted. These comparisons indicated that the mean differences between MDs and OTs (7.56); MDs and PTs (3.50); OTs and RNs (6.88); OTs and PTs (4.07); OTs and Psychs (5.49) were statistically significant. However, these were only marginally different according to the arbitrary criteria.

2.4 DISCUSSION

The current study indicates that physicians, nurses, PTs, OTs and psychologists involved in pain management have similar patterns of responses on a self-report measure that assesses

dimensions of EBP. The only clinically relevant difference was that physicians reported higher EBP behavior. The total score of EBP-KABQ questionnaire indicates that physicians did marginally better when compared to other professionals, and it should be noted that the observed mean total scores for all the professions fell within a range of 6 points.

The results of this current study are in line with previous studies. In a Taiwanese study, where a structured questionnaire was used to survey physicians and nurses on their beliefs, attitudes and behaviors with regards to EBP, physicians self-reported higher scores than nurses.[24, 30] Similar findings were reported in another large survey of 6160 healthcare professionals including physicians, nurses, physiotherapists, pharmacists and technicians in a nationwide study of hospital-based professionals in Taiwan.[30] There are multiple potential reasons for this finding. Physicians are expected to be facilitators of change as they have decision making capacity in most health care organizations.[31] Thus, they may have greater awareness of how EBP affects their behavior or decision-making. Studies have found that the weights of the barriers to EBP that have been identified by the physicians are less than what has been reported by other professionals like nurses, PTs, and OTs.[24, 30] For example, physicians may have greater access to electronic resources due to socioeconomic advantages within the hospital system and in their personal lives. Moreover, the meaning of research evidence and the type of research evidence that might be valued across different professions might be different, and this would affect questionnaire scores. For example, if some professionals value qualitative research to a greater extent, they may find the tenants and principles of EBP to be disconnected from these values; or find it more difficult to implement. Another important consideration is that EBP is deeply rooted in the field of medicine which focuses on empirical evidence [32, 33] and was the original source for development of EBP. Thus, there may have a time factor affecting penetration across professions. Medicine may have had the time for deeper and broader penetration into medical curriculum and post-professional training as compared to other disciplines. This is particularly relevant given the broad geographic sampling in our study,

The nurses had statistically higher attitudes and knowledge scores when compared to the other groups; however it was not clinically relevant as only marginal differences were observed. Previous studies have suggested that nurses have a good knowledge of EBP.[26, 34] Evidence-based practice is strongly integrated within the nursing curriculum even at the undergraduate level.[35-37] Also, previous studies have found that nurses tend to understand research terms

better than other healthcare professionals and have a holistic approach towards research evidence.[34, 38] In contradiction to our study, two Taiwanese studies have reported low levels of knowledge among nurses on EBP. [24, 30] Potential explanations for this could be differences across countries in training or the sampling approaches.

Although it was not the purpose of this study to compare dimensions of EBP, a general trend was observed that behavior scores were lower than other dimensions of EBP. This aligns with the survey of 400 Norwegian nurses, where most of them reported low levels of implementation in practice. [5] There could be various factors leading to this loss of translation from knowledge to action. Nurses tend to use experience-based knowledge, as this profession is based more on the theory of guided practice.[39] There are debates in the nursing literature around concerns that EBP is based on a medical model that is grounded on empirical evidence giving less importance to patient values and other types of evidence.[39, 40] It is conceivable that the barriers that nurses have identified in previous studies such as lack of time, poor research skills and low confidence in critically appraising research evidence are more substantive barriers in implementation of EBP than that are faced by physicians.[5, 24, 30]

In the current study, PTs had similar attitudes and knowledge scores compared to other professions. While there is no benchmark for "excellent" knowledge, the knowledge subscale score of 83 was relatively high. This is in contradiction to a previous study where an online survey of 271 PTs revealed that only one third of the physiotherapists reported being aware of the existence of EBP guidelines and only 13% knew where to find them.[17] The reasons for this difference in results could be because the knowledge section in their study consisted of only 3 questions while in the current study we had 8 items exploring the knowledge pertaining to EBP. Moreover, we focussed on one particular area of practice that is pain management, while the previous study focuses on a broader area. Like other professionals in this study, behavior scores were lower than attitude scores. This is consistent with a previous systematic review of 12 studies that found that positive attitudes towards EBP did not translate into consistent and effective use of EBP in physiotherapy practice.[19] The findings of the current study concur with that of the systematic review and add to it a unique dimension of EBP in pain management.

We found that the occupational therapists in our study scored the lowest in the behavior and outcome / decision subscale, although this only reached clinical relevance for behavior. Occupational therapists (and psychologists) may have a different role in dealing with pain than

physicians, nurses and physiotherapists who have substantial roles in the management of acute pain. If occupational therapists are more focused on chronic pain, then they may have different experiences with application of EBP. This could be related to the nature of the research evidence related to chronic pain in general or specific to OT. This may have affected their behavior towards EBP and the perceived outcomes of EBP. The barriers that OTs experience such as lack of time, higher costs of continuing education, weaker research skills, and placing greater value on experience than evidence could also explain lower scores.[41] A previous study that utilised a structured knowledge attitude practice (KAP) survey to identify the perceptions of Australian paediatric occupational therapists reported low levels of research implementation. [15] Another study that included 431 New Zealand occupational therapists' view on EBP reported that 98% of the therapists predominantly relied on their own clinical expertise to guide clinical decision making.[18] Our findings add to the previous literature about EBP implementation practice in OT in that we used a validated questionnaire to identify perceptions of EBP among OTs specialising in pain management.

Despite the fact that psychologists have an important role in the management of chronic pain, they have not been previously involved in studies that have looked into perceptions of health care professionals involved in pain management on EBP.[42-44] The sample size for psychologists was smaller (n=89) owing to difficulties recruiting psychologists who identified themselves as working in the area of pain. This may be because few psychologists specialize in this area or that few identified their patient problems in terms of a physical condition. It does mean that we had lower statistical power to detect differences between psychologists and other groups. However, since EBP is just emerging in the field of psychology, this data provides a valuable perspective on its penetration into the field. Psychologists exhibited similar knowledge when compared to other professionals. Since psychologists would have a Ph.D. in many countries, a positive attitude about the use of evidence in practice is expected. However, their behavior scores were significantly lower than physicians. Potential reasons could be that EBP came later to psychology, and there would be less literature or training relating to evidence-based pain management that is specific to psychology. Also, the nature of psychology and how treatment happens with the individual might not be as amenable to EBP as in other fields. For example, many physicians would be interested in drug trials, which are straight forward to test in classic randomised controlled designs. Conversely, the complex and often multimodal treatment

provided by psychologist and other rehab professionals is less amenable to this design. This may make implementation of EBP more challenging. Further, there might be few role models to mentor psychologists about how to implement EBP.

The strengths of this current study are its large sample size, which increased our overall power. In fact, due to our large sample size even small differences were significant, and we had some marginal differences that we considered not clinically relevant. The study had more than 100 participants in each subgroup, with the exception of psychologists. Thus, we were at risk of declaring small differences to be statistically significant. While setting 10% as the threshold for clinical relevance was arbitrary, it was important to set this type of criteria to avoid over-interpretation of small differences. The 10% rule was conservative as some have suggested 20% as a ballpark for clinical importance. However, there were differences in the sizes of our subgroups that related to the number of professionals volunteering in each subgroup despite extensive recruitment of all groups. Therefore, we are not equally powered across comparisons. The use of a structured and validated questionnaire (EBP-KABQ) is a strength of the study.[27, 28] The fact that individual professions were compared in the context of pain management provided some level of control of variation in practice area although this may be more apparent than real, given that the relevant evidence, focus of pain management and type of interventions, might be substantially different across different professions and so a unifying focus does not control for all aspects of practice context.

The findings of our study should also be considered in light of some limitations. We evaluated behavior using the EBP-KABQ, and acknowledge that self-reported behavior may not be actual behavior. There were geographic and demographic differences in our samples, and the extent to which participants were engaged in pain management could have been variable. Given the decision to keep data collection brief, we did not collect data on potential mediating variables and thus are unsure of the potential reasons for the differences we observed.

2.5 CONCLUSION

The current study indicates that physicians, nurses, OTs, PTs and psychologists involved in pain management have similar patterns of responses on a self-report measure that assesses dimensions of EBP. The only clinically relevant difference was that physicians reported higher EBP

behavior. Positive attitudes and high levels of knowledge may not translate into effective EBP implementation, and the barriers for implementation need to be addressed.

Acknowledgements: The authors wish to thank Ms. Margaret Lomotan for assistance with the study. Joy C MacDermid was supported as a CIHR Chair in Gender, Work and Health and the Dr. James Roth Chair in Musculoskeletal Measurement and Knowledge Translation.

This work was supported by operating grants from Canadian Institutes of Health research (CIHR): CIHR - FRN: 107539 & FRN: 123308.

2.6 REFERENCES

1. Strauss SE: ***Evidence-based Medicine****:* 3rd ed. Edinburgh: Elsevier/Churchill Livingstone; 2005.

2. Melnyk BM, Fineout-Overholt E: ***Evidence-based practice in nursing & healthcare: A guide to best practice****:* 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2011.

3. Roberts AR, Yeager KR: ***Foundations of Evidence-Based Social Work Practice:*** New York: Oxford University Press; 2006.

4. Bostrom AM, Wallin L, Nordstrom G: **Evidence-based practice and determinants of research use in elderly care in Sweden.** J Eval Clin Pract 2007, **13**(4):665-673.

5. Dalheim A, Harthug S, Nilsen RM, Nortvedt MW: **Factors influencing the development of evidence-based practice among nurses: a self-report survey.** BMC Health Serv Res 2012, **12**:367.

6. Grol R, Wensing M: **What drives change? Barriers to and incentives for achieving evidence-based practice.** Med J Aust 2004, **180**(6 Suppl):S57-S60.

7. Kitson A, Harvey G, McCormack B: **Enabling the implementation of evidence based practice: a conceptual framework.** Quality in Health Care 1998, **7**(3):149-158.

8.Eizenberg MM: **Implementation of evidence-based nursing practice: nurses's personal and professional factors?** J Adv Nurs 2011, **67**(1):33-42.

€9. McColl A, Smith H, White P, Field J: **General practitioner's perceptions of the route to evidence based medicine: a questionnaire survey.** BMJ 1998, **316**(7128):361-365.

10. Young JM, Ward JE: **Evidence-based medicine in general practice: beliefs and barriers among Australian GPs.** J Eval Clin Pract 2001, **7**(2):201-210.

11. Mehrdad N, Salsali M, Kazemnejad A: **The spectrum of barriers to and facilitators of research utilization in Iranian nursing.** J Clin Nurs 2008, **17**(16):2194-2202.

12. Iles R, Davidson M: **Evidence based practice: a survey of physiotherapists' current practice.** Physiother Res Int 2006, **11**(2):93-103.

13. Salbach NM, Jaglal SB, Korner-Bitensky N, Rappolt S, Davis D: **Practitioner and organizational barriers to evidence-based practice of physical therapists for people with stroke.** Phys Ther 2007, **87**(10):1284-1303.

14. Heiwe S, Kajermo KN, Tyni-Lenne R, Guidetti S, Samuelsson M, Andersson IL, Wengstrom Y: **Evidence-based practice: attitudes, knowledge and behaviour among allied health care professionals.** Int J Qual Health Care 2011, **23**(2):198-209.

15. Lyons C, Brown T, Tseng MH, Casey J, McDonald R: **Evidence-based practice and research utilisation: perceived research knowledge, attitudes, practices and barriers among Australian paediatric occupational therapists.** Aust Occup Ther J 2011, **58**(3):178-186.

16. Scurlock-Evans L, Upton P, Upton D: **Evidence-based practice in physiotherapy: a systematic review of barriers, enablers and interventions.** Physiotherapy 2014, **100**(3):208-219.

17. Bernhardsson S, Johansson K, Nilsen P, Oberg B, Larsson ME: **Determinants of guideline use in primary care physical therapy: a cross-sectional survey of attitudes, knowledge, and behavior.** Phys Ther 2014, **94**(3):343-354.

18. Graham F, Robertson L, Anderson J: **New Zealand occupational therapists' views on evidence-based practice: a replicated survey of attitudes, confidence and behaviours.** Aust Occup Ther J 2013, **60**(2):120-128.

19. Silva TMd, Costa LdCM, Garcia AN, Costa LOP: **What do physical therapists think about evidence-based practice? A systematic review.** Man Ther 2015, **20**(3):388.

20. Al-Kubaisi NJ, Al-Dahnaim LA, Salama RE: **Knowledge, attitudes and practices of primary health care physicians towards evidence-based medicine in Doha, Qatar.** East Mediterr Health J 2010, **16**(11):1189-1197.

21. Mayer J, Piterman L: **The attitudes of Australian GPs to evidence-based medicine: a focus group study.** Fam Pract 1999, **16**(6):627-632.

22. Drake RE, Goldman HH, Leff HS, Lehman AF, Dixon L, Mueser KT, Torrey WC: **Implementing evidence-based practices in routine mental health service settings.** Psychiatr Serv 2001, **52**(2):179-182.

23. Painter K: **Evidence-based practices in community mental health: outcome evaluation.** J Behav Health Serv Res 2012, **39**(4):434-444.

24. Chiu YW, Weng YH, Lo HL, Hsu CC, Shih YH, Kuo KN: **Comparison of evidence-based practice between physicians and nurses: a national survey of regional hospitals in Taiwan.** J Contin Educ Health Prof 2010, **30**(2):132-138.

25. Palfreyman S, Tod A, Doyle J: **Comparing evidence-based practice of nurses and physiotherapists.** Br J Nurs 2003, **12**(4):246-253.

26. Wilkinson SA, Hinchliffe F, Hough J, Chang A: **Baseline evidence-based practice use, knowledge, and attitudes of allied health professionals: a survey to inform staff training and organisational change.** J Allied Health 2012, **41**(4):177-184.

27. Shi Q, Chesworth BM, Law M, Haynes R, MacDermid JC: **A modified evidence-based practice- knowledge, attitudes, behaviour and decisions/outcomes questionnaire is valid across multiple professions involved in pain management.** BMC Med Educ 2014, **14**(1):263.

28. Johnston JM, Leung GM, Fielding R, Tin KY, Ho LM: **The development and validation of a knowledge, attitude and behaviour questionnaire to assess undergraduate evidence-based practice teaching and learning.** Med Educ 2003, **37**(11):992-1000.

29. MacDermid JC, Law M, Buckley N, Haynes RB: **"Push" versus "Pull" for mobilizing pain evidence into practice across different health professions: a protocol for a randomized trial.** Implement Sci 2012, **7**:115.

30. Weng Y, Kuo KN, Yang C, Lo H, Chen C, Chiu Y: **Implementation of evidence-based practice across medical, nursing, pharmacological and allied healthcare professionals: a questionnaire survey in nationwide hospital settings.** Implement Sci 2013, **8**:112.

31. Reinertsen JL: **Physicians as Leaders in the Improvement of Health Care Systems.** Ann Intern Med 1998, **128**(10):833-838.

32. G G, J C, D C, al e: **Evidence-based medicine: A new approach to teaching the practice of medicine.** JAMA 1992, **268**(17):2420-2425.

33. Sackett DL, Rosenberg WMC, Gray JAM, Haynes RB, Richardson WS: **Evidence based medicine: what it is and what it isn't.** BMJ 1996, **312**(7023):71-72.

34. O'Donnell CA: **Attitudes and knowledge of primary care professionals towards evidence-based practice: a postal survey.** J Eval Clin Pract 2004, **10**(2):197-205.

35. Cronje RJ, Moch SD: **Part III. Reenvisioning undergraduate nursing students as opinion leaders to diffuse evidence-based practice in clinical settings.** J Prof Nurs 2010, **26**(1):23-28.

36. Moch SD, Cronje RJ: **Part II. Empowering grassroots evidence-based practice: a curricular model to foster undergraduate student-enabled practice change.** J Prof Nurs 2010, **26**(1):14-22.

37. Moch SD, Cronje RJ, Branson J: **Part 1. Undergraduate nursing evidence-based practice education: envisioning the role of students.** J Prof Nurs 2010, **26**(1):5-13.

38. Greenhalgh T, Douglas HR: **Experiences of general practitioners and practice nurses of training courses in evidence-based health care: a qualitative study.** Br J Gen Pract 1999, **49**(444):536-540.

39. Sigma Theta Tau International Evidence-Based Practice Task Force: **Evidence-based nursing: rationale and resources.** Worldviews Evid Based Nurs 2004, **1**(1):69-75.

40. Gerrish K, Ashworth P, Lacey A, Bailey J, Cooke J, Kendall S, McNeilly E: **Factors influencing the development of evidence-based practice: a research tool.** J Adv Nurs 2007, **57**(3):328-338.

41. Dysart AM, Tomlin GS: **Factors related to evidence-based practice among U.S. occupational therapy clinicians.** Am J Occup Ther 2002, **56**(3):275-284.

42. Turk DC, Gatchel RJ: ***Psychological approaches to pain management: a practitioner's handbook:*** New York: Guilford Publications; 2013.

43. Wallace J, Panch G: **Pain clinics, a new role for psychiatrists Results of a questionnaire survey of liaison psychiatrist involvement in pain clinics in the Greater London area.** Psychiatric Bulletin 2001, **25**(12):473-474.

44. Eccleston C: **Role of psychology in pain management.** Br J Anaesth 2001, **87**(1):144-152.

Table 1 Demographic characteristics

CHARACTERISTICS	**N=675**
Age	**%**
20-35	26.4
36-45	23.4
46-55	33.0
56+	17.2
Clinical Designation	**N (%)**
MD	131 (19.4)
OT	141 (20.8)
PT	186 (27.6)
RN	128 (19.0)
Psychologist	89 (13.2)
Highest education level	**%**
Diploma/BA	34.6
MA/MSC	33.2
MD	18.1
Ph.D.	14.1
Received advanced clinical certifications	54.1
Years of clinical training	**%**
Less than 2 years	28.3
2-5 years	43.7
Above 5 years	28.0
Location of practice	**N (%)**
Urban	463 (69)
Rural	101 (15)
Both	111 (16)

Table 2 EBP-KABQ scores for different professions

PROFESSION	KNOWLEDGE (Max score 100)			ATTITUDE (Max score 100)			BEHAVIOUR (Max score 100)			OUTCOME / DECISIONS (Max score 100)			TOTAL (Max score 100)		
	Mean (SD)	P<0.05	CR	Mean (SD)	P<0.05	CR	Mean (SD)	P<0.05	CR	Mean (SD)	P<0.05	CR	Mean (SD)	P<0.05	CR
PT	82.7 (10.1)	RN	M	56.9 (6.13)	-	-	43.2 (14.9)	PHY OT	R M	69.2 (13.4)	-	-	61.5 (5.25)	PHY RN	M M
OT	82.8 (10.0)	RN	M	57.9 (6.06)	-	-	36.8 (14.9)	PT PHY PSY RN	M R M M	65.1 (14.1)	RN PHY	M M	60.7 (5.57)	PHY RN	M M
PHY	85.6 (11.7)	-	-	57.7 (8.13)	-	-	56.0 (15.8)	OT PT RN PSY	R R R R	72.7 (14.2)	OT	M	64.8 (6.78)	OT PT	M M
RN	86.8 (8.5)	OT PT	M M	58.8 (6.19)	-	-	45.6 (17.5)	PHY OT	R M	72.0 (13.3)	OT	M	64.0 (5.91)	OT PT	M M
PSY	85.7 (10.2)	-	-	58.1 (6.47)	-	-	43.0 (17.5)	PHY OT	R M	70.6 (13.5)	-	-	63.0 (5.85)	-	-

PT – Physiotherapists; OT – Occupational Therapists; PHY – Physicians; RN – Registered Nurses; PSY – Psychologists

SD standard deviation

P<0.05 indicates professions that were statistically significant with a particular profession

CR – Clinical relevance; M – Marginally different; R – Clinically Relevant

Figure 1 EBP-KABQ scores for different professions

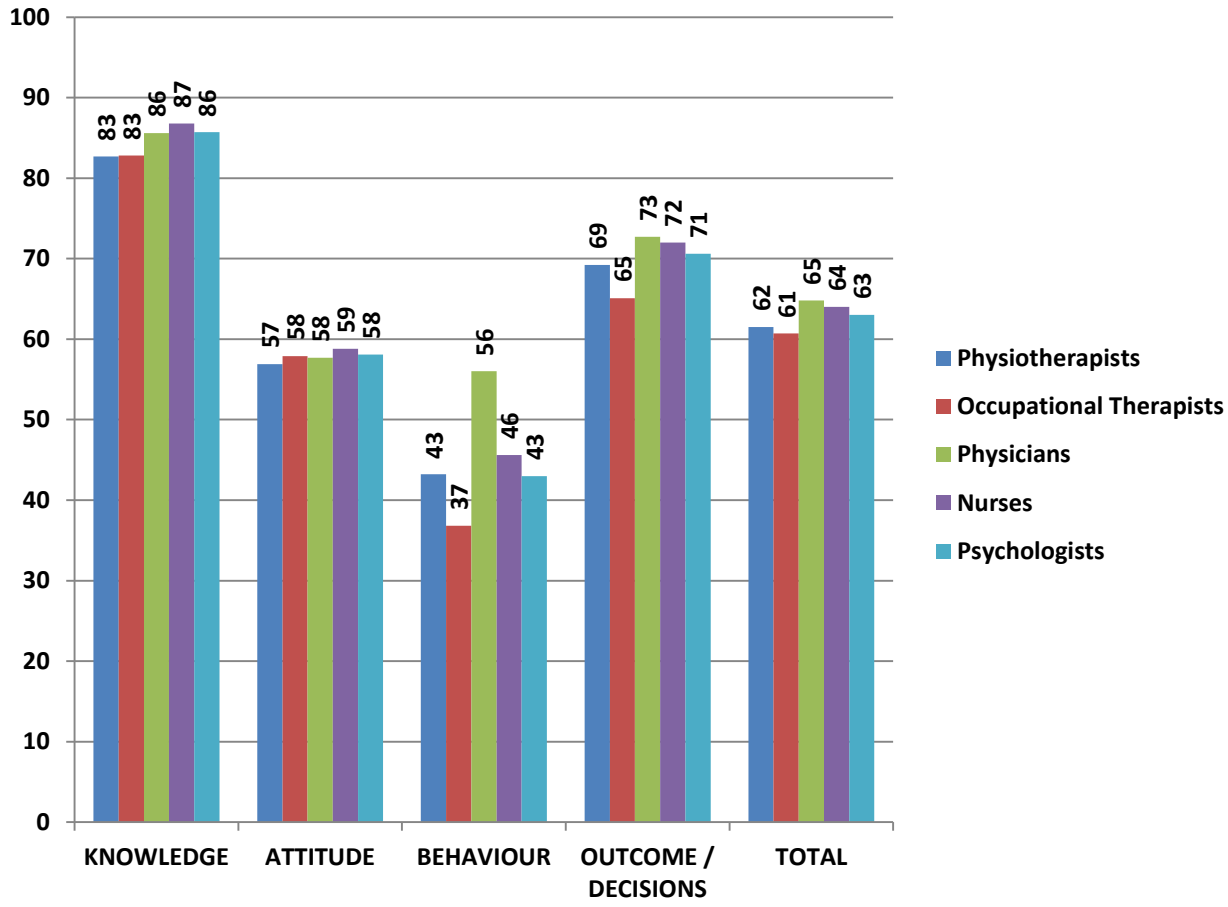


Table 3 EBP Knowledge/Attitudes/Behaviors Questionnaire (EBP-KABQ)

This is a survey designed to evaluate aspects of evidence-based practice. Please answer with your true opinions and practices (i.e., Do not tell us what you THINK we want to hear, rather tell us what YOU really believe) and complete all the questions.

All responses will be treated in strict confidence and seen only by independent research assistants. All individual identities will be masked and the analysis of the data will be blinded. Only the aggregate results will be published.

Thank you for your participation.

Evidence-Based Practice (EBP) is defined as**:** *Using/Applying evidence-based practice means the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. That is, looking up, appraising and applying both basic, factual information as well as disease- and condition-specific evidence.*

Please circle the most appropriate response:

KNOWLEDGE SUBSCALE

Please indicate how much you agree/disagree with the following statements.	**Strongly Agree**	**Moderately Agree**	**Some what Agree**	**Neutral**	**Somewhat Disagree**	**Moderately Disagree**	**Strongly Disagree**
1. I am confident in my ability to use evidence-based practice.	7	6	5	4	3	2	1
2. Using evidence-based practice increases the certainty that the selected treatment will be effective.	7	6	5	4	3	2	1
3. It is important for me to search bibliographic databases to be an effective clinician.	7	6	5	4	3	2	1
4. It is important for me to critically appraise research papers to be an effective clinician.	7	6	5	4	3	2	1
5. Evidence and patient preferences are equally important in making clinical decisions.	7	6	5	4	3	2	1

BEHAVIOR SUBSCALE

		Every day	Every other day	Every week	Every month	Never	Other (please specify)
6.	How frequently do you access clinical research evidence *in general*?	5	4	3	2	1	_____
7.	How frequently do you access clinical research evidence *from a textbook*?	5	4	3	2	1	_____
8.	How frequently do you access clinical research evidence *from original research papers*?	5	4	3	2	1	_____
9.	How frequently do you access clinical research evidence *from the Cochrane database*?	5	4	3	2	1	_____
10.	How frequently do you access clinical research evidence *from secondary sources such as ACP Journal Club, the journal Evidence-Based Medicine, POEMs (Patient-oriented evidence that matters) or CATs (Critically appraised topics)*?	5	4	3	2	1	_____

OUTCOME / DECISIONS SUBSCALE

		Completely	A lot	Moderately	Some-what	A little	Not at all
11.	How much has the use of evidence-based practice affected your clinical decisions?	6	5	4	3	2	1
12.	How much has the use of evidence-based practice affected your patient outcomes?	6	5	4	3	2	1

		All the time	Regularly	Frequently	Occasion ally	Almost Never	Never
13.	How often does new research evidence result in a change in your practice?	6	5	4	3	2	1

The following questions are asking about your personal opinion about EBP.

There are no correct answers.

Please indicate how much you agree/disagree with the following statements

ATTITUDE SUBSCALE

		A lot	A Moderate Amount	Some	A little	None at all
14.	How much confidence do you have in your clinical decision-making?	5	4	3	2	1

Please indicate how much you agree/disagree with the following statements	Strongly Agree	Moderately Agree	Some what Agree	Neutral	Some What Disagree	Moderately Disagree	Strongly Disagree
15. Evidence-based practice is a "cook-book" approach that disregards clinical experience.	7	6	5	4	3	2	1
16. It is easy to find the research.	7	6	5	4	3	2	1
17. Evidence-based practice takes too much time.	7	6	5	4	3	2	1
18. Evidence-based practice ignores the "art" of clinical practice.	7	6	5	4	3	2	1
19. Previous clinical experience is more important than research findings in choosing the best treatment available for a patient.	7	6	5	4	3	2	1
20. Evidence-based practice should be an integral part of clinical practice.	7	6	5	4	3	2	1
21. From my personal observation and experience, evidence-based practice is being used by my colleagues.	7	6	5	4	3	2	1
22. I use evidence-based practice because it improves patient	7	6	5	4	3	2	1

outcomes.

23. I use evidence-based practice because I believe in it.	7	6	5	4	3	2	1
24. I use evidence-based practice because my colleagues do.	7	6	5	4	3	2	1
25. I don't use evidence-based practice because I don't have time.	7	6	5	4	3	2	1
26. I don't use evidence-based practice because it is difficult to change.	7	6	5	4	3	2	1
27. I don't use evidence-based practice for another reason (specify): _____	7	6	5	4	3	2	1

Thank you for taking the time to complete this survey.

CHAPTER 3: THE SEARCH TO ALLEVIATE PAIN: UNDERSTANDING THE COMPETENCIES OF CLINICIANS ACCESSING ELECTRONIC DATABASES TO SEARCH FOR EVIDENCE ON PAIN MANAGEMENT USING A MIXED METHODS APPROACH.

Abstract

Introduction: Searching electronic databases is an essential skill for a clinician who wishes to base his/her clinical practice on research evidence in order to provide high-quality care to patients seeking their service. This act of searching and retrieving evidence falls under the second step of the EBP process – tracking down the best evidence.

Purpose: The purpose of the current study is to measure and understand the competencies of clinicians accessing electronic databases to search for evidence on pain management.

Methods: Study design: Mixed methods – convergent parallel strategy.

Procedure: Our participants consisted of 37 healthcare professionals (14 occupational therapists, 13 physiotherapists, 8 nurses, 2 psychologists) who were actively involved in pain management. This study involved two parts (a qualitative and a quantitative part) that ran in parallel. Participants were interviewed using a semi-structured interview guide (qualitative data); data were transcribed verbatim. During the interview, participants were evaluated on a set of pre-determined practice competencies using a chart-stimulated recall (CSR) technique (quantitative data). Interviews were completed on a single occasion. CSR was scored on a 7 point Likert scale by the interviewer. These were summarized by means and standard deviations for each competency and as an overall score. Transcripts were entered in N-Vivo for a line by line coding. Coding to obtain themes was completed by two raters. Themes across each of the competencies were integrated by three raters.

Results: The mean total CSR score was 36 out of 63. The highest score 5.7/7 was achieved for identifying sources of information and the lowest score, 2.4/7, was for awareness of a systematic review related to their question. From the 9 items, 5 items namely identifying the issues, formulating the question, identifying sources of information, finding the evidence, and articulating the study conclusion had scores above 4, indicating acceptable competency in these

areas. Seven themes evolved out of the qualitative responses to these competencies. They are: formulating a research question, sources of evidence accessed, search strategy, refining the yield, barriers and facilitators, clinical decision making and knowledge and awareness about appraising quality of evidence. The qualitative results informed an understanding of the strengths and weaknesses in the competencies evaluated.

Conclusion: Using a mixed methods approach, we found that clinicians demonstrated basic literature searching skills, use of PICO to design questions and awareness of resources. They performed less well in using search strategies that would make their searches more accurate or efficient and were less able to judge quality.

Keywords: Mixed methods, literature review, CSR, qualitative interviews

3.1 INTRODUCTION

EBP is defined as integrating individual clinical expertise with the best available external clinical evidence from systematic research.(1) EBP is an iterative process that includes 5 steps in the following order: formulating an answerable question; tracking down the best evidence; critical appraisal of the retrieved evidence; application of the appraised evidence in individual clinical practice and finally assessing the outcome of the process.(2) Searching electronic databases is an essential skill for any clinician who wishes to base his/her clinical practice on research evidence. The act of searching and retrieving evidence falls under the second step of the EBP process – tracking down the best evidence. Literature searching is an essential skill that improves with training and practice. (3)

There are multiple steps that are involved in the process of searching and retrieving evidence.(4, 5) First and foremost the clinician should be able to identify the clinical problem for which they need an answer. The next step is to frame a research question to clearly describe the clinical problem. The PICO (T) (population, intervention, control, outcomes and possibly time) format can be used and is an effective way to frame a research question.(2, 6) Previous research studies have found that using the PICO format to frame a research question was associated with better overall reporting quality.(7-9)

The next step is to identify the sources of evidence that could provide research articles that can answer this question. Previous studies have supported the use of electronic databases as the best source; however other sources may be relevant.(10) Sometimes, inability to identify an appropriate source can leave the need for answers unmet.(11) The next step is the actual search, followed by the refining of the search and retrieval of relevant articles.(4) Once articles are retrieved, the evidence should be critically appraised and then integrated into practice keeping in mind patient preferences.

Searching and appraising evidence is a commonly reported barrier to EBP.(12) Previous studies have documented the experience of clinicians using online electronic databases for literature review. Rosenbaum and colleagues have reported that many healthcare professionals in their study that involved searching The Cochrane Library, displayed feelings of ineptitude, alienation and frustration because of technical jargon and maneuvering difficulties.(13) Another study found that many clinicians reported that many clinicians did not have adequate training in searching for medical literature in MEDLINE.(14) The experience of clinicians using online

databases to find evidence related to pain management is an area that has not been studied well. Understanding their competencies might identify resources for pushing out evidence to clinicians provide a better experience of searching for evidence, thus improving evidence-based practice.

Understanding the competency of clinicians is a complex process and quantitative methods alone cannot give a clear picture. It is important to understand why those numbers were obtained. Mixed methods design would be an ideal way to achieve this. A mixed Methods approach is a design that involves integration of qualitative and quantitative data to better understand a concept that is being studied.(15) Mixed methods is a type of research inquiry that provides a holistic approach by enabling researchers to bridge the two streams of qualitative and quantitative methodology.(16) Mixed method designs are becoming more prevalent in healthcare and health-related research.(17, 18) We chose a mixed methods design because it can give us a greater understanding of the competencies of clinicians as they use electronic databases to find evidence related to pain management. This would give us a greater insight into areas of strength and weakness with respect to the competencies evaluated, and extends our understanding beyond numbers; while also cross-validating the quantitative assessment with qualitative data.(19)

The purpose of the current study is to measure and understand the competencies of clinicians accessing electronic databases to search for evidence on pain management.

3.2 METHODS

3.21 Study design: Mixed methods – convergent parallel strategy.

Participants: A voluntary convenience sample was recruited for the study. Health care professionals who are part of a randomized control trial looking into the effectiveness of Push versus Pull strategies for disseminating evidence on pain management (20) signed up for the study voluntarily by checking an option in the forms provided for the study asking them if they were interested in discussing their experiences in searching for evidence on pain. Our participants consisted of 37 healthcare professionals who are currently involved in pain management. [PTs (13), OTs (14), RN (8) and Psychologists (2)]. Demographic characteristics are listed in Table 1. Ethics approval for this study was obtained through McMaster Research Ethics Board, Hamilton, Ontario, Canada. The study was conducted from the MacHand Lab at McMaster University, Hamilton, Canada. Once participants were recruited, a research coordinator contacted them via mail and telephone and booked a convenient time for a telephone interview.

This study involved two parts (a qualitative and a quantitative part) that ran parallel to understand the level and areas of strength/weakness with respect to the competencies of clinicians conducting literature searches. The methodology selected was a convergent parallel strategy(15) where the framing of questions and their interpretation was embedded in the context of method designed to evaluated competencies using Chart stimulated recall (CSR).

Quantitative methods: CSR was used to evaluate the competencies of clinicians quantitatively. CSR was originally developed as a quantitative assessment of competency where a clinician is interviewed with a focus on understanding the underlying cognitive processes while managing a client. The process is facilitated by allowing the clinician to access the client chart during the interview to serve as a platform for understanding their approach to a situation in their own practice. During the interview, a skilled evaluator scored their responses based on alignment with a set of pre-determined practice competencies.(21) CSR was originally used in medical education as a teaching and evaluation tool.(22, 23) It can provide a window into the mind of the clinician and the rationale behind decisions while managing a client.(24)

CSR is used to assess competencies in several disciplines like medicine, occupational therapy, and physical therapy.(21, 25-27) In a study that involved 12 occupational therapists who were assessed by 2 OT faculties at two different occasions, CSR demonstrated a high inter-rater reliability (ICC 0.97) and low inter-case reliability (ICC 0.44).(28) Miller et al(26) in their study that included 53 physical therapists and compared the reliability of CSR to various tools used in the onsite assessment (including CSR) found that the inter-rater reliability of CSR was above 0.70. Norman and colleagues conducted a study on the reliability of practice assessments used to examine the continuing competence of family physicians practicing in Ontario. They found that CSR demonstrated high inter-rater reliability of ICC 0.75 – 0.90.(21)

For this study the CSR process was used to evaluate 9 competencies that were identified for the application of research evidence in pain management. These were identified based on an understanding of the steps of EBP and application to individual patients. The 9 competencies are described in the interview guide (Table 3). Each competency was scored on a 7 point scale, with higher scores indicating better competency in a given area.

Qualitative methods: While originally described as a competency rating, the CSR approach was adapted in this study and in a previous trial (20) evaluating clinician's competencies of using outcome measures in practice, (29) to include qualitative analysis of the text responses.

Qualitative analysis of the responses, provide an opportunity to explore themes such as areas of strength/weakness, misconceptions, or attitudes/ beliefs towards the competencies.

Data Collection: In the current study, clinicians were asked to recall 2 of their recent patients where pain was a major complaint and were asked to describe them, and how they managed their patients' pain. They were allowed access to the client chart during the interview, but this was not required. All interviews were conducted by one of the investigators (VA) by phone. The interviewer (VA) put forth a series of open-ended questions about each of the 9 competencies, starting with broad questions and probing as needed to determine how the individual was thinking or behaving with respect to the descriptors provided for each competency. Where possible specific examples such as search terms or databases used was a probe. (See Appendix 1) All interviews were audiotaped using an Olympus VN-3100PC recorder. As they were being interviewed they were scored on the 9 pre-determined practice competencies that were described earlier. Each competency was scored on a 7 point Likert scale. (See Appendix 2) The sum of the 9 items makes the total score. Structured interviews (n = 37) were continued until saturation (the point at which no new data emerged). The following 9 competencies that reflect the process of literature review process were examined:

1. Identification of an issue about the patient's pain for clinical decision-making

2 Formulating the question in an answerable manner

3. Identification of the source of research evidence to answer this question

4. Knowing how to find research evidence that would answer this question

5. Articulate the general conclusion from relevant research

6. Ability to articulate specifics of dosage or expected effects from relevant research

7. Ability to name contraindications or considerations derived from relevant research

8. Ability to differentiate high-quality versus low-quality studies

9. Ability to identify and cite systematic reviews pertaining to this question

3.22 Data analysis

3.221 Quantitative: Mean and standard deviation for individual dimensions of the CSR scoring and overall score was calculated using SPSS version 22.[1]

3.22Qualitative:

All interviews were transcribed verbatim, then checked by the interviewer for accuracy and for analysis we used a general descriptive qualitative search methodology, as described by Sandelowski.(30) NVivo 10[2] qualitative data management software was used for data organization. Data collection and analysis occurred following an inductive, iterative process. Coding was framed in three progressive stages; open, axial and selective coding was done by two raters. Open coding consisted of a line-by-line analysis of the transcript to determine codes. As each new transcript was analyzed, data were compared with existing codes and either an existing code or a new code was created using NVivo. This stage of analysis also involved writing reflective memos that helped later in the analysis stages. Axial coding is the second step, in which codes were compared with each other and reflective memos to form categories, representing similar codes brought together through the relating of concepts inherent in the codes.(30) Selective coding is the last step where categories were examined and compared to each other to develop themes. Credibility and trustworthiness of the study process were enhanced by the following means:

i. Prolonged engagement with data in person and frequent listening to the interviews and checking if it matched the CSR scoring.(31)
ii. Verbatim transcription of interviews.(32)
iii. Development and maintenance of audit trail throughout the research process, to ensure that the same questions were asked with every participant process.(31)
iv. Peer debriefing was conducted with another author (JMD). Transcripts, codes, themes, and recordings were examined during peer debriefing. (30)

3.3 RESULTS

QUANTITATIVE METHOD (CSR SCORES):

Participants were scored on nine practice competencies by an interviewer (VA) as they were being interviewed. The mean total CSR score was 36 of a total of 63(SD = 7.64; Range = 20-52)

[1] IBM corporation, NY, USA
[2] QSR International, Australia

. This score indicated that the participants had moderate level of competency on literature searches. When the individual competencies were explored, it was found that the participants scored well on basic evidence search skills (competencies 1-5; mean scores 4 -6 out of 7). When it came to advanced skills (competencies 6-9) like appraising evidence, grading quality of evidence etc. they scored low. (mean scores 2-4 out of 7). (See Table 2)

3.31 Qualitative:

Seven main themes were identified in each of the competencies based on the analysis of interviews and peer debriefing. Themes were refined through iterative discussion.

Based on the first round of analysis the results from each of the 9 competencies were organized around themes. The data included a description of the current behaviors around specific competencies, misconceptions or areas where knowledge was lacking and perceptions of respondents.

1: Formulating a research question

The use of PICO (population or patient, intervention or indicator, comparison or control, outcome) to formulate research questions came up during the interviews. The following quote illustrates this:

> *"I guess what we learned in school was PICO, population, intervention, comparison or outcome so, for both of those, I think I did more population so low back pain" – 643*

However, only 2 out of the 37 participants specifically mentioned using PICO format, when probed about whether they used this approach. While exploring the reasons for low utilization of the PICO format to formulate research questions, participants said that not all searches are based on interventions, so they had to modify their search terms. This finding is illustrated in the following quote of a clinician who felt comfortable using PICO because the question was an intervention question:

> *"I try to use the PICO format sometimes, like for a patient or population, like the diagnosis, that kind of thing, an intervention that I'm, that I'm interested in, so in this case, it was graded motor imagery or neurosensory retraining, and then the comparison group" – 745*

Theme 2: Sources of evidence accessed

Participants reported searching for and accessing evidence in various electronic databases, journals, and professional websites. PubMed was the most commonly used database followed by

Google Scholar. The other that used was CINAHL, OVID, Psych info. This seemed to be based on awareness rather than specific knowledge about differences in the databases. The following quotes describe this:

> *"I would usually, where I would usually go sort of these two either go to PubMed or Google Scholar" – 632*
>
> *"I use the CINAHL database, OVID, Google Scholar, trying to find some journals that lend credibility" – 639*

Participants who were rehab professionals websites such as American Physical Therapy Association (APTA), Rehab +, Canadian Journal of Occupational Therapy, American Journals of Occupational Therapy, while RNs and psychologists more often mentioned Psych Info, Clinical Information Access Portal, International Association for The Study of Pain. This is illustrated in the following quote:

> *"For me I always go to the APTA, I work for a company, we do outpatient therapy, they have a lot of articles and they have all the research-based evidence, and I don't know what else to say. I might look in journals, I read abstracts to articles, maybe pain medication articles, The Journal of Pain and orthopedic"- 651*

We generated a word cloud for the most commonly searched databases using NVivo. (See figure 1) In the word cloud, larger the word, the more frequently it was mentioned by the participants.

Figure 1 Common databases searched

Theme 3: Search strategy

Most participants searched by single or limited number of keywords. Only a minority of participants reported the use of Boolean operators to connect search terms (3/37). Further, participants who did use such connectors have demonstrated low levels of competency in how to best operationalize these. One participant noted:

> *"Yeah, I would probably use 'AND', and depending on what it was, …… depending on what it was if there were 2 ways of saying something, sometimes I would use 'OR', both back pain or chronic back pain or back pain in search engines" – 643*

The most stated reasons for using "AND" was for finding synonyms and "OR" for increasing the specificity of the search. None of the participants specifically mentioned using filters like Clinical Queries even when this would have been preferable to designing their own Boolean search strategy. The following quote illustrates this:

> *"I would probably put chronic pain AND whiplash AND female AND Intervention. I know it's a really long search but I would probably add interventions afterward"- 649*

Another common practice that came up during the interviews was the use of plus sign "+" to connect search terms. This is evident from the following quote:

> *"Like what I try and do, for example, the first one, I would search diabetes plus insulin plus chronic pain and that's how I do that one" – 639*

Also, our participants noted that they tend to use different forms of the same word to be more comprehensive in their search. The following quote describes this practice:

> *"Yeah, I would probably use and, and depending on what it was, I'm trying to think, depending on what it was if there were 2 ways of saying something, sometimes I would use or, both back pain or chronic back pain or back pain in search engines" –643*

Theme 4: Refining the yield

The participants in our study used different methods to narrow down or refine the search. The most commonly used strategy was scan the title then abstract and, if deemed of interest, download the full-text of the article. This process is illustrated in the following comment

"Usually, I would scan the titles… if the title looks like something that would actually be relevant, I would read the abstract. If the abstract looks good I would actually download the article… then actually reading the articles."- 643

Another strategy used by participants was to limit the search by the date of publication, by looking for recent articles. The following quote highlights this practice:

"Usually, I would scan… the year of publication just because if it's super outdated, I probably wouldn't look at it …." – 643

Some noted that they would look into relevant articles section of the databases (PubMed feature) or/and the articles that cited the current paper. This is evident in the following comment:

"……can do related articles or cited by articles so you can ballpark a whole new list of 30 articles that you get more recent ones ……" - 643

Finally, some of our participants noted that they just read the articles that were at the top of the list. The following quote illustrates this:

"Logistically I would look at the ones that came up first, I would open them, I guess I might be pulled by certain titles…"- 653

Theme 5: Barriers and facilitators

Access, time, and resources were noted as major barriers to searching and appraising evidence; while institutional access was a major facilitator. Respondents did not mention open access resources; demonstrate a clear knowledge about how to access databases versus full–text articles, or the range of journals that were available in their workplace. The barriers and facilitators are summarized in the following table with illustrative quotes.

Barriers	***Illustrative Quotes***
Access to databases	*"Right now, I don't have access to, used to be a, I used to go to XXX have access to all the databases. Right now, I don't through my workplace. So, I actually generally just start with just a Google Scholar search, see if I can find something there"- 683*

Limited time and access	*"I would like to be searching journals. But one of the limitations is time and the other is access, our hospital from a rehab perspective doesn't have access to any journals. So we're limited to what you can access"- 679*
Limited Staffing	*"……..our hospital has very limited staff resources also very limited time for research" - 679*
Difficulty in navigation	*"Medline search or PubMed. I've looked at them but honestly I don t find them very useful, I find them difficult to navigate. I haven't looked at them for a while and abstracts aren't always sufficient for me in getting full articles. It's something that I have not found easy to do"- 651*

Facilitators	***Illustrative quotes***
Access to databases	*"I would log on to, I have access to the University of XXX library, so I would log on to…"- 663*

Theme 6: Clinical decision-making

For making clinical decisions the participants in our study often consulted peers, as their professional expertise was valued. However, their acquisition of "knowledge" of the evidence was also sometimes provided second-hand through their peers. The following quote illustrates this:

> *"…by talking to a physiotherapy colleague about that, he told me that for back braces a lot of time they are not recommended with chronic pain because you get reliant on them and then your stomach muscles weaken and etcetera. So I didn't recommend the back braces" – 643*

Some participants indicated that they give greater priority to clinical experience gained over time dealing with various kinds of patients, in decision making. Further, few participants were clear on how to integrate evidence and experience. This is evident in the following quotes:

> *"I have 25 years' experience so here it comes; I give a set of exercises that have been effective for me and I use them. Have they been well researched, I doubt it..."- 653*

"Well you know that's probably just experience that I've learned over the years" – 673

Some participants relied on their entry level training even after 20 years of experience. It is noted in the following quotes:

".....and it's something that learned in school, and am practicing even after 20 years..."- 750

"..... I learned this in school when I did my undergrad and practice even after 20 years of experience…"- 653

Participants in our study also noted that they looked up to factual evidence or secondary sources of evidence that would meet their information needs. The following quote illustrates this:

"Pretty much it's evidence-based as far as the medications utilization in a particular patient group and I've always tried to get informed by the evidence notes if it's available. Being that I have been a member of the New Zealand Pain Society so frequently giving updates theories different online"- 677

One participant told that decisions integrate multiple sources of information, including research evidence. This is illustrated in the following comment:

"I've learned through colleagues, a little bit through research and upper management as well as too, and training as well as to how often they should be performing relaxation, how often they should be planning out their day and that kind of stuff, it's been more on the job training I guess you could say", - 649

Theme 7: Knowledge and awareness about appraising quality of evidence

When asked about the two main paradigms of research methods, a few of our participants were able to identify the two research paradigms – quantitative and qualitative. This is illustrated in the following quote:

"A study design would be, there are various kinds of study designs, there's quantitative where you would typically have a defined outcome as in … so it's more measuring quantity and then there's qualitative." 673

A fewer participants were able to identify and discuss the levels of evidence. The following quote illustrates this:

"Yes, the National Guidelines for Acute Pain Management in Australia, there is a chapter on it, but I haven't read it in many years, but it talks about level 1, level 2, level 3, level 4, and I think it goes up to 5; Level 5 is the more from experience by case studies, I think level 1 is randomized control trials, good research techniques." 733

3.4 DISCUSSION

This study explored the competencies of clinicians using electronic databases to search evidence related to pain. Overall we found that clinicians have low to moderate competencies with respect to multiple aspects of searching, evaluating and applying evidence in their practice. This conclusion is based on integrating qualitative and quantitative data from our CSR. Since the qualitative data revealed both what people were doing; and sometimes, more importantly, gaps in knowledge or behavior, it provided a useful understanding of areas where competency was lower than expected. We organized our data in themes ranged from searching for evidence, refining the yield, barriers encountered during search and quality of studies searched. We acknowledge these themes were driven by the competencies we evaluated.

We found that clinicians performed well with their basic evidence search skills like framing a research question, knowing about appropriate databases, identifying simple keywords etc. However, there were multiple indicators that their search skills lacked depth. For example, embedded tools within databases such as MeSH terms or filters were not mentioned or reported as being used. Boolean operators help to translate a clinical question to a specified format which the search engine can understand. This would help to filter off content that is irrelevant to the research question. Use of Boolean terms was rare, and when implemented indicated a lack of understanding of how these work e.g. use of redundant terms. However, in our study only 2 out of the 37 participants used Boolean operators routinely in their searches. The reasons for this could be that many participants do not have the knowledge of these advanced literature search skills and these skills are not consistently taught at schools that train healthcare professionals. It may also be that clinicians may think that it is complicated and time-consuming to use these

Boolean operators, which in reality would actually save their time by avoiding irrelevant articles. It has been previously reported that the skills required to acquire, appraise and integrate knowledge into clinical practice is a major determinant of EBP.(33, 34) Improving continuing education opportunities around the area of literature searching skills would help clinicians understand the usefulness of these operators and implement them in everyday search of evidence.

Clinical Queries is a filter that would have helped clinician's access research for making specific clinical decisions e.g. effectiveness or prognosis- yet even where specific types of papers were identified as information source was not used. Further, people did not mention subscribing to alerting services such as those embedded in PubMed or Rehab+. Filtering the evidence was poorly described, and often haphazard. Given that searching was not performed efficiently, a lack of awareness of how to filter studies by quality becomes a more important deficit.

Formatting a well-built clinical question (foreground question) is the fundamental skill in the evidence-based search strategy, and these questions should be relevant to client problems and should be able to direct the search to get precise answers.(6) In the current study only 2 out of the 37 participants responded as using the PICO format to frame research questions. Previous studies have also suggested low implementation rates of PICO in journal reporting. A systematic review of 313 articles published in anesthesiology journals found that 96% did not apply PICOT format into their research question.(7) When probed, respondents in the current study reported that they had learned this during their clinical training but had forgotten it,. Solutions to this knowledge gap might include refresher courses on literature searches, testing this competency in licensure, role-modeling, technologic solutions or other strategies.

Inability to identify the levels of evidence and classify articles of high and low methodological quality would impede the implementation of EBP in clinical practice resulting in patient care that is not current. (35) In our study, we found that the participants in our study scored less in the CSR (< 4) for this area. Also, most of the participants in the current study were not able to identify the levels of evidence. It is important clinicians would be able to differentiate between high-quality and low-quality evidence. As the clinical literature grows in a rapid pace it becomes essential so that EBP becomes doable so as to improve patient care.

In the current study, we found that most of the clinicians used PubMed followed by Google Scholar. This is consistent with previous studies that have found PubMed and Google Scholar to be the most accessed electronic databases by health professionals.(35-37) we observed that clinicians tend to use electronic databases and online portals that were specific to their profession. For example, nurses and psychologists tend to use Psychinfo more than other databases. This behavior is consistent with previous studies.(33, 38) Clarke and colleagues(38) in their literature review to understand the information needs of physicians and nurses have found that they accessed job-specific resources to find practitioner-oriented information. Bolstrom and colleagues(33) reported that seeking research that is related to clinical practice is a major predictor of research utilization (OR = 5.56, $P = 0.019$).

The participants in our study also talked about various barriers and facilitators of online search for pain evidence. A major barrier was the ability to access electronic databases. Similar reports have emerged in the literature and our findings confirm them.(33, 39) Bolstrom and colleagues(33) found that access to databases was a major predictor of research utilization (OR = 6.65; p = 0.005). This calls in for changes in policy that would enable increased access to electronic databases at workplaces. However, clinicians also lack awareness of resources that are available. They would include open access journals and textbooks, evidence refineries that summarize evidence, options to gain access through students and even access to paper journals in their own contexts. For example, one participant reported that their library has no rehabilitation journals- which is very unlikely. Also, another important barrier was the lack of time which has become an endemic problem for research utilization. Previous research studies have identified this issue and our qualitative finding adds credibility to the quantitative findings of those studies.(40-42)

The participants in the current study reported that they looked to their peers to help with clinical decision making. This has been previously reported by Clarke and colleagues.(38) The reasons for this could be the quickness and the ease of getting information from the peers.(38) However, the pieces of information gathered this way might be out-dated and sometimes incorrect, affecting the quality of care rendered to patients. Another valued source was previous experience which can help clinicians be more accurate and efficient with decision-making as they recognize patterns more quickly.(43) However, when expertise is not combined with current

evidence then it may become out-dated and reflect a persistent use of less effective options. Studies suggest that 30 to 40% of patients do not receive care according to current scientific evidence.(44) Current models of patient care focus on evidence-based practice, and it is important that clinicians move from traditional knowledge sources to evidence-based practice to enhance the quality of the care delivered.

The strengths of the current study are as follows: We used a mixed methods approach of integrating qualitative and quantitative methods. We used the quantitative data that was collected to back up the qualitative interview data. This enabled us to better explore the dimensions of evidence search that studied. We used CSR technique to collect our quantitative data. This is a valid and reliable approach with professionals such as physicians, nurses, and rehabilitation professionals, to collecting data in mixed methods studies and has added to the credibility of the data collected in this study.(21, 28, 29, 45, 46) This study included participants from different geographical regions (Canada, United States, Australia, New Zealand, South Africa) thus giving a snapshot of how evidence-based practice is implemented in different parts of the globe. Interpretation and findings of the study have a few limitations, the number of professionals was not equal, and hence we did not try to compare the differences across professionals. Even though there was only 2 psychologists participated in the study, their transcripts were also analyzed and included since their behaviors are relatively less studied when compared with other professionals.

In conclusion, using a mixed methods approach, we found that clinicians were performing well with their basic literature review skills, but when it came to advanced skills like using Boolean operators, critical appraisal and finding levels of evidence.

Acknowledgments: The authors wish to thank Margaret Lomotan for assistance with the study. This study was funded by CIHR - FRN: 107539 & FRN: 123308

3.5 REFERENCES

1. Sackett DL, Rosenberg WMC. The Need for Evidence-Based Medicine. Journal of the Royal Society of Medicine. 1995;88(11):620-4.

2. Sackett DL. Evidence-based medicine : how to practice and teach EBM. Edinburgh; New York: Churchill Livingstone; 2000. 261 p.

3. Ghali WA, Saitz R, Eskew AH, Gupta M, Quan H, Hershman WY. Successful teaching in evidence-based medicine. Medical Education. 2000;34(1):18-22.

4. Krupski TL, Dahm P, Fesperman SF, Schardt CM. How to perform a literature search. The Journal of urology. 2008;179(4):1264-70.

5. Browne Ma. The field of information policy: 1. Fundamental concepts. Journal of Information Science. 1997;23(4):261-75.

6. Asking Focussed Questions Oxford, United Kingdom: Centre for Evidence-Based Medicine; 2014 [Available from: http://www.cebm.net/asking-focused-questions/.

7. Thabane L, Thomas T, Ye C, Paul J. Posing the research question: not so simple. Canadian Journal of Anaesthesia. 2009;56(1):71-9.

8. Rios LP, Ye C, Thabane L. Association between framing of the research question using the PICOT format and reporting quality of randomized controlled trials. BMC Medical Research Methodology. 2010;10:11.

9. Borg Debono V, Zhang S, Ye C, Paul J, Arya A, Hurlburt L, et al. A look at the potential association between PICOT framing of a research question and the quality of reporting of analgesia RCTs. BMC Anesthesiology. 2013;13(1):44.

10. Parkhill A, Hill K. Identifying the effective evidence sources to use in developing Clinical Guidelines for Acute Stroke Management: lived experiences of the search specialist and project manager. Health Information and Libraries Journal. 2009;26(1):47-55.

11. Maggio LA, Cate OT, Moorhead LL, van Stiphout F, Kramer BM, Ter Braak E, et al. Characterizing physicians' information needs at the point of care. Perspectives on Medical Education. 2014;3(5):332-42.

12. Weng YH, Kuo KN, Yang CY, Lo HL, Chen C, Chiu YW. Implementation of evidence-based practice across medical, nursing, pharmacological and allied healthcare professionals: a questionnaire survey in nationwide hospital settings. Implementation Science. 2013;8:112.

13. Rosenbaum SE, Glenton C, Cracknell J. User experiences of evidence-based online resources for health professionals: user testing of The Cochrane Library. BMC Medical Informatics and Decision Making. 2008;8:34.

14. Haynes RB, McKibbon KA, Walker CJ, Ryan N, Fitzgerald D, Ramsden MF. Online Access to MEDLINE in Clinical SettingsA Study of Use and Usefulness. Annals of Internal Medicine. 1990;112(1):78-84.

15. Creswell JW, Clark VLP. Designing and Conducting Mixed Methods Research: Washington D.C.: SAGE Publications; 2011.

16. Hesse-Biber SN, Johnson RB. The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry: Oxford: Oxford University Press; 2015.

17. Curry LA, Krumholz HM, Cathain A, Clark VLP, Cherlin E, Bradley EH. Mixed Methods in Biomedical and Health Services Research. Circulation: Cardiovascular Quality and Outcomes. 2013;6(1):119-23.

18. Ostlund U, Kidd L, Wengstrom Y, Rowa-Dewar N. Combining qualitative and quantitative research within mixed method research designs: a methodological review. International Journal of Nursing Studies. 2011;48(3):369-83.

19. Wisdom JP, Cavaleri MA, Onwuegbuzie AJ, Green CA. Methodological reporting in qualitative, quantitative, and mixed methods health services research articles. Health Services Research. 2012;47(2):721-45.

20. MacDermid JC, Law M, Buckley N, Haynes RB. "Push" versus "Pull" for mobilizing pain evidence into practice across different health professions: a protocol for a randomized trial. Implementation science 2012;7:115.

21. Norman GR, Davis DA, Lamb S, Hanna E, Caulford P, Kaigas T. Competency assessment of primary care physicians as part of a peer review program. Jama. 1993;270(9):1046-51.

22. Schipper S, Ross S. Structured teaching and assessment: a new chart-stimulated recall worksheet for family medicine residents. Canadian Family Physician. 2010;56(9):958-9, e352-4.

23. Jennett P, Affleck L. Chart audit and chart stimulated recall as methods of needs assessment in continuing professional health education. Journal of Continuing Education in the Health Professions. 1998; 18(3): 163-71.

24. Jennett PA, Scott SM, Atkinson MA, Crutcher RA, Hogan DB, Elford RW, et al. Patient charts and physician office management decisions: Chart audit and chart stimulated recall. Journal of Continuing Education in the Health Professions. 1995; 18:31-9.

25. Goulet F, Jacques A, Gagnon R, Racette P, Sieber W. Assessment of family physicians' performance using patient charts: interrater reliability and concordance with chart-stimulated recall interview. Evaluation & the Health Professions 2007;30(4):376-92.

26. Miller PA, Nayer M, Eva KW. Psychometric properties of a peer-assessment program to assess continuing competence in physical therapy. Physical Therapy. 2010;90(7):1026-38.

27. Salvatori P, Simonavicius N, Moore J, Rimmer G, Patterson M. Meeting the challenge of assessing clinical competence of occupational therapists within a program management environment. Canadian Journal of Occupational Therapy. 2008;75(1):51-60.

28. Salvatori P, Baptiste S, Ward M. Development of a tool to measure clinical competence in occupational therapy: a pilot study? Canadian journal of occupational therapy. 2000;67(1):51-60.

29. MacDermid JC, Solomon P, Law M, Russell D, Stratford P. Defining the effect and mediators of two knowledge translation strategies designed to alter knowledge, intent and clinical utilization of rehabilitation outcome measures: a study protocol [NCT00298727. Implementation science. 2006;1:14.

30. Sandelowski M. The problem of rigor in qualitative research.Advances in Nursing Science. 1986;8(3):27-37.

31. Patton MQ. Enhancing the quality and credibility of qualitative analysis. Health Services Research. 1999;34(5):1189-208.

32. Beck CT. Qualitative research: the evaluation of its credibility, fittingness, and auditability. Western Journal of Nursing Research. 1993;15(2):263-6.

33. Bostram AM, Wallin L, Nordstram G. Evidence-based practice and determinants of research use in elderly care in Sweden. Journal of Evaluation in Clinical Practice. 2007;13(4):665-73.

34. Dalheim A, Harthug S, Nilsen RM, Nortvedt MW. Factors influencing the development of evidence-based practice among nurses: a self-report survey. BMC Health Services Research. 2012;12:367.

35. Younger P. Using google scholar to conduct a literature search. Nursing Standard (Royal College of Nursing (Great Britain)). 2010;24(45):40-6; quiz 8.

36. National Library of Medicine (US). Key MEDLINE Indicators. 2014. https://www.nlm.nih.gov/bsd/bsd_key.html

37. Freeman MK, Lauderdale SA, Kendrach MG, Woolley TW. Google Scholar versus PubMed in locating primary literature to answer drug-related questions. The Annals of Pharmacotherapy. 2009;43(3):478-84.

38. Clarke MA, Belden JL, Koopman RJ, Steege LM, Moore JL, Canfield SM, et al. Information needs and information-seeking behaviour analysis of primary care physicians and nurses: a literature review. Health Information and Libraries Journal. 2013;30(3):178-90.

39. Eizenberg MM. Implementation of evidence-based nursing practice: nurses' personal and professional factors? Journal of Advanced Nursing. 2011;67(1):33-42.

40. McColl A, Smith H, White P, Field J. General practitioner's perceptions of the route to evidence based medicine: a questionnaire survey. BMJ Clinical Research .. 1998;316(7128):361-5.

41. Heiwe S, Kajermo KN, Tyni-Lenne R, Guidetti S, Samuelsson M, Andersson IL, et al. Evidence-based practice: attitudes, knowledge and behaviour among allied health care professionals. International Journal for Quality in Health Care 2011;23(2):198-209.

42. Young JM, Ward JE. Evidence-based medicine in general practice: beliefs and barriers among Australian GPs. Journal of Evaluation in Clinical Practice. 2001;7(2):201-10.

43. Banning M. A review of clinical decision making: models and current research. Journal of Clinical Nursing. 2008: 17(2):187-95.

44. Grol R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. Medical Care. 2001;39(8):II-46-II-54.

45. Cunnington JP, Hanna E, Turnhbull J, Kaigas TB, Norman GR. Defensible assessment of the competency of the practicing physician. Academic Medicine. 1997;72(1):9-12.

46. Goulet F, Jacques A, Gagnon R, Bourbeau D, Laberge D, Melanson J, et al. Performance assessment. Family physicians in Montreal meet the mark! Canadian Family Physician. 2002;48:1337-44.

Table 1 Demographic characteristics

CHARACTERISTICS	**n = 37**
Age	**%**
20-35	26.4
36-45	23.4
46-55	33.0
56+	17.2
Clinical Designation	**N**
OT	14
PT	13
RN	8
Psychologist	2
Received advanced clinical certifications	43.2 %
Years of clinical training	**%**
Less than 2 years	35.1
2-5 years	43.2
Above 5 years	21.6
Location of practice	**N (%)**
Urban	25 (67.6)
Rural	7 (18.9)
Both	5 (13.5)

Table 2 Chart Stimulated Recall (CSR) scores

Dimensions (n=37)	Min	Max	Mean	SD
1. Identifies an issue about the patient's pain for clinical decision-making	2	7	4.73	1.19
2. Is able to formulate the question in an answerable manner	2	7	4.08	0.75
3. Could identify the source of research evidence to answer this question	1	7	5.70	1.95
4. Could identify how to find research evidence that would answer this question	1	7	4.20	1.49
5. Was able to articulate the general conclusion from relevant research	1	6	4.10	1.18
6. Was able to articulate specifics of dosage or expected effects from relevant research	2	7	3.90	1.16
7. Was able to name contraindications or considerations derived from relevant research	1	7	3.60	1.14
8. Was able to differentiate high-quality versus low-quality studies	1	7	3.03	1.61
9. Was able to identify and cite systematic reviews pertaining to this question	1	7	2.41	1.80

Table 3 Interview Guide

Properties to be Probed	**Example Qualitative Questions (where it says XX substitute a specific detail from the medical record)**
1. Identifies an issue about the patient's pain for clinical decision-making	Tell me something about this patient's pain problem where research might help you make a decision about managing their problem?
2. Is able to formulate the question in an answerable manner	How would you format that question you wish to search for research evidence? - Are there any specific ways to formulate that question?
3. Could identify the source of research evidence to answer this question	Where might you find answers to that question? Where might you find research about that question?
4. Could identify how to find research evidence that would answer this question	If you were going to search for evidence to answer this question where would you look? How would you do that?
5. Was able to articulate the general conclusion from relevant research	Is there any research on this topic? Can you tell me what it says
6. Was able to articulate specifics of dosage or expected effects from relevant research	How did you determine the dosage or the expected treatment response? Is there any research about that? Please describe
7. Was able to name contraindications or considerations derived from relevant research	Were there any contraindications or factors that might modify this particular patient's response to that treatment? If so, how do you know about that?
8. Was able to differentiate high-quality versus low-quality studies	What is the quality of the research on this topic? What kinds of study designs have been used?
9. Was able to identify and cite systematic reviews pertaining to this question	Are there any systematic reviews that might help you with respect to this question?
Additional probes may be used to clarify how closely a respondent is matching the benchmarks below to assist with determining an accurate score.	

Table 4 Chart Stimulated Recall Data Collection Guide

Participant ID _____ Date _____

By asking clinicians about specific entries on their patient's medical record, rate the following (consult training manual to review definitions of level of competencies from 1 = unable to perform to 7 = able to perform at highest level of competency)

Properties to be Probed Chart ID:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Identifies an issue about the patient's pain for clinical decision-making							
2. Is able to formulate the question in an answerable manner							
3. Could identify the source of research evidence to answer this question							
4. Could identify how to find research evidence that would answer this question							
5. Was able to articulate the general conclusion from relevant research							
6. Was able to articulate specifics of dosage or expected effects from relevant research							
7. Was able to name contraindications or considerations derived from relevant research							
8. Was able to differentiate high-quality versus low-quality studies							
9. Was able to identify and cite systematic reviews pertaining to this question							
SUBTOTAL SCORE							

CHAPTER 4 A STRUCTURED CLASSIFICATION OF THE TYPES OF STUDIES ACCESSED BY DIFFERENT HEALTH PROFESSIONALS INVOLVED IN PAIN MANAGEMENT

Abstract

Introduction: Identifying evidence searching behaviours of clinicians interested in pain management can inform our understanding of information needs and interests of clinicians.

Purpose: The objective of the current study is to understand differences in access behaviours of clinicians from different professions with respect to their use of a pain-evidence resource. ($PAIN^+$)

Methods: This study was conducted by retrieving and categorising a subset of the activity of users of a pain evidence alerting service called $PAIN^+$. Anonymous activity logs for 258 clinicians who were users of the $PAIN^+$ service for at least 2 months and had read at least 1 article over a 16 month period were analyzed. As registered users of $PAIN^+$, they regularly received emailed alerts about newly published clinical articles, pre-appraised for scientific merit and clinical relevance. These alerts included citations, with links to the article's abstract and clinical ratings. Users could then access PubMed links so that they could retrieve the abstract, and where possible the full-text articles. The abstracts retrieved by each person were listed in order of time accessed. The abstracts, up to a maximum of 10, were classified using a descriptive classification system to understand the types of research, pain subtypes, intervention, and outcomes that were reported in these studies. Frequencies and chi-square tests were performed to compare access behaviors across professions.

Results: Between Aug 2011 and Nov 2012, a total of 258 participants (60 physicians, 60 nurses, 60 physiotherapists, 48 occupational therapists (OTs) and 30 psychologists) viewed 2311 abstracts, translated to an average of 9 abstracts for every participant. More than 52% of abstracts viewed were primary clinical studies, mostly (87%) were studies on effectiveness. The majority of the accessed studies (99.8%) were quantitative studies; only psychologists and OTs read the available qualitative studies. 58% of the abstracts were on pain related to the musculoskeletal system. The majority of the abstracts viewed were on chronic pain (76%). Drugs, injections, and rehabilitation therapy were the commonly accessed interventions in accessed studies. The visual analog scale (VAS) scale for pain was the most common outcome

measure that was used in the evidence accessed by the clinicians involved in the study. Statistically significant professional differences were observed for most of the categories. Occupational therapists were highly focused on chronic pain (86%) and nurses the least (64%). Physicians and nurses accessed more studies on injections (23%) and drugs (26%) than other professionals. Nurses accessed surgical studies; whereas other professions rarely did. PTs and OTs preferentially accessed studies on rehabilitation. OTs and psychologists accessed the available studies on cognitive interventions; OTs accessed more ergonomic studies than other professionals. Psychologists accessed the available educational and psychosocial intervention studies. Professions showed similar access to the available studies on multidisciplinary interventions.

Conclusions: While the nature of the accessed studies was partially related to available studies within the database, professional differences in access were evident that related to the nature of the intervention, type of pain and the research design. Evidence repositories intended for different professional groups may need to consider how to include their varied information needs in the filtering, coding, and evaluation of study quality.

Keywords: Classification, PAIN^{+}, Information interests, coding

4.1 INTRODUCTION

Evidence-based practice (EBP) is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients/clients. (1) EBP is a process that involves a series of steps - asking a clinical question, searching for evidence to answer that question, appraising the evidence, application of the evidence keeping in mind the client's needs and preferences; and finally evaluating the entire process to make improvements as needed.(1, 2) EBP is considered one of the top 10 modern innovations in the field of medicine.(3) Evidence-based care results in better treatment outcomes. A meta-analysis indicates that patients who receive evidence-based healthcare have 28% better outcomes than patients who were provided with care that is not evidence based. (4) As such, it has been widely accepted across a spectrum of health disciplines, and beyond.

The development of the World Wide Web (WWW) has substantial potential for the practice of EBP. (5) The rapid expansion of electronic databases and journals should facilitate research reaching target end users. Conversely, the process of finding the right high-quality evidence can be challenging given the vast amount of evidence that is being published every day. Accessing the potential for electronic databases to improve access to research evidence has become an important research question.

Electronic databases can provide end users with thousands of papers on a particular topic within a few seconds. For instance, PubMed contained 24 million citations and was used to perform searches 2.7 billion times in 2014.(6, 7) In response to the challenges of navigating such vast resources, targeted evidence-based tools have been developed. A suite of such resources developed at McMaster University focus on matching the clinician with the best papers in their field, and pushing out targeted citations by e-mail in combination with ratings of their quality and relevance.(8, 9) All the citations from these journals are pre-rated for evidence quality by research staff and then clinical relevance and interest are rated by at least 3 members of an international panel comprising of clinicians (physicians, nurses, physical and occupational therapists, and clinical psychologists) with a common interest in pain management.PAIN$^+$ is one such targeted EBP tool which focuses on pushing high-quality pre-appraised evidence on pain and its treatment. (8, 10) While some of the early push-out tools focused on professions, PAIN$^+$ focuses on a specific area of management and thus is an inter-professional resource. A collection of these studies started in August 2011, and as of Nov 2012, the PAIN$^+$ database contained 2534

articles. Of those, 809 (32%) were systematic reviews/meta-analysis, and 1385 (55%) were RCTs. Information needs and preferences of different professions have been studied before, (11-14) and this can lead to better taxonomies or classifications of topics that would help to create informatics resources to support EBP needs of clinicians.(12, 15) McKinlay and colleagues found that physicians prefer systematic reviews rather than primary studies.(16) Another study looking into the information needs of primary care physicians found that 53% of their questions were on diagnosis, and 26% were on treatment.(11) However, the interest and information needs of clinicians involved in pain management remain an unexplored area. Exploring information access behaviours across professions can inform our understanding of differences in professional focus with respect to pain management, knowledge needs and attitudes towards different types of research evidence. The objective of the current study is to understand and compare differences in access behaviours of clinicians from various health professionals with respect to their uses of a pain-evidence resource ($PAIN^+$).

4.2 METHODS:

The data in this study were derived from a randomized trial designed to evaluate PUSH vs. PULL strategies of knowledge translation. (9) This study was conducted by retrieving and categorising a subset of the activity of users of pain evidence alerting service. This study was approved by the McMaster University research ethics board. A total of 258 participants (60 physicians, 60 nurses, 60 physiotherapists, 48 occupational therapists and 30 psychologists) participated in this study. Anonymous activity logs for clinicians who were $PAIN^+$ users as part of the original randomized trial were retrieved from the $PAIN^+$ system. Participants were selected if they were registered for at least for 2 months on the $PAIN^+$ system and had accessed at least 1 article over a 16 month period were collected (Aug 2011 to Nov 2012). Since they were registered with $PAIN^{+,}$ they regularly received email alerts on published, pre-appraised research articles and systematic reviews tailored to their disciplinary needs along with links to the abstracts of the article, its clinical ratings, and any rater comments. Users could then access PubMed links so that they could retrieve the abstract, and where possible the full-text articles. A maximum of 10 abstracts that the clinicians accessed from their e-mail alerts by logging into their account was included for each participant. Lists were temporal reflecting the time that the abstract link was accessed. For each user, data on profession and links to the abstracts that were read (minimum 1 to maximum 10) were collected. The content of the abstracts was classified

using a descriptive classification system to understand the types of research, pain subtypes, intervention, and outcomes that were reported in these studies.

4.2.1 Abstract classification:

Once the abstracts were downloaded, one reviewer (VA) read through the abstracts and coded them using a classification typology developed by the second author (JM). The coding classified abstract content according to the study design, type of evidence, type of pain investigated, type of intervention and type of research paradigm. Random checking by the second author was done to verify the accuracy of the data. The classification coding that was used is as follows:

Type of evidence: Meta-analysis**,** systemic review**,** narrative review**,** clinical practice guideline**,** cohort**,** primary clinical study**,** opinion/commentary/editorial and others

Type of Clinical Question: Description, clinical measure, prevalence, etiology, diagnosis, effectiveness, risk analysis, economic and knowledge translation.

Type of research paradigm: Qualitative and quantitative.

Type of Pain Studied

A. Physiological: Nociceptive (visceral, somatic), neuropathic and others.

B. Temporal: Acute and chronic.

C. Systemic: Musculoskeletal, neurological, psychological, respiratory and cardiovascular, gastrointestinal, genitourinary, other visceral, mixed and others.

D. Etiological (type of health conditions): Genetic, trauma, operation, infective, neoplasm/cancer, toxic, degenerative, mechanical, dysfunctional (psychophysiological), unknown/other and psychological origin.

E. Mechanism-based classification: Transient pain, tissue injury pain, and nervous system injury pain.

Type of Interventions Studied: Drug/pharmacological, surgical, injections/ interventional therapy, cognitive/behavioural therapy, educational, ergonomics, multidisciplinary, rehabilitation therapy, psychosocial, home program, general/social work and others.

Type of Outcomes Assessed: Pain scores, global assessment, return to work, return to daily activity, health care utilization, health status, quality of life, disability, general satisfaction, cost, pain threshold/tolerance, other physiological measures, EMG/NCV, quantitative sensory testing, other sensory measures and physical performance.

4.3 STATISTICAL ANALYSIS

SPSS version 22[1] was used to analyse the descriptive data. A frequency analysis and histograms were used to compare interests of different professions. A chi-square test for the counts was done to test statistically significant differences between the groups using StatPac statistics calculator[2]. The significance level was set at $p < 0.05$. Yate's correction was used to .

4.4 RESULTS

4.4.1 Participants: A total of 258 participants met the eligibility criteria and were included in the study. There were 60 physicians, 60 nurses, 60 physiotherapists, 48 occupational therapists and 30 psychologists. All together they viewed 2311 abstracts, which would translate to an average of 9 abstracts for every participant.

4.4.2 Abstract coding

Type of evidence: Overall 52% of abstracts viewed by our participants were primary clinical studies (RCTs). Physiotherapists viewed more RCTs than other professions (Chi square value= 159.1; *df* = 4; P<0.01). This was followed by meta-analysis (32%). OTs and nurses viewed more meta-analysis than other professionals (Chi square value= 74.2; *df* = 4; P<0.01P<0.01Systematic reviews followed next (13%). OTs and nurses viewed more systematic reviews than other professionals. (See Figure 1)

Type of clinical question: The participants in our study retrieved mainly abstracts that studied effectiveness (87%). The differences between the professions were statistically significant. Occupational therapists viewed more articles on effectiveness than other groups. (Chi square value= 204.8; *df* = 4; P<0.01) (See figure 2). The next most commonly retrieved clinical question was clinical measurement (7%). PTs viewed more articles on clinical measurement than other groups.

Type of research paradigms: In terms of research paradigms our participants' primarily accessed quantitative studies (99.8%). Physicians accessed more quantitative research when compared to other groups (Chi-square value= 248.8; df = 4; P<0.01). Qualitative research was accessed only by 0.2%. Individual disciplines were not statistically different (Chi-square value= 2.12; df = 4; p = 0.71). (See Figure 3)

[1] IBM Corporation. New York NY, USA
[2] StatPac Inc. Pepin WI, USA

Type of Pain

A. Physiological classification: The most common type of abstract retrieved based on the physiologic type of pain was nociceptive pain (86.3%). Statistically significant differences were observed between the disciplines for nociceptive pain with physicians viewing more abstracts in this category slightly higher than other disciplines [physicians (89%), nurses (80%), physiotherapists (88%), occupational therapists (86%) and psychologists (87%); Chi-square value=215.26; *df* = 4; P<0.01)]. (See Figure 4)

B. Temporal classification: For the duration of pain, participants more frequently searched abstracts on chronic pain (74%) versus acute pain (26%). (See figure 5) There were statistically significant differences between the disciplines with OTs, followed by psychologists accessing more abstracts on chronic pain. [physicians (73%), nurses (64%), physiotherapists (75%), occupational therapists (85%) and psychologists (79%); Chi square value= 150.29; *df* = 4; P<0.01)]. (See Figure 5)

C. Systemic classification: 58% of the abstracts retrieved by all professions were on pain related to the musculoskeletal system. The differences between professionals were statistically significant for musculoskeletal pain and OTs viewed more abstracts than other disciplines. (Chi square value= 190; *df* = 4; P<0.01). This was followed by neurological system [physicians (13%), nurses (18%), physiotherapists (16%), occupational therapists (8%) and psychologists (16%)]. The differences were statistically significant with nurses viewing more abstracts on neurological system involvement (Chi square value= 67.82; *df* = 4; p = 0.0 P<0.010). (See Figure 6)

D. Etiological classification: The abstracts most accessed by the participants classified based on pain etiology included mechanical / degenerative (33%) and dysfunctional (psycho-physiological) (32%). There were statistically significant difference between the groups with OTs (Chi square value= 95.53; *df* = 4; P<0.01) retrieving more on mechanical/degenerative types; while psychologists retrieved more abstracts on dysfunctional (psycho-physiological) type (Chi square value= 68.07; *df* = 4; P<0.01). (See Figure 7) Abstracts on cancer pain was retrieved more by PTs (Chi square value= 13.03; *df* = 4; P<0.01). (See Figure 7)

E. Mechanism-based classification: When classifying the abstracts based on the mechanism of injury, abstracts on tissue injury related pain was the most common (85%) followed by nervous system involvement (6%). There was statistically significant differences between professions for

both the types with OTs accessing more abstracts on tissue injury (Chi-square value= 196; *df* = 4; P<0.01). (See Figure 8) and physicians accessing more abstracts on nervous system damage (Chi-square value= 46.68; *df* = 4; P<0.01). (See Figure 8)

Type of Interventions: Drugs (26%), injection/intervention (23%), followed by rehabilitation therapy (20%) were the most common types of study intervention retrieved by the participants. There were statistically significant differences between the disciplines with physicians accessing more abstracts on drugs (Chi square value= 95.4; *df* = 4; P<0.01) and nurses (Chi square value= 198; *df* = 4; P<0.01) accessing more abstracts on injections/ interventional therapy. OTs followed by PTs viewed more abstracts on rehabilitation interventions. (Chi square value= 95; *df* = 4; P<0.01). (See Figure 9)

Type of Outcomes: Pain scores using a visual analog scale (VAS) were the most commonly reported outcome measure (27.5%) in the studies accessed; although 66% used multiple outcome measures. (See Figure 10) PTs viewed more abstracts that used VAS as an outcome measure (Chi square value= 99; *df* = 4; P<0.01). (See Figure 10), while OTs viewed more abstracts with multiple outcome (Chi square value= 126; *df* = 4; P<0.01). (See Figure 10)

4.5 DISCUSSION

In the current study, we found that clinicians accessed multiple studies when provided with alerts about recent pain research indicating interest in pain research across professions. Although there were limitations on what people could access based on what is the literature being published, and the subset that was pulled from this literature to provide high-quality evidence alert there were some indications of professional differences in information accessing behaviours. There were statistically significant differences between the professions as to the type of research and content that they accessed.

We found that nearly 97% of the abstracts retrieved were RCTs, systematic reviews or meta-analysis; although 87% of the studies in PAIN$^+$ fit within these categories. This finding might suggest a preference for these higher quality studies. Since PAIN$^+$ filters out low-quality studies, we did not expect to find low-quality studies represented in the studies retrieved. On the other hand, we found that primary clinical studies (52%) were more frequently accessed than systematic reviews (13%) and meta-analysis (32%). Since 55% of the articles available in PAIN$^+$ are RCTs, the differential access to high-quality research was primarily with respect to

systematic reviews and meta-analysis. This finding is consistent with other studies showing that evidence synthesis is preferred by clinicians over primary studies.(16)

A previous study identified that physicians seek high-quality studies such as systematic reviews and primary clinical studies, but did not include other professions in their analysis. (16) We found statistically significant professional differences, with PTs and OTs accessing more systematic reviews and RCTs than other groups. This could be related to the evolution of rehabilitation school curriculums since an increasing number have higher degree requirements (MPT or DPT) which have often included mandatory courses on evidence-based practice. Further, professional associations often strongly advocating for EBP thus inculcating an attitude and behavior of seeking high-quality evidence to answer questions at hand.(18)

We found that the majority of studies accessed by the participants in this study were on treatment effectiveness (87%) followed by clinical measurement (7%) and diagnosis (2%). Previous studies have identified a similar finding. In a review to identify the information needs of physicians and nurses, Clarke and colleagues found that physicians mainly seek information on treatment and diagnosis; while nurses mainly seek for information on treatment.(19) We also found statistically significant differences between professionals in how they accessed these abstracts. Physicians accessed more abstracts on effectiveness, perhaps because physicians are primarily responsible for the medical management (20), and nurses accessed information that was aligned with their scope of practice. (21) On the other hand, PTs accessed more articles on clinical measurement which may indicate an interest in using measures that are valid and reliable to measure outcomes.

Quantitative studies were accessed by more clinicians. This indicates a strong inclination towards research that can be quantified; the reason for this could be the bias towards quantitative research methods. Moreover, lack of knowledge about qualitative methods could be another reason why people prefer quantitative methods.(22, 23) However the two research paradigms can be complementary; quantitative methods find accurate answers by eliminating bias while qualitative methods provide a context for those results providing a holistic picture.(24) OTs and psychologists were accessing more qualitative studies than other disciplines. This may be related to their scope of practice. Psychologists deal with the mind and OTs deal more with the social aspects of patient care.

In the current study we found that abstracts on pain related to musculoskeletal conditions were most often retrieved, followed by neurological causes. According to a report by the World Health Organisation, musculoskeletal conditions are the most common cause of long-term pain and disability; affecting hundreds of millions across the globe.(25) Musculoskeletal conditions include a broad range of conditions such as trauma, soft tissue injuries, degenerative conditions, and repetitive disorders that usually present with pain as a primary symptom. All professions were similar except for psychologists; they viewed only 20% of musculoskeletal system related abstracts. It might be expected that psychologists do not treat specific medical conditions, and would not focus on musculoskeletal pain directly; but rather be more concerned with the psycho-physiological aspects of pain along with the understanding of the causes of pain.

A clinically relevant observation regarding the temporal characteristics of pain was noted among the abstracts that were retrieved. Physicians, nurses and PTs sought information related to acute pain while OTs and psychologists were looking for evidence related to chronic pain more than the other disciplines. This reflects the practice and referral patterns of clinicians involved in pain management. For acute pain, patients usually seek physicians who are the gatekeepers of the healthcare system, and then they are referred to nurses and PTs for further management. Patients with chronic pain are more likely to be referred to psychologists and OTS reflecting the need to address persistent symptoms and the greater psychological component to chronic pain. (26, 27) Cognitive behavioural therapy and other psychological pain management techniques are targeted to the chronic pain population, and thus, the literature access reflects the scope of practice.

We also observed that nurses, physicians, and psychologists sought information on drugs more often than other interventions; and rehabilitation therapists sought information on rehabilitation interventions. There are a number of studies that support this finding of the current study. Cogdil and colleagues found that nurse practitioners involved in primary care most frequently needed information related to drug therapy and diagnosis.(28) A literature review to understand the information needs of physicians and nurses concluded that nurses and physicians look for information on diagnoses, drug(s) and treatment/therapy.(19) Another study on information seeking behaviour of physicians found that the most common clinical questions were on drug therapies.(13). Physicians, and in some countries nurse practitioners, prescribe drugs for pain relief and hence information on drug therapies is more aligned with the care they provide. Nurses may not always prescribe drugs but have professional responsibilities for detecting

medication errors, side effects and delivering proper dosages. (21) Thus, their need for evidence on these topics is aligned with their scope of practice. (21) However, given that we studied multiple professions, we were able to see their response to the alerts about studies on multidisciplinary interventions. The fact that all professions accessed these studies provides some suggestion that the concept of multidisciplinary care is supported by clinicians managing pain.

The most common primary outcome measure that was used in the studies accessed was visual analog scale (VAS) for pain. This is consistent with the outcome measure that clinicians mostly used in assessing pain (29) and so this may provide a comparator benchmarks for clinicians to know what treatment effects they can expect when implementing pain research in practice. However, pain is determined by multiple factors and to fully understand treatment effects, measures that capture these factors that affect pain would be preferable. Further, a previous study has found that VAS may not be responsive. (30) Other surrogates like medication use and physiologic measures like the recurrence of pain were also commonly included in pain studies accessed in this study. It should be kept in mind that the outcome measures used might not be a primary concern with respect to the selection of studies to access. That is, clinicians might not access a study because it used the VAS as the primary outcome measure. This likely reflects that the VAS is the most common outcome measure for pain and was used in the studies that the clinicians accessed for a different reason.

The strength of the current study is that it provides a unique perspective on the types of pain research accessed by different health professions exposed to alerts on new pain research as it becomes available on PAIN^{+}. It was a large enough sample to provide stable responses on the access behaviours for the entire group. However, results must be considered in light of the study limitations which include: the use of one reviewer to classify and code the abstracts which mean that we did not quantify classification errors by comparing different raters. However, random checking of the data was used for informal assessment of rater agreement. The study addressed the behaviours of clinicians in accessing alerts provided not what they might have sought/accessed through independent searching. Thus, this data reflects their interest in new information rather than current information needs. While these are related, interest may not be a precise surrogate for need.

PAIN $^{+}$ filters studies from 110 journals, including all major pain journals that have a track record of providing a yield of high-quality studies. Thus, not all high-quality studies published might have made it to PAIN^{+}, since it is not feasible to extract studies from all possible journals. Further, some research that might be rigorous may not make it through the methodological filters. For example, qualitative research may be under-represented for this reason. Since people could only access what was provided, the process itself determined their exposure. We can only determine what participants accessed not what they read or extracted from those studies. Access may not be a useful surrogate for use in practice. Our sample was uneven across professional groups affecting the power of subgroup comparisons. Since we do not know the clinically relevant differences in these behaviours, it is difficult to ascribe the level of importance to the differences we observed.

In conclusion, users demonstrated an interest in accessing pain research through an alerting service. We found that clinicians who received alerts from PAIN^{+} on pain-related research retrieved abstracts that were of high quality on the effectiveness of drugs, injections, and rehabilitation, often related to chronic musculoskeletal pain conditions. While the nature of the accessed studies was partially related to the available studies within the database, professional differences in access were evident that related to the nature of the intervention, type of pain and the research design. These differences were partially explained by the scope of practice expectations. Evidence repositories intended for different professional groups may need to consider how to include their varied information needs in the filtering, coding, and evaluation of study quality.

ACKNOWLEDGEMENTS

The authors wish to thank Ms. Margaret Lomotan for assistance with the study. Joy C MacDermid was supported a CIHR Chair in Gender, Work and Health and the Dr. James Roth Chair in Musculoskeletal Measurement and Knowledge Translation.
This work was supported by operating grants from Canadian Institutes of Health research (CIHR): CIHR - FRN: 107539 & FRN: 123308.

4.6 REFERENCES

1. Sackett DL, Rosenberg WMC. The Need for Evidence-Based Medicine. Journal of the Royal Society of Medicine. 1995;88(11):620-4.

2. Sackett DL. Evidence-based medicine: how to practice and teach EBM. Edinburgh; New York: Churchill Livingstone; 2000. 261 p.

3. Dickerson F. Evidence-Based Mental Health Practice: A Textbook. The Journal of Nervous and Mental Disease. 2007;195(1):97-8.

4. Heater BS, Becker AM, Olson RK. Nursing Interventions And Patient Outcomes: A Meta-Analysis of Studies. Nursing Research. 1988;37(5):303-7.

5. Lowe HJ, Lomax EC, Polonkey SE. The World Wide Web: a review of an emerging internet-based technology for the distribution of biomedical information. Journal of American Medical Informatics Association. 1996;3(1):1-14.

6. National Library of Medicine (US). Key MEDLINE Indicators. 2014. https://www.nlm.nih.gov/bsd/bsd_key.html

7. National Library of Medicine (US). List of All Journals Cited in PubMed®. 2015. https://www.nlm.nih.gov/bsd/serfile_addedinfo.html

8. Haynes RB, Holland J, Cotoi C, McKinlay RJ, Wilczynski NL, Walters LA, et al. McMaster PLUS: a cluster randomized clinical trial of an intervention to accelerate clinical use of evidence-based information from digital libraries. Journal of American Medical Informatics Association 2006;13(6):593-600.

9. MacDermid JC, Law M, Buckley N, Haynes RB. "Push" versus "Pull" for mobilizing pain evidence into practice across different health professions: a protocol for a randomized trial. Implementation science. 2012;7:115.

10. Pain PLUS (Premium LiteratUre Service). 2015. https://plus.mcmaster.ca/painplus

11. Gonzalez-Gonzalez AI, Dawes M, Sanchez-Mateos J, Riesgo-Fuertes R, Escortell-Mayor E, Sanz-Cuesta T, et al. Information needs and information-seeking behavior of primary care physicians. Annals of Family Medicine. 2007;5(4):345-52.

12. Ely JW, Osheroff JA, Gorman PN, Ebell MH, Chambliss ML, Pifer EA, et al. A taxonomy of generic clinical questions: classification study. BMJ (Clinical research ed). 2000;321(7258):429-32.

13. Ely JW, Burch RJ, Vinson DC. The information needs of family physicians: case-specific clinical questions. The Journal of Family Practice. 1992;35(3):265-9.

14. Gorman PN, Yao P, Seshadri V. Finding the answers in primary care: information seeking by rural and nonrural clinicians. Studies in Health Technology and Informatics. 2004;107(Pt 2):1133-7.

15. Allen M, Currie LM, Graham M, Bakken S, Patel VL, Cimino JJ. The classification of clinicians' information needs while using a clinical information system. AMIA Annual Symposium Proceedings. 2003:26-30.

16. McKinlay RJ, Cotoi C, Wilczynski NL, Haynes RB. Systematic reviews and original articles differ in relevance, novelty, and use in an evidence-based service for physicians: PLUS project. Journal of Clinical Epidemiology. 2008;61(5):449-54.

17. Archiebald C. Foreword. In: Chalmers I EM, Keirse MJNC, editor. Effective care in pregnancy and childbirth. Oxford: Oxford University Press; 1989.

18. Jette DU, Bacon K, Batty C, Carlson M, Ferland A, Hemingway RD, et al. Evidence-based practice: beliefs, attitudes, knowledge, and behaviors of physical therapists. Physical Therapy. 2003;83(9):786-805.

19. Clarke MA, Belden JL, Koopman RJ, Steege LM, Moore JL, Canfield SM, et al. Information needs and information-seeking behaviour analysis of primary care physicians and nurses: a literature review. Health Information and Libraries Journal. 2013;30(3):178-90.

20. The College of Physicians and Surgeons of Ontario. The practice Guide: Medical Professionalism and College Policies 2007 [Available from: http://www.cpso.on.ca/Policies-Publications/The-Practice-Guide-Medical-Professionalism-and-Col.]

21. College of Registered Nurses of British Columbia. RN Scope of Practice 2015 [Available from: https://www.crnbc.ca/Standards/RNScopePractice/Pages/Default.aspx.]

22. Jack SM. Utility of Qualitative Research Findings in Evidence-Based Public Health Practice. Public Health Nursing. 2006;23(3):277-83.

23. Britten N. Making sense of qualitative research: a new series. Medical Education. 2005; 39: 5-6.

24. Firestone WA. Meaning in Method: The Rhetoric of Quantitative and Qualitative Research. Educational Researcher. 1987;16(7):16-21.

25. Woolf AD, Pfleger B. Burden of major musculoskeletal conditions. Bulletin of the World Health Organization. 2003;81:646-56.

26. Roditi D, Robinson ME. The role of psychological interventions in the management of patients with chronic pain. Psychology Research and Behavior Management. 2011;4:41-9.

27. Turk DC, Gatchel RJ. Psychological Approaches to Pain Management, Second Edition: A Practitioner's Handbook: NewYork: Guilford Publications; 2013.

28. Cogdill KW. Information needs and information seeking in primary care: a study of nurse practitioners. Journal of the Medical Library Association. 2003;91(2):203-15.

29. Macdermid JC, Walton DM, Cote P, Santaguida PL, Gross A, Carlesso L. Use of outcome measures in managing neck pain: an international multidisciplinary survey. Open Orthopedics Journal. 2013;7:506-20.

30. Kersten P, White PJ, Tennant A. Is the Pain Visual Analogue Scale Linear and Responsive to Change? An Exploration Using Rasch Analysis. PLoS ONE. 2014;9(6):e99485.

Figure 1 Classification based on type of evidence

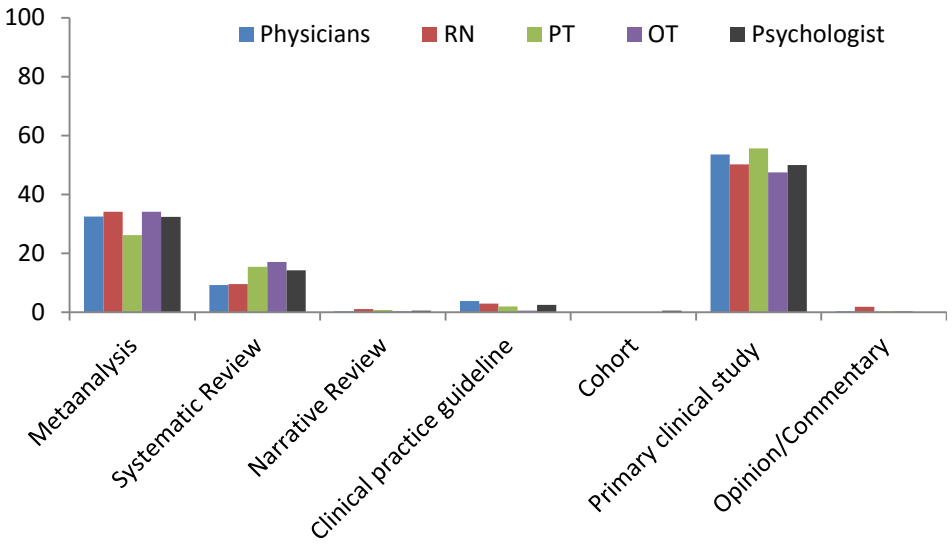


Figure 2 Classification based on type of clinical question

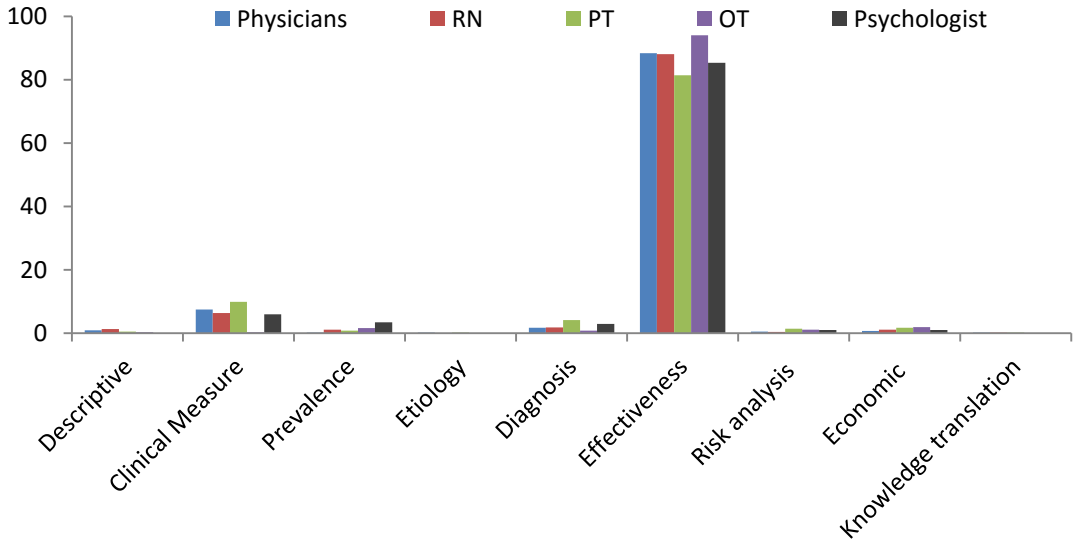


Figure 3 Classification based on type of research design

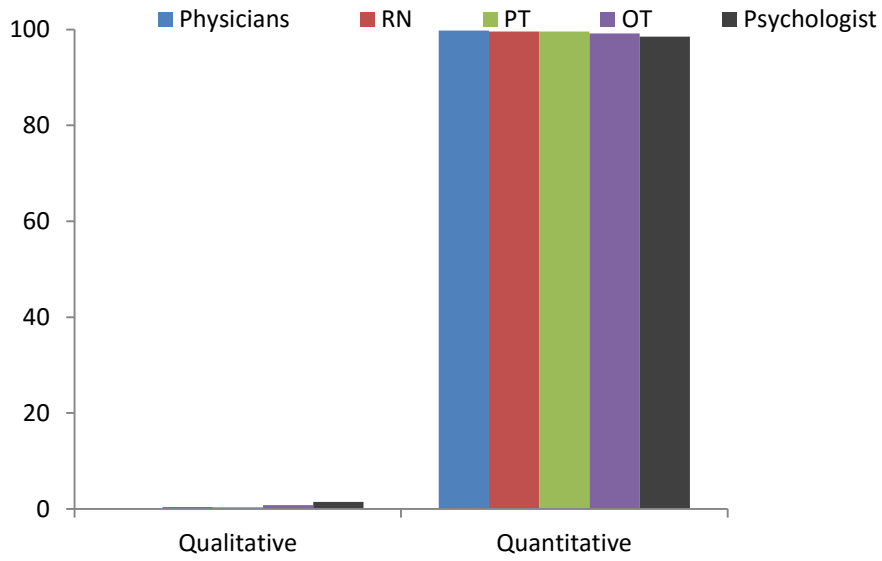


Figure 4 Classification based on physiological characteristics of pain

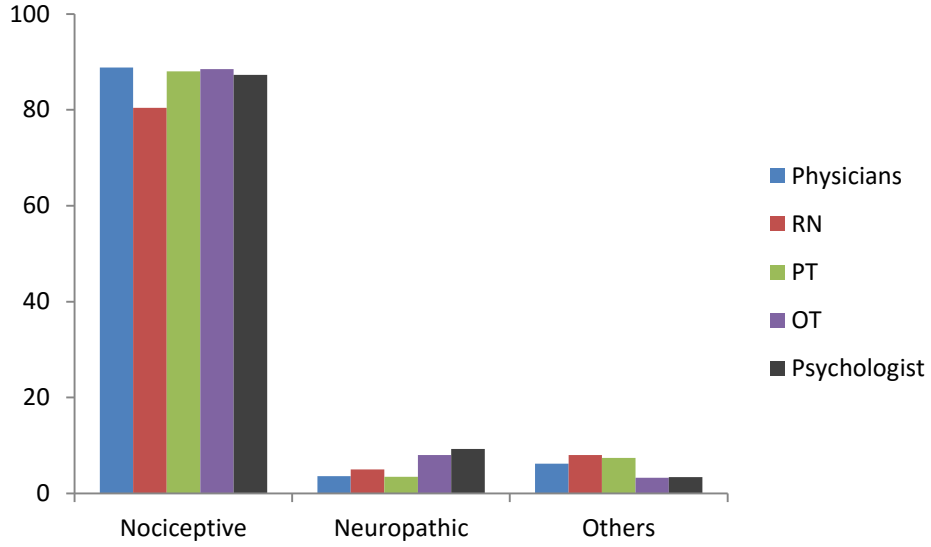


Figure 5 Classification based on temporal characteristics of pain

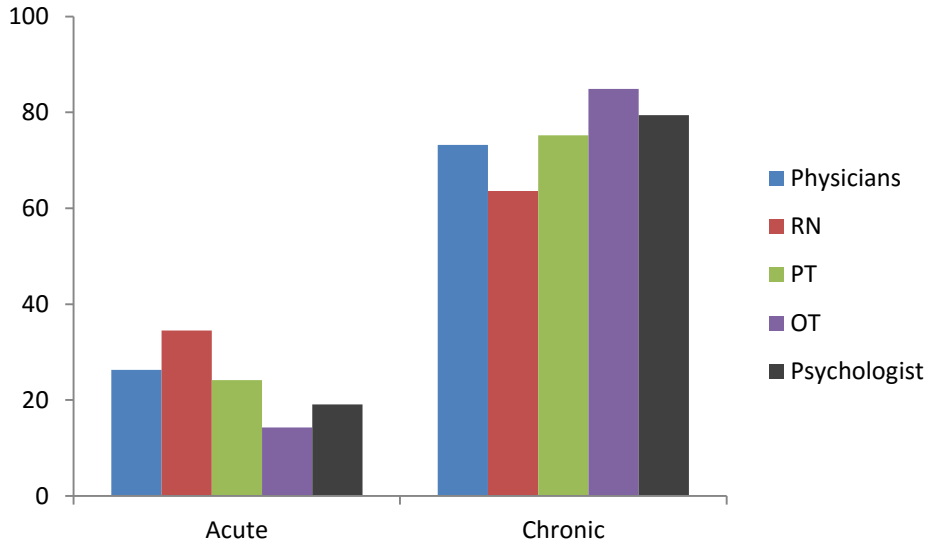


Figure 6 Classification based on body systems

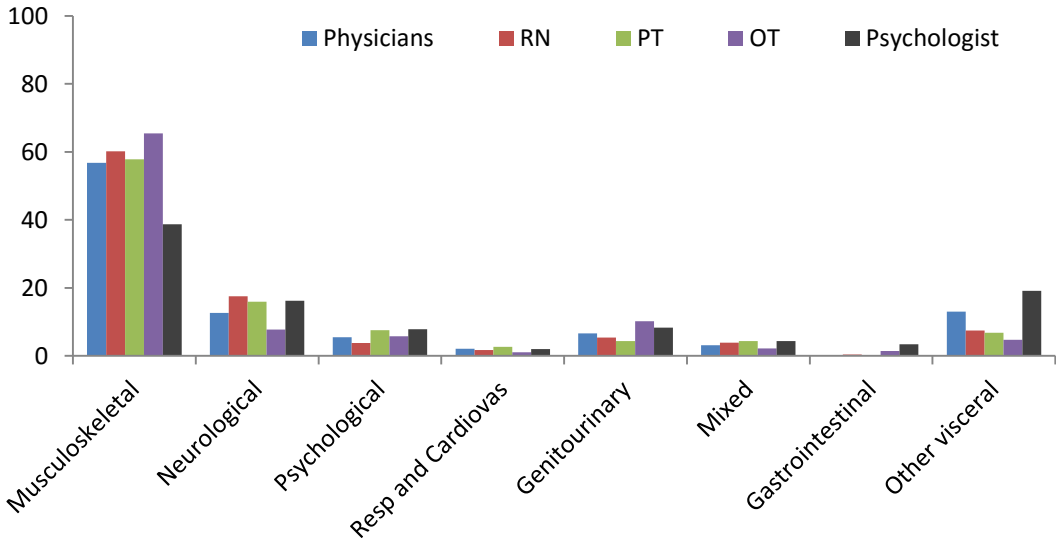


Figure 7 Classification based on etiology

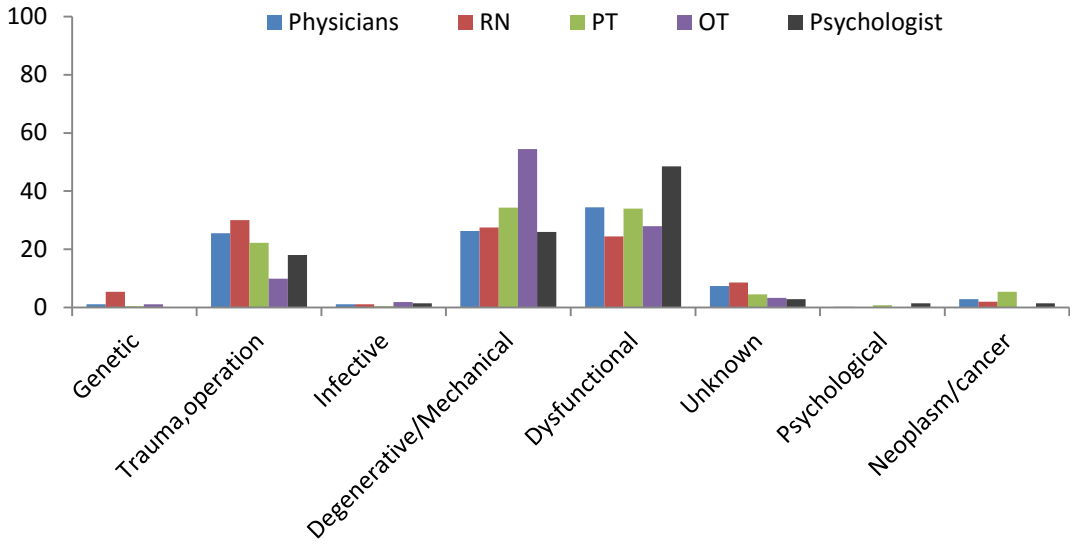


Figure 8 Classification based on mechanism

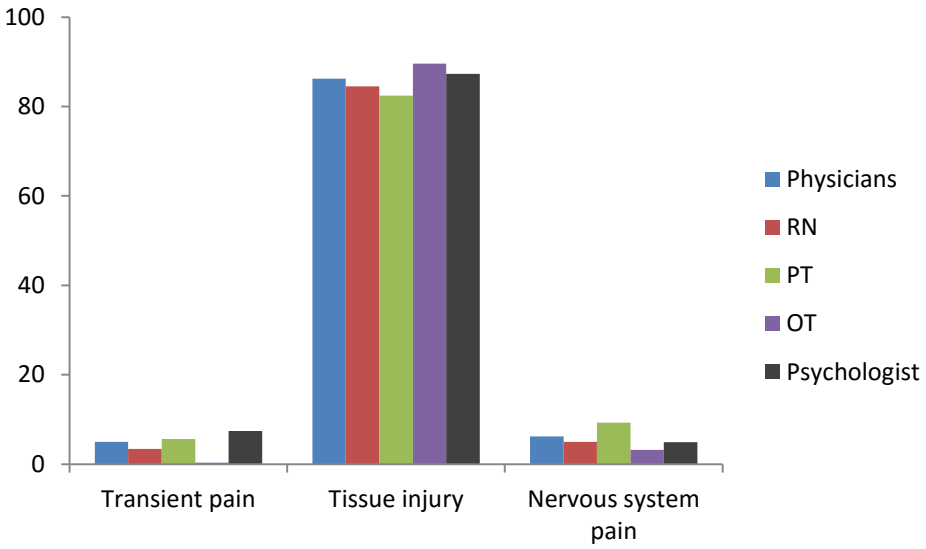


Figure 9 Classification based on types of interventions

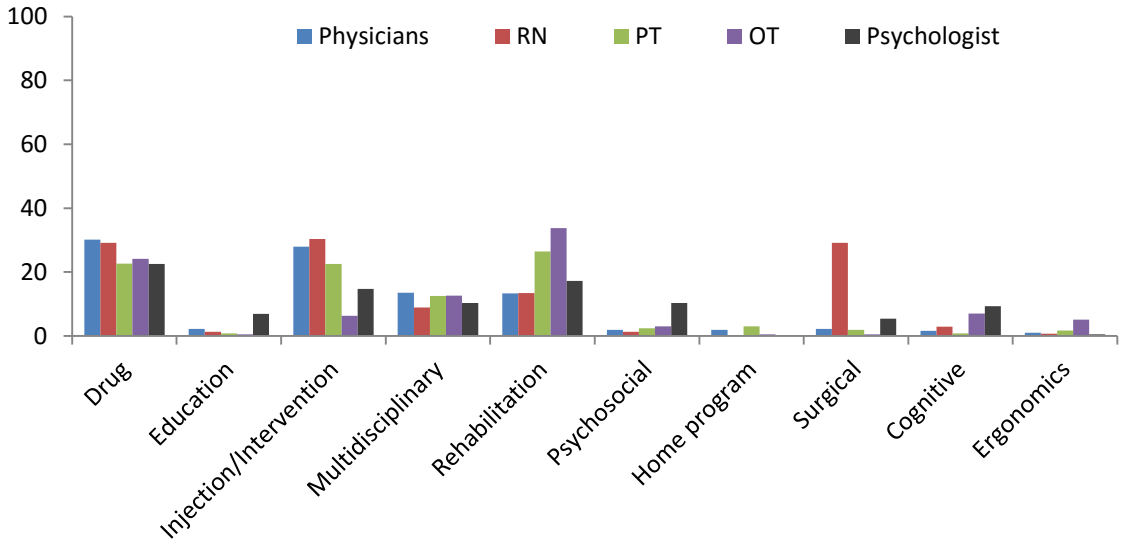
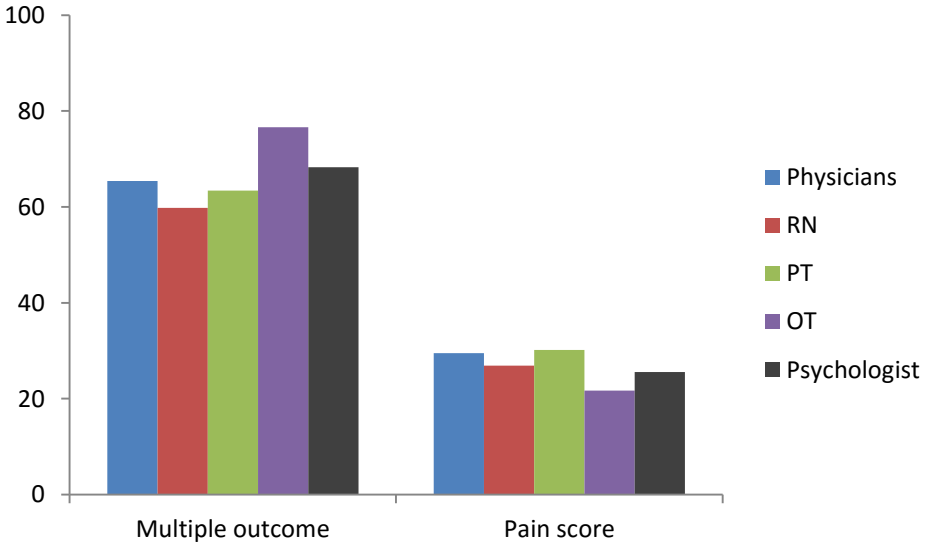


Figure 10 Classification based on types of outcomes



CHAPTER 5 COMPARING THE USEFULNESS OF USING EITHER PAIN$^+$ OR PUBMED TO ACCESS PAIN RESEARCH EVIDENCE: A RANDOMIZED CROSSOVER TRIAL

Abstract

Introduction: PAIN$^+$ and PubMed are two electronic databases with two different mechanisms of evidence retrieval. PubMed is used to "Pull" evidence where clinicians can enter search terms to find answers while PAIN$^+$ is a newly developed evidence repository where along with "Pull" service there is a "Push" service, through alerts on articles pre-appraised for quality, based on interests of clinicians.

Purpose: The primary purpose of the study was to compare yield and usefulness of PubMed and PAIN$^+$ in retrieving evidence to address clinical research questions on pain management. The secondary purpose of the study was to identify what search terms and methods were used by clinicians to target pain research.

Study design: Two phase double blinded randomized cross over trial

Methods: Clinicians (n=76) who were exposed to PAIN$^+$ for at east one year took part in this study. The study has 2 phases. In phase 1, they were randomly assigned to search for multidisciplinary search query using either PAIN$^+$ or PubMed through a neutral interface and crossed over to the other search engine. A similar process was done in phase 2, but the search query was a discipline specific one. The yield was calculated using the number of retrieved articles presented to participants and usefulness was evaluated using a series of Likert scale questions.

Results:

Multidisciplinary scenario: On the whole, the participants had an overall one page yield of 715 articles for PAIN$^+$ and 1135 articles for PubMed. The topmost article retrieved by PAIN$^+$ was rated as more useful and relevant than the article retrieved by PubMed. PubMed was preferred than PAIN$^+$ to perform a multidisciplinary search.

Discipline specific scenario: On the whole, the participants had an overall one page yield of 1046 articles for PAIN$^+$ and 1398 articles for PubMed. The topmost article retrieved by PAIN$^+$ was rated as more useful and consistent with current clinical practice than the articles retrieved by PubMed. PAIN$^+$ was preferred than PubMed to perform discipline specific search.

Conclusion: PAIN$^+$ and PubMed both were rated as useful in retrieving pain evidence for clinicians across different health disciplines who are involved in pain management. Greater preferences and perceived usefulness of the top 3 retrieved papers was observed for PAIN$^+$, but other dimensions of usefulness did not consistently favor either search engine.

Key words: PAIN$^+$, PubMed, abstract coding, descriptive classification, preference, perceived usefulness

5.1 INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.[1] Pain is affected by complex interactions between biological, psychological and social factors.[2, 3] Multiple disciplines are involved in pain management including physicians, nurses, physiotherapists, occupational therapists, and psychologists, with each discipline having specific roles and perspectives.[4]

Evidence-based practice (EBP) is commonly regarded as a method for obtaining best practice that is relevant to all health professions.[5] Five steps are involved in successful implementation of EBP: step 1 is to formulate an answerable question; step 2 involves tracking down the best evidence; step 3 involves critical appraisal of the evidence retrieved; step 4 involves application of the evidence to the individual and step 5 is to assess the outcome of the process and make changes as necessary.[6]

Accessing and appraising evidence has been one of the most consistent barriers to EBP across professions. Accordingly, one of the most substantial developments supporting EBP has been the evolution of methods that support evidence retrieval and appraisal. With the ever-increasing proliferation of research evidence, electronic databases and strategies for extracting relevant research from those databases are critical components of optimizing EBP. There are two modes of transferring knowledge to target audiences. Evidence can be extracted from medical, nursing, psychology, and rehabilitation journals; appraised for quality/relevance, and then sent out (PUSH) to clinicians by email alerts. The alternate and more traditional approach is where clinician's type in keywords related to their query into cumulative electronic databases and retrieves evidence (PULL). Databases like PubMed, SCOPUS, EMBASE, etc. fall under the PULL category.

The most commonly searched electronic database for pain research evidence is PubMed.[7] PubMed is a service of the US National Library of Medicine® that provides free access to MEDLINE®, the NLM® database of indexed citations and abstracts from medical, nursing, dental, veterinary, health care, and preclinical sciences journal articles. As of March 2015, there were 5,609 journals were indexed by MEDLINE. PubMed also indexes a selected set of life sciences journals not in MEDLINE. The usefulness of PubMed in retrieving evidence has

been tested in different areas of medical practice [8-14] but not with respect to pain evidence. PubMed facilitates the second step of evidence retrieval in the EBP model.

PAIN$^+$ (Premium LiteratUre Service) is an electronic evidence service created by Dr. Joy MacDermid, in collaboration with the Health Information Research Unit (HIRU), at McMaster University who developed the platform for the McMaster Premium Literature Service, (McMasterPLUS^{TM})[15] and provides the technical expertise and infrastructure to support multiple evidence repositories and "pull" (retrieval) and "push" (alerting) services. PAIN$^+$ was designed to provide access to pre-appraised current best evidence on pain to support clinical decisions. It covers over 110 premier clinical journals that address pain. All the citations from these journals are pre-rated for evidence quality by research staff and then clinical relevance and interest are rated by at least 3 members of an international panel comprising of clinicians (physicians, nurses, physical and occupational therapists, and clinical psychologists) with a common interest in pain management. PAIN$^+$ facilitates the second and third step of EBP model, (retrieving evidence and rapid appraisal of the quality of the evidence). PAIN$^+$ falls under the PUSH category.

Clearly these two types of evidence repositories differ. PubMed provides a much broader scope of literature but does not evaluate the quality of the individual articles. Depending on the search strategy there is potential for a larger number of papers to be retrieved, but the relevance may be questionable when high volumes of research are retrieved. PAIN$^+$ was designed to focus on the most relevant pain research and to provide targeted high-quality studies to practitioners interested in pain management. Because the extraction and quality appraisal process are labor-intensive, the number of journals abstracted is limited to those that provide a consistent yield of pain related research. Hence, PAIN$^+$ may miss important pain studies published in journals not targeted for extraction because pain is not a common focus. Due to these differences, it is important to understand how these two different approaches perform in providing clinically relevant research evidence on pain management.

5.11 Purpose

The primary purpose of the study was to compare yield and usefulness of PubMed and PAIN$^+$ in retrieving evidence to address clinical research questions on pain management. The secondary

purpose of the study was to identify what search terms and methods were used by clinicians to target pain research.

METHODS

5.21 Participants: 120 PAIN$^+$ users (30 MDs, 30 RN, 30 OT/PT, 30 Psych) who have been exposed to PAIN$^+$ for more than one year were invited via email to participate in this study. Of the 120 health care professionals who were invited, 76 agreed to be part of the study and were enrolled in the current study. Sample characteristics are described in Table 1. The study was approved by McMaster Research Ethics Board, Hamilton, Ontario, Canada.

5.22 Study design: Two phase, double blinded randomized crossover trial

Randomisation: Once the participants were recruited for the study, they were randomly allocated to the PAIN$^+$ arm or the PubMed arm by a computer program.

Allocation concealment: The allocation of the participant to either the PubMed or PAIN$^+$ was concealed from the participant and the evaluator by the use of a computer program.

Blinding: Participants and evaluator were blinded to the search engine they were searching from, by use of a neutral interface that was the same for both search engines and that identified neither.

Interventions: Participants were asked to perform a literature search in either PAIN$^+$ or PubMed depending on their allocation for a multi-disciplinary and a discipline specific clinical question using a neutral interface (details are explained in the procedure section).

Wash-out period: Participants crossed over to the second search engine immediately, without any wash-out period.

5.221 Outcome measures:

Primary outcomes: The primary outcomes were, search yield and usefulness indicators.

Search yield indicators:

One-page yield: For each participant, individual first-page retrieval was calculated as one-page yield. It was the total number of articles that was presented on the first page of the retrieval, up to a maximum of 20 articles, to reflect the typical number of citations that would be presented on a first page retrieval,

Overall one-page yield: This was calculated by adding up the total number of articles retrieved across all participants.

Usefulness indicators:

Likert scales were used to measure the different dimensions of usefulness of PubMed and PAIN$^+$ in retrieving pain evidence. Questions were presented at the end of each scenario. The areas included usefulness of retrieved evidence, relevancy to practice, quality of the retrieved evidence, potential ability of the evidence to change practice, usefulness of the search session and rating of search engines. (See Figure 5)

Secondary outcomes: The search terms used and the use of Boolean operators.

5.222 Procedure: Participants interacted with the study scenarios (See Figure 1) through a neutral electronic interface that presented two clinical queries. In the first query, clinicians were presented with a multi-disciplinary pain related research question (identical for all study participants) "Are multidisciplinary pain programs effective in managing chronic non-cancer pain?" and in the second part, they were presented with a discipline-specific clinical question. (See Figure 1) Participants were asked to perform a literature search to find articles relevant to the presented clinical scenario, using either PubMed or PAIN$^+$ depending on their allocation. Participants picked their own keywords and were allowed to do one revised search if no citations were retrieved in the initial search. (See Figure 2)

Once the search terms were entered, participants were presented with the first 20 articles retrieved from the search and were asked to select the top 3 relevant articles (without having to read the abstract). They were then asked to pick the top paper out of the 3 relevant papers and read the abstract to respond to the following questions: '*How relevant are these papers to your practice?'* (7-point Likert scale)*; 'How would you rate the quality of this paper?'* (5-Point Ordinal scale); '*Based on the information in this paper, how likely would you change your practice?'* (7-point Likert scale). They rated the usefulness of each of the 3 citations selected and then the usefulness of the overall session on a 7-point Likert scale. (See Figure 5)

After the completion of the search in the initial arm, the participants crossed over to the other search engine (PubMed or PAIN$^+$). We did not include a wash-out period in the study. It was not possible because this is a single sitting study, and also since it is an online environment. They were again asked to perform a literature search and find articles relevant to the presented clinical scenario through a neutral electronic interface. After both searches had been completed for the multidisciplinary scenario, participants were asked the last question: *Which search was better "Search1 or Search 2"?* Participants then moved on to the discipline specific scenario

(Phase-II where they were presented with a second discipline-specific pain related research question. (See Figure1) The process that was followed in phase-I was repeated.

5.3 STATISTICAL ANALYSIS:

Descriptive statistics and all the analyses were completed using SPSS version 22.[1] Statistical significance was set at a level of $p<0.05$.

To compare PubMed and PAIN$^+$: Independent t tests were used to compare PubMed and PAIN$^+$ for all the usefulness questions except for the question "Is the conclusion of this study consistent with your current practice?" for which Chi-square test was used because the responses were categorical.

5.4 RESULTS

5.41 Participants: Out of the 120 health care professionals who were invited, 76 agreed to be part of the study and were enrolled in the study. The majority of the sample was comprised of nurses (n=27) while the smallest subgroup was the 7 psychologists who agreed to be part of the study. (See Table 1)

On the whole 308 searches were made and 4294 articles were retrieved. (See Table 1) For the multidisciplinary scenario, 77 searches on PubMed retrieved 1135 articles while a similar number of searches in Pain$^+$ retrieved 715 articles. The search terms used are depicted in Figure 3. For the discipline specific scenario, PubMed yielded 1398 articles while Pain$^+$ retrieved 1046 articles. (See Table 1) The search terms used are depicted in Figure 4.

5.42 Usefulness of search engines:

5.421 Multidisciplinary scenario: The top 3 articles retrieved by PAIN$^+$ were rated as more useful than the top 3 articles retrieved by PubMed (mean difference = 1.10 ; 95% CI 0.66 – 1.54; $P < 0.001$). For the dimension, consistency of the most relevant citation retrieved with current clinical practice; it was found that PubMed was rated higher than PAIN$^+$. (Chi square value 11.92; $p < 0.001$) (See Table 5) There was no statistically significant difference between the two search engines in how clinicians rated the following usefulness criteria: quality of the most relevant paper; change of practice in the future; and usefulness of the overall session. (See Table 3) Participants preferred PubMed (48%) over PAIN$^+$ (39%) (Chi square = 13.82; $p < 0.001$) to conduct searches for pain related research. (See Table 1)

[1] SPSS Version 22 IBM industries

5.422 Discipline-specific scenario: The top 3 articles retrieved by Pain$^+$ were rated as more useful than the top three articles retrieved by PubMed (mean difference = 0.63; 95% CI 0.21 – 1.04; P < 0.004). When comparing the consistency of the results of the most relevant study with current clinical practice, Pain$^+$ was rated higher than PubMed. (Chi square value 45.63; p < 0.02). (See Table 5) Clinicians reported that they were more likely to change practice in the future based on the evidence retrieved by PubMed when compared to PAIN$^+$ (mean difference = 0.22; 95% CI 0.08 – 0.35; p < 0.002). The quality of the most relevant paper; and overall usefulness of the session were not statistically different between engines. (See Table 3) Participants preferred PAIN$^+$ (52%) over PubMed (29%) (Chi square = 12.96; p < 0.002). (See Table 1)

5.43 Description of the search terms and use of Boolean operators: Boolean operators such as the use of "AND", "OR" and "Not" to connect search terms were used by 29% of the participants. Overall 45 unique terms were used by our participants for their search. The top 10 search terms are listed in Table 2. The search terms used for the multidisciplinary query (see Figure 3) and discipline-specific queries (see Figure 4) are shown in a word cloud generated using NVivo software[2]. Interpretation of a word cloud is as follows: The larger the word, the more frequently it was mentioned. As such it provides a visual of the search terms used by the participants.

5.5 DISCUSSION

The results of the current study indicate that both PubMed and PAIN$^+$ retrieved useful pain research in both a multi-disciplinary and discipline-specific context. Although findings were inconsistent across some study measures and scenarios, overall participants preferred PAIN$^+$ to a greater extent and found the first 3 retrieved papers to be more clinically useful.

The participants in our study noted that the top 3 articles that were retrieved by PAIN$^+$ were more useful than PubMed for both multidisciplinary and discipline specific queries. The reasons for this could be that PAIN$^+$ is designed to identify, appraise and push out the most relevant high quality research. The fact that the evidence was perceived as useful is encouraging and suggests that it might more readily direct practitioners to best practice evidence. Since PubMed has broad coverage, simplistic searches may yield studies that are lower quality or less specifically focused on pain. To solve this problem, PubMed provides search delimitators that

[2] QSR International, Australia

can be manually applied or provides customized search filters that help focus the retrieval on different types of clinical research questions or study designs. [16-22] These filters are not completely accurate at identifying best evidence but are expected to provide more targeted results than user generated search terms.[23] The importance of these filters or customized search platforms like PAIN$^+$ is confirmed by our finding that relatively unsophisticated search strategies (Boolean operators) were used by most users and that few exercised the options to manually focus their search strategies to better quality studies.

While rating the quality of the topmost article retrieved, similar trends were observed in both multi-disciplinary and discipline specific queries. PAIN$^+$ was rated higher than PubMed; however the trend was not statistically significant. The reasons why the difference did not reach statistical significance could be that only the topmost article was rated for quality; and this may not reflect the quality of the overall one-page yield, particularly since most users would be expected to review more than the first paper in a one-page yield. Future studies should allow users to rate the quality of at least the top 5 abstracts which can be a better indicator of the quality of the overall yield.

Our study indicated that clinicians preferred PubMed (48%) over PAIN$^+$ (39%) for multidisciplinary scenario,($P < 0.005$) while PAIN$^+$ (52%) was preferred over PubMed (29%) for discipline specific searches($p < 0.003$). However, it should be noted that the difference in the percentage of clinicians who preferred PubMed over PAIN$^+$ for multidisciplinary queries was only 9% when compared to a 23% difference in clinicians who preferred PAIN$^+$ over PubMed for discipline specific queries. The reasons why clinicians prefer one search engine is unclear, but as the “front face” of the search was made identical it must have related to the overall perceived value of the outputs. This could include the quality, relevance or volume.

The articles retrieved by PAIN$^+$ were rated as more consistent with current practice and those retrieved by PubMed were rated as more likely to change practice, but these statistical differences were small in size and unlikely to indicate clinically important differences. Since these are opposing concepts, yet both potentially positive, the fact that they were different in opposing directions suggests that participants understood and differentiated these questions appropriately. This is in line with a previous study comparing PubMed, Scopus, Web of Science and Google Scholar, which found that the ability of PubMed to bring out relevant articles was inconsistent. [9] Also another study comparing PubMed to Google Scholar found that Google

Scholar found more articles that were relevant than PubMed. [12] This may relate to the quality or relevance of the individual studies retrieved or the overall impression about the state of the evidence from the search retrieval. This does support that targeted evidence support tools maybe more effective in effecting change in the behaviour of clinicians to adopt EBP in regular practice. However, since only surrogate measures were examined in this study, not actual behaviour, this cannot be said for certain.

We were able to observe that the search strategies used by clinicians were simplistic, often consisting of only the type of pain or type of intervention of interest. Only 29% of the clinicians who were part of the study used Boolean searches and none used delimitators like a date or study design to focus on recent or higher quality evidence. This decreased use of advanced tools might result in more irrelevant results which may hamper the search of the clinician with limited time.[24] Our findings are consistent with a previous observational study of search logs clinicians over a 12-month period where Boolean operators were used only 12% of the time.[25] It may be that clinicians know about filtering strategies and do not think they are efficient or want to peruse a large volume of studies to avoid missing things of interest. The finding that clinicians use cancer pain or non-cancer pain in their search strategy indicates some familiarity with how research literature is categorized as they are important filter terms for pain evidence, and there are important clinical differences between these two types of pain. The prevalence of searches for cancer pain is not unexpected given that cancer is one of the most common reasons for chronic pain.[26]

A strength of the current study is that we included professionals from multiple disciplines given the inter-disciplinary nature of pain management. However, we were not powered to examine differences between the disciplines, nor were the groups equally represented. The neutral interface limited potential bias that may have occurred based on perceived authority of PubMed versus PAIN^{+}, or visual preferences. Our findings should be considered in light of methodological constraints. Since we limited the number of relevant articles that can be flagged by the clinician to their top three, this affected our ability to calculate efficiency parameters like search recall and also affected the precision calculations. Future studies are needed where the number of relevant articles is not restricted. Another limitation was that we did not include a wash out period due to the nature of the study environment (online). This may have affected the results of our study because when the search in the first interface did not provide good results

Participants might have modified their search for the second interface. Further, their perceptions of one search may have affected the next search in other ways. The randomisation procedures should have minimized the impact this had on our conclusions since any potential carry-over effects were randomly distributed. We recommend future studies to include a wash-out period and take a longitudinal approach to determine the impact or use of these two different search tools over time. A potential source of heterogeneity in the study is the use of different questions for clinicians in the discipline specific scenario and including them in the same analysis.

In conclusion, PAIN$^+$ and PubMed both were rated as useful in retrieving pain evidence for clinicians across different health disciplines who are involved in pain management. Greater preferences and perceived usefulness of the top 3 retrieved papers was observed for Pain+, but other dimensions of usefulness did not consistently favor either search engine.

Acknowledgements

The authors wish to thank Ms. Margaret Lomotan for assistance with the study. Joy C MacDermid was supported by a CIHR Chair in Gender, Work and Health and the Dr. James Roth Chair in Musculoskeletal Measurement and Knowledge Translation.

This work was supported by operating grants from Canadian Institutes of Health research (CIHR): CIHR - FRN: 107539 & FRN: 123308.

5.6 REFERENCES

1. Merskey H, Bogduk N: **IASP Task Force on Taxonomy: Classification of Chronic Pain.** 2nd ed. (Revised). Seattle: IASP Press: 2011.

2. Gravitz MA, Gatchel RJ: ***Clinical Essentials of Pain Management.*** Washington, DC: American Psychological Association Press; 2005.

3. Engel G: **The need for a new medical model: a challenge for biomedicine.** Science 1977, 196(4286):129-136.

4. Gatchel RJ, McGeary DD, McGeary CA, Lippe B: **Interdisciplinary chronic pain management: Past, present, and future.** Am Psychol 2014, 69(2):119-130.

5. Sackett DL, Rosenberg WMC: **The Need for Evidence-Based Medicine.** J R Soc Med 1995, 88(11):620-624.

6. Sackett DL: ***Evidence-based medicine: how to practice and teach EBM:*** 2nd ed. Edinburgh; New York: Churchill Livingstone; 2000.

7. US National Library of Medicine: **National Library of Medicine (US) Key MEDLINE Indicators.** 2014 [http://www.nlm.nih.gov/bsd/bsd_key.html]

8. Anders ME, Evans DP: **Comparison of PubMed and Google Scholar literature searches.** Respir Care 2010, 55(5):578-583.

9. Falagas ME, Pitsouni EI, Malietzis GA, Pappas G: **Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses.** The FASEB Journal 2008, 22(2):338-342.

10. Freeman MK, Lauderdale SA, Kendrach MG, Woolley TW: **Google Scholar versus PubMed in locating primary literature to answer drug-related questions.** Ann Pharmacother 2009, 43(3):478-484.

11. Nourbakhsh E, Nugent R, Wang H, Cevik C, Nugent K: **Medical literature searches: a comparison of PubMed and Google Scholar.** Health Info Libr J 2012, 29(3):214-222.

12. Shariff SZ, Bejaimal SA, Sontrop JM, Iansavichus AV, Haynes RB, Weir MA, Garg AX: **Retrieving clinical evidence: a comparison of PubMed and Google Scholar for quick clinical searches.** J Med Internet Res 2013, 15(8):e164.

13. Shultz M: **Comparing test searches in PubMed and Google Scholar.** J Med Libr Assoc: 2007, 95(4):442-445.

14. Agoritsas T, Merglen A, Courvoisier DS, Combescure C, Garin N, Perrier A, Perneger TV: **Sensitivity and predictive value of 15 PubMed search strategies to answer clinical questions rated against full systematic reviews.** J Med Internet Res 2012, 14(3):e85.

15. HIRU, McMaster University: **Pain PLUS (Premium LiteratUre Service).** [https://plus.mcmaster.ca/PainPlus/]

16. Li J, Lu Z: **Developing Topic-Specific Search Filters for PubMed with Click-Through Data.** Methods Inf Med 2013, 52(5):395-402.

17. Shaikh N, Badgett RG, Pi M, Wilczynski NL, McKibbon KA, Ketchum AM, Haynes RB: **Development and Validation of Filters for the Retrieval of Studies of Clinical Examination From Medline.** J Med Internet Res 2011, 13(4):e82.

18. Shariff SZ, Sontrop JM, Haynes RB, Iansavichus AV, McKibbon KA, Wilczynski NL, Weir MA, Speechley MR, Thind A, Garg AX: **Impact of PubMed search filters on the retrieval of evidence by physicians.** CMAJ 2012, 184(3):E184-E190.

19. van de Glind EM, van Munster BC, Spijker R, Scholten RJ, Hooft L: **Search filters to identify geriatric medicine in Medline.** J Am Med Inform Assoc 2012, 19(3):468-472.

20. Kastner M, Wilczynski N, McKibbon K, Garg A, Haynes R: **Diagnostic Test Systematic Reviews: Bibliographic search filters ("Clinical Queries") for diagnostic accuracy studies perform well.** J Clin Epidemiol 2009, 62(9):974-981.

21. Lokker C, Haynes RB, Wilczynski NL, McKibbon KA, Walter SD: **Retrieval of diagnostic and treatment studies for clinical use through PubMed and PubMed's Clinical Queries filters.** J Am Med Inform Assoc 2011, 18(5):652-659.

22. Wilczynski NL, McKibbon KA, Walter SD, Garg AX, Haynes RB: **MEDLINE clinical queries are robust when searching in recent publishing years.** J Am Med Inform Assoc 2013, 20(2):363-368.

23. Leeflang MM, Scholten RJ, Rutjes AW, Reitsma JB, Bossuyt PM: **Use of methodological search filters to identify diagnostic accuracy studies can lead to the omission of relevant studies.** J Clin Epidemiol 2006, 59(3):234-240.

24. Gilman IP, Thomas JC, Winder MC: **Literature Reviews. In *Understanding Research in Clinical and Counseling Psychology.*** 2nd edition. Edited by Thomas JC, Hersen M. NewYork: Taylor & Francis; 2011:269-292.

25. Meats E, Brassey J, Heneghan C, Glasziou P: **Using the Turning Research Into Practice (TRIP) database: how do clinicians really search?** J Med Libr Assoc: 2006, 95(2):156-163.

26. van den Beuken-van Everdingen MH, de Rijke JM, Kessels AG, Schouten HC, van Kleef M, Patijn J: **High prevalence of pain in patients with cancer in a large population-based study in The Netherlands.** Pain 2007, 132(3):312-320.

Table 1 Demographics and search characteristics

Sample Characteristics n (%)	
n	77 (100)
Physicians	12 (16)
Nurses	27 (35)
Physiotherapists	21 (27)
Occupational Therapists	10 (13)
Psychologists	7 (10)
Search Characteristics	
Number of professionals who used Boolean searches	27
Number of unique search terms used	45
Total number of searches performed	308
Number of original research articles retrieved	
Total	4294
PubMed – multidisciplinary	1135
Pain^{+} – multidisciplinary	715
PubMed - discipline-specific	1398
Pain^{+} - discipline-specific	1046
Preference for electronic database in % (PubMed: Pain^{+}:No preference) p=0.02	
For multidisciplinary scenario	48: 39 : 13
For discipline-specific scenario	29 : 52 : 19

Table 2 Frequently used search terms

Search Terms	Frequency
non cancer	75
cancer pain	61
multidisciplinary pain	46
pain programs	41
chronic pain	39
pain program	21
pain treatment	4
pain programs	3
meta-analysis	3
clinical trial	3

Table 3 Independent t test for effectiveness of Pain$^+$ Vs PubMed in retrieving evidence on pain for a multidisciplinary scenario

Effectiveness characteristic	Electronic database	N	Mean	SD	T value	P value
Usefulness rating of Top 3 [1- Not useful at all to 7- Very useful]	Pain$^+$	77	5.15	1.13	4.97	0.00*
	PubMed	77	4.05	1.55		
Rate the quality of paper [1Very Low – 5 Very High]	Pain$^+$	77	3.69	0.70	1.87	0.06
	PubMed	77	3.51	0.70		
Change practice based on the article retrieved [1- Not likely at all to 7- Very likely]	Pain$^+$	77	1.61	0.60	-1.90	0.06
	PubMed	77	1.75	0.56		
Usefulness of the overall session [1- Not useful at all to 7- Very useful]	Pain$^+$	77	4.31	1.74	0.52	0.60
	PubMed	77	4.22	1.65		

*significant at $p<0.05$

Table 4 Independent t test for effectiveness of Pain$^+$ and PubMed in retrieving evidence on pain for discipline-specific scenarios

Effectiveness characteristic	Electronic database	N	Mean	SD	T value	P value
Usefulness rating of Top 3 [1- Not useful at all to 7- Very useful]	Pain$^+$	77	5.54	1.38	2.99	0.00*
	PubMed	77	4.91	1.50		
Rate the quality of paper [1Very Low – 5 Very High]	Pain$^+$	77	4.03	0.78	1.22	0.22
	PubMed	77	3.92	0.75		
Change practice based on the article retrieved [1- Not likely at all to 7- Very likely]	Pain$^+$	77	1.36	0.49	-3.23	0.00*
	PubMed	77	1.58	0.62		
Usefulness of the overall session [1- Not useful at all to 7- Very useful]	Pain$^+$	77	5.07	1.78	1.91	0.059
	PubMed	77	4.62	1.88		

*significant at $p<0.05$

Table 5 Chi-square test of independence to compare the consistency of the results with clinical practice retrieved from Pain^{+} and PubMed

n = 77	Percentage who agreed – PAIN^{+}	Percentage who agreed – PubMed	Pearson Chi-square	Degrees of freedom	P value
Multidisciplinary scenario	37%	56%	45.64	4	0.001*
Discipline-specific scenario	65%	51%	11.92	4	0.02*

*significant at $p<0.05$

Figure 1 Clinical questions presented to clinicians in the study

Multidisciplinary Scenario

Are multidisciplinary pain programs effective in managing chronic non-cancer pain?

Discipline-specific scenarios:

Scenario for physicians

Are injection therapies effective in management of neck pain?

Scenario for nurses

Are antidepressants effective in management of neuropathic pain?

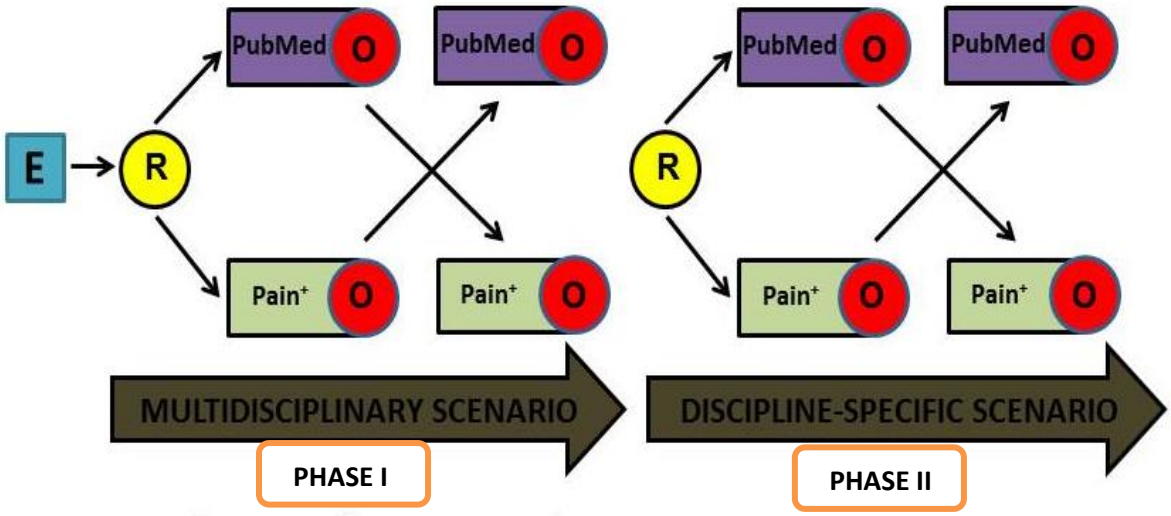
Scenario for OTs/PTs

Is spinal manipulative therapy more effective than other physiotherapy treatment modalities for chronic low back pain?

Scenario for psychologists

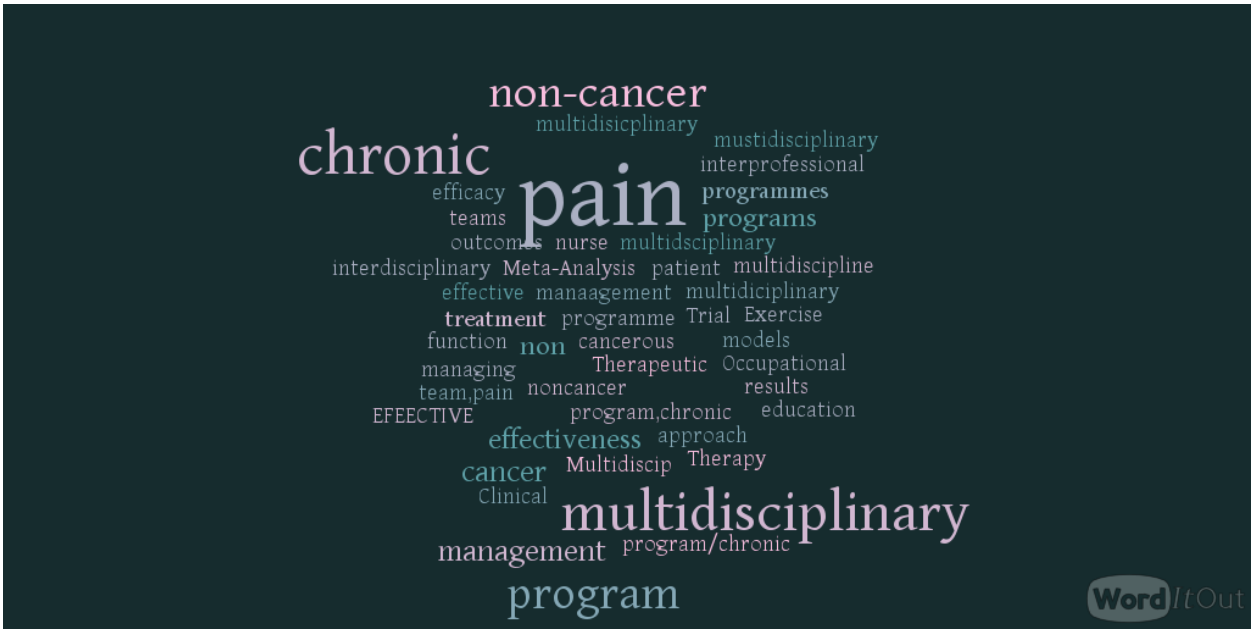
Is behavioural therapy an effective in reducing pain and disability in patients with low back pain?

Figure 2 Crossover study design



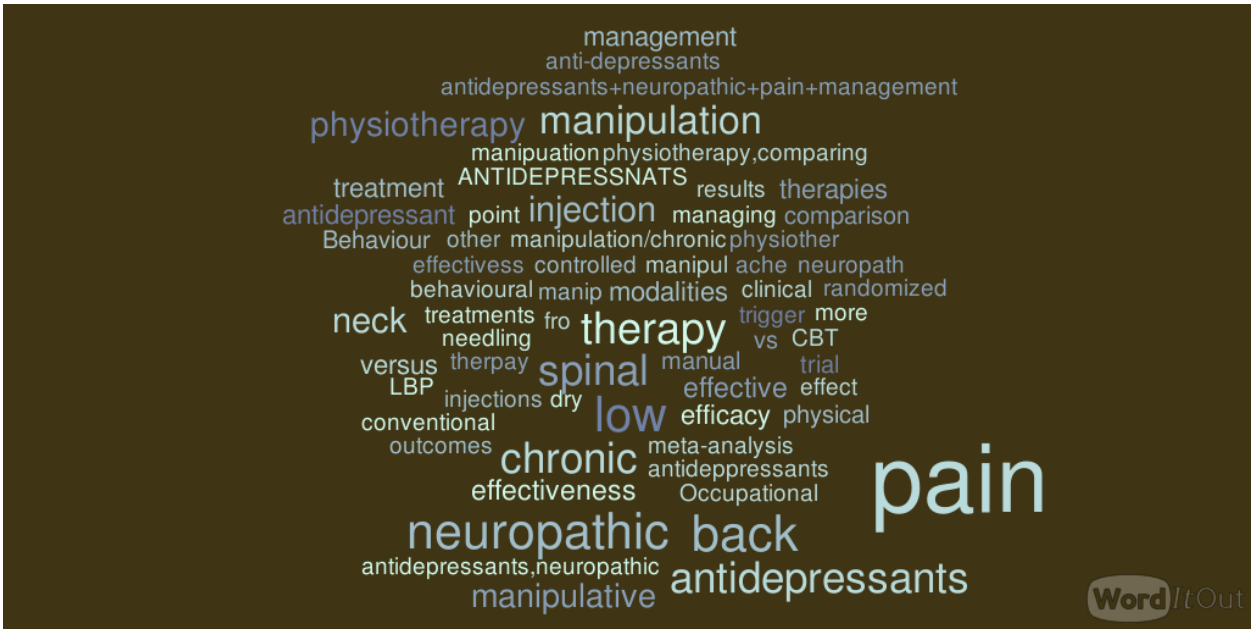
Legend: E – Enrollment; R – Randomization; O – Outcome assessment

Figure 3 Word cloud depicting the search terms used for searches by the participants of the study for multidisciplinary query



*Large and bold letters indicate greater frequency

Figure 4 Word cloud depicting the search terms used for searches by the participants of the study for discipline specific query



*Large and bold letters indicate greater frequency

Figure 5 Questions posed to clinicians after each search

Participants will be presented with the first 20 articles retrieved from each Search (1 or 2):

Participant will check off top 3 relevant papers and rate (without having to read the abstract):

- **The usefulness of each of the top 3 citations retrieved**
  How useful is this citation?
  Response: *1 = not useful at all, 4 = somewhat useful; 7 = very useful*
- **The usefulness of the overall session**
  How useful is the overall search session?
  Response: *1 = not useful at all, 4 = somewhat useful; 7 = very useful*

Participant will pick <u>top paper out of 3</u> relevant papers and read the abstract to rate:

- *How relevant is this paper to your practice?*
  Response: *1 = not relevant at all, 4 = somewhat relevant; 7 = very relevant*
- *How would you rate the quality of this paper?*
  Response: *Very high, high, moderate, low, very low*
- *Based on the information in this paper, how likely is it that you would change your practice?*
  Response: *1= not likely at all, 4 = somewhat likely, 7 = very likely*

After both searches are completed for the multidisciplinary or discipline specific scenario, the participant will be asked the last question:

- *Which search is better?*
  Response: *Search 1 or Search 2*

CHAPTER 6 GENERAL DISCUSSION

6.1 Summary

The overarching purpose of this thesis was to understand how clinicians across different professional groups view evidence-based practice (EBP) and to focus specifically on the EBP strategies for searching and evaluating research evidence in the context of pain management. The thesis was conducted as a series of studies conducted in conjunction with, but prior to, an RCT that evaluated a push-out alerting service of pain research ($PAIN^{+}$) compared with a pull approach.

Previous studies have identified that translation of research into clinical practice takes approximately 17 years.(1-3) Hence, to speed up and successfully implement EBP in the specialty of pain management, it is important to have focussed EBP tools which are efficient and useful, along with generic evidence synthesis tools like PubMed. It is also of great value to understand clinician's knowledge, attitude, behavior, their perceptions of outcomes of EBP, literature searching habits, and evidence access behaviors. The four components of this thesis explored these areas providing us a better understanding of general knowledge and skills of EBP and access behaviors that might influence the uptake of research in the specialty of pain management. The ability to access and select evidence is a key precursor to implementation of pain research in practice.

In the first study (Chap 2;) we compared the knowledge, attitude, behaviors of physicians, nurses, physiotherapists, occupational therapists and psychologists involved in pain management towards EBP and their perceived outcome of EBP using a standardized modified Knowledge, Attitude, Behavior, Outcome questionnaire (EBP-KABQ).(4, 5) We found that all the five groups of clinicians had a positive attitude towards EBP and no differences were observed between the groups, which are congruent with previous studies. (6-11) In terms of knowledge, we found statistically significant differences between the groups; nurses reported better knowledge when compared to other groups of clinicians. Physicians, nurses, PTs, OTs and psychologists involved in pain management had similar patterns of responses on a self-report measure that assesses dimensions of EBP. The only clinically relevant difference was that physicians reported higher EBP behavior than other groups. The important finding may have been that for all groups, behavior was the lowest scoring aspect of the KABQ.

The findings of this study indicate the need to enhance EBP implementation for all professions involved in pain management. It might be important to understand the implementation challenges in using a more qualitative approach. Interventions that target behavior should be more widely studied. For example, it might be useful to understand how mentors and educators could provide more role modeling, implementation guides or support, scenarios, or competency-based evaluations to promote, evaluate and remediate these challenges. This study suggests the need for focused training programs and resources to improve clinician's knowledge, attitude, behavior and perceived outcomes of EBP.

In the second study (Chap 3), we used a mixed methods approach to understand the competencies of clinicians accessing electronic databases to search for evidence on pain management to answer clinical queries. We found that clinicians were able to perform basic search strategies, but overall had poor competency for using readily available strategies for improving the accuracy of their searches. For example, they demonstrated poor awareness of PICO to structure search questions, Boolean operators to increase specificity, embedded filters like Clinical Queries or critical appraisal approaches to focus on the best evidence. For example, only 8% of the participants used Boolean operators. Participants used PubMed as their common database, followed by Google Scholar. We were also able to identify some of the barriers to searching for research studies including lack of time, lack of resources and access to resources. Our cohort was similar to previous studies that have identified such barriers.(9, 11-13). This supports the findings of the previous study that was conducted to evaluate the determinants of research use in elderly care in Sweden. They have reported that access to resources is a determinant of research utilization.(14)

Understanding the type of information that is accessed by individuals in different disciplines will enable us to cater to their EBP needs. In our third study (Chap 4), we performed a structured classification of the abstracts from the PAIN^{+} database that were viewed by clinicians based on email alerts that they received. We found that professionals will access multiple research studies when provided an alerting service, and seem to preferentially access systematic reviews/meta-analysis. This is interesting given that the previous study showed that few people were aware of how to find systematic reviews in PubMed. This can easily be accomplished through PubMed's Clinical Queries where these are specifically listed for different types of clinical questions.(15,16)

Many of the findings of this paper were consistent with the scope of practice of the professions included. This does reaffirm that different professional groups are likely to seek information that is related to their practice questions and services they are expecting to provide.

In the last part of the thesis (Chap 5), we compared a focussed evidence "Push" service ($PAIN^+$) to the most popular 'pull' type system (PubMed) using a randomized crossover trial approach. Articles retrieved by $PAIN^+$ were considered of high quality and more relevant to current clinical practice. It is not clear why this happened, but the $PAIN^+$ studies have been evaluated for quality by experts in critical appraisal and this may have increased the user's confidence in this aspect. This relates to the findings in Chapter 3 where participants expressed a lack of confidence in their critical appraisal skills. Tools like $PAIN^+$ would meet the needs of clinicians in this field, which may not be sufficiently addressed by a generic database like PubMed since it removes the burden of critical appraisal.

6.2 Contribution of this thesis to evidence-based practice in the specialty of pain management

In the context of a single thesis, it is difficult to address all the research gaps in a particular area of study. However, this thesis has made significant contributions to EBP in the specialty of pain management. It has laid a solid groundwork for future research. We were able to identify and compare knowledge, attitude and behaviors of clinicians involved in pain management towards EBP. This can inform policy makers to decide on the pros and cons of their mechanism of EBP implementation such as appropriate allocation of money and resources. Understanding of the competencies of clinicians performing clinical searches can help provide better search experiences through the use of modern technology and also to identify and clear the barriers that are preventing them from performing effective literature searches to answer their clinical queries. This thesis, by helping to understand the type of information that is of interest to clinicians involved in pain management, may help evidence push services like $PAIN^+$ to cater to their specific needs and interests. The final study where we compared $PAIN^+$ and PubMed has contributed to the clear understanding of the areas in which these two different EBP tools could be effective. For instance $PAIN^+$ was perceived to be useful for discipline specific search while PubMed was perceived useful for the multidisciplinary search. Thus, these two tools can be appropriately used depending on the patient needs and clinical question.

6.3 Strengths and Limitations

The strengths of the current thesis include the use of a validated standardized questionnaire to understand the knowledge, attitude, behavior and outcomes of evidence-based management. Previous studies have not used a validated measure to capture the knowledge, attitude and behavior of clinicians towards evidence-based practice.(6, 7, 11) The use of KABQ(17) has increased the validity of the results. Another strength of this thesis was that we were sufficiently powered to analyze the various aspects of EBP in pain management that we have analyzed; this increases the credibility of our findings. The use of mixed methods approach adds an additional perspective to this thesis. This helped us not just to rely on numbers but enabled us to understand the reason behind those numbers. Another major strength is the use of a crossover RCT design to compare PAIN$^+$ and PubMed.

The current thesis also had its own inherent limitations and the results of the studies should be viewed in light of these weaknesses. One major weakness is we did not use a longitudinal dataset to analyze changes in behavior, nor had any measure of actual behavior. Our assessment of EBP behavior was with a standardized, but a generic tool that was not specific to pain management scenarios. Further, self-reported behavior is subject to bias. It would have helped us to understand the effect of PAIN$^+$ on EBP skills and its implementation in clinicians if, we could have followed clinician's forward in time to see if there was an impact on their practice. It should be noted that the participants of this study are completing an 18-month follow-up which would provide longitudinal data to compare change over time, but this will also be dependent on self-report. While behavior change is the goal of knowledge translation interventions, many studies use surrogates measures for actual practice change. Overall, this thesis focused on access behaviors and skills as those were seen as important precursors to uptake and implementation of pain research evidence. We acknowledge that access does not necessarily ensure application.

Another major limitation is the exclusion of a wash-out period from the randomized cross-over trial. This could not be achieved because of the online environment in which the study was conducted. This might have led clinicians to change their search strategies when compared to their first search depending on the outcome of the first search. However, the use of a neutral interface would have prevented any bias towards a particular search engine. Another limitation of this thesis is the use of only one reviewer to code the abstracts for abstract classification. This

may have prevented quality checking and verification of the codes. However, the reviewer was well trained and has extensive experience with coding and literature searches which might have reduced the risk of error.

6.4 Future directions

We recommend future studies to include appropriate wash-out period when comparing PAIN$^+$ with PubMed or other search engines**.** The search yield that is presented to the participants should be set at least at 40 giving clinicians a wide variety of studies to choose from, as a previous study has found that clinicians do not browse past the first two pages of PubMed results which ideally contains 20 articles each. (18) It might be important to explore what users felt was missing from the alerts they received. We also recommend including multiple reviewers to code the abstracts during future abstract classification studies, which increases the validity and credibility of the classification. We also recommend that future studies use the results of this thesis which has identified the characteristics of the clinicians and their preferences, to conduct an evaluation study of how EBP is being implemented in the specialty of pain management. Given the limitations in skills demonstrated future studies on how to improve implementation of pain research will need to extend beyond access behavior.

6.5 REFERENCES

1. Morris ZS, Wooding S, Grant J. The answer is 17 years, what is the question: understanding time lags in translational research. J. R. Soc. Med. 2011;104(12):510-20.

2. Westfall JM, Mold J, Fagnan L. Practice-based research--"Blue Highways" on the NIH roadmap. Jama. 2007;297(4):403-6.

3. Green LW, Ottoson JM, Garcia C, Hiatt RA. Diffusion theory and knowledge dissemination, utilization, and integration in public health. Annu Rev Public Health. 2009;30:151-74.

4. Johnston JM, Leung GM, Fielding R, Tin KY, Ho LM. The development and validation of a knowledge, attitude and behavior questionnaire to assess undergraduate evidence-based practice teaching and learning. Med Educ. 2003;37(11):992-1000.

5. Shi Q, Chesworth BM, Law M, Haynes RB, MacDermid JC. A modified evidence-based practice- knowledge, attitudes, behavior and decisions/outcomes questionnaire is valid across multiple professions involved in pain management. BMC Med Educ. 2014;14:263.

6. Heiwe S, Kajermo KN, Tyni-Lenne R, Guidetti S, Samuelsson M, Andersson IL, et al. Evidence-based practice: attitudes, knowledge and behaviour among allied health care professionals. Int J Qual Health Care 2011;23(2):198-209.

7. Iles R, Davidson M. Evidence-based practice: a survey of physiotherapists' current practice. Physiother Res Int. 2006;11(2):93-103.

8. Jette DU, Bacon K, Batty C, Carlson M, Ferland A, Hemingway RD, et al. Evidence-based practice: beliefs, attitudes, knowledge, and behaviors of physical therapists. Phys Ther. 2003;83(9):786-805.

9. Lyons C, Brown T, Tseng MH, Casey J, McDonald R. Evidence-based practice and research utilisation: perceived research knowledge, attitudes, practices and barriers among Australian paediatric occupational therapists. Aust Occup Ther J. 2011;58(3):178-86.

10. McColl A, Smith H, White P, Field J. General practitioner's perceptions of the route to evidence based medicine: a questionnaire survey. BMJ (Clinical research ed). 1998;316(7128):361-5.

11. Young JM, Ward JE. Evidence-based medicine in general practice: beliefs and barriers among Australian GPs. J Eval Clin Pract. 2001;7(2):201-10.

12. Salbach NM, Jaglal SB, Korner-Bitensky N, Rappolt S, Davis D. Practitioner and organizational barriers to evidence-based practice of physical therapists for people with stroke. Phys Ther. 2007;87(10):1284-303.

13. Scurlock-Evans L, Upton P, Upton D. Evidence-based practice in physiotherapy: a systematic review of barriers, enablers and interventions. Physiotherapy. 2014;100(3):208-19.

14. Bostrom AM, Wallin L, Nordstrom G. Evidence-based practice and determinants of research use in elderly care in Sweden. J Eval Clin Pract. 2007;13(4):665-73.

15. Demner-Fushman D, Hauser SE, Humphrey SM, Ford GM, Jacobs JL, Thoma GR. MEDLINE as a source of just-in-time answers to clinical questions. AMIA Annu Symp Proc. 2006:190-4.

16. Wilczynski NL, McKibbon KA, Walter SD, Garg AX, Haynes RB. MEDLINE clinical queries are robust when searching in recent publishing years. J Am Med Inform Assoc. 2013;20(2):363-8.

17. Guo R, Wen Q, Shi H, Jin Z, Zhang H. An efficient and provably-secure certificateless public key encryption scheme for telecare medicine information systems. J Med Syst. 2013;37(5):9965-013--0. Epub 2013 Aug 31.

18. Shariff SZ, Bejaimal SA, Sontrop JM, Iansavichus AV, Haynes RB, Weir MA, et al. Retrieving clinical evidence: a comparison of PubMed and Google Scholar for quick clinical searches. J Med Internet Res. 2013;15(8):e164.

Hamilton Health Sciences

McMaster University

St. Joseph's Healthcare Hamilton

Hamilton Integrated Research Ethics Board
AMENDMENT REQUEST

REB Project #: [redacted]

Principal Investigator: Dr. Joy MacDermid

Project Title: A randomized trial: "Push" versus "Pull" for mobilizing pain evidence into practice across different health professions

Document(s) Amended with version # and date:

- Administrative Change - Addition of Student Co-Investigator: Vanitha Arumugam
- Consent Form – Online Consent to Participate in Research Study Dated: 26 July, 2013

Research Ethics Board Review
(this box to be completed by HIREB Chair only)

[X] **Amendment approved as submitted**

[ ] **Amendment approved conditional on changes noted in "Conditions" section below**

[ ] **New enrolment suspended**

[ ] **Study suspended pending further review**

Level of Review:

[ ] Full Research Ethics Board
[X] Research Ethics Board Executive

Conditions:

The Hamilton Integrated Research Ethics Board operates in compliance with and is constituted in accordance with the requirements of: The Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans; The International Conference on Harmonization of Good Clinical Practices; Part C Division 5 of the Food and Drug Regulations of Health Canada, and the provisions of the Ontario Personal Health Information Protection Act 2004 and its applicable Regulations; For studies conducted at St. Joseph's Hospital, HIREB complies with the health ethics guide of the Catholic Alliance of Canada

[redacted]
Suzette Salama PhD., Chair
Raelene Rathbone, MB BS, MD, PhD, Chair

8/1/2013
Date

All Correspondence should be addressed to the HIREB Chair(s) and forwarded to:
HIREB Coordinator
[redacted]

Hamilton Health Sciences

McMaster University

St. Joseph's Healthcare Hamilton

Hamilton Integrated Research Ethics Board
RENEWAL FORM

Review of an Active Study (to be completed by HIREB Chair only)

REB Project [redacted]

Principal Investigator: Dr. Joy MacDermid

Project Title: A randomized trial: "Push" versus "Pull" for mobilizing pain evidence into practice across different health professions

[X] **Approved for Continuation**

[ ] **Approved conditional on changes noted in "Conditions" section below**

Type of Approval:

[X] Full Research Ethics Board

[ ] Research Ethics Board Executive

REB Approval Period: **Approval period covers November 16-2014 to November 16-2015**

[ ] **New Enrolment Suspended**

[ ] **Suspended pending further review**

Conditions:

The Hamilton Integrated Research Ethics Board operates in compliance with and is constituted in accordance with the requirements of: The Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans; The International Conference on Harmonization of Good Clinical Practices; Part C Division 5 of the Food and Drug Regulations of Health Canada, and the provisions of the Ontario Personal Health Information Protection Act 2004 and its applicable Regulations; for studies conducted at St. Joseph's Hospital, HIREB complies with the health ethics guide of the Catholic Alliance of Canada.

[redacted]
Suzette Salama PhD., Chair
Raelene Rathbone, MB BS, MD, PhD, Chair

11/5/2014
Date of REB Meeting

All Correspondence should be addressed to the HIREB Chair(s) and forwarded to:
HIREB Coordinator
[redacted]

McMaster University

Title: A randomized trial: "Push" versus "Pull" for mobilizing pain evidence into practice across different health professions

Principal Investigators: Joy MacDermid, PhD, McMaster University
Mary Law, PhD, McMaster University

Co-Investigators: Norm Buckley, MD, McMaster University
Brian Haynes, MD, PhD, McMaster University

Student Co-Investigator: Vanitha Arumugam, PhD (candidate), University of Western Ontario

Funding: Canadian Institutes of Health Research (CIHR)

Online Consent to Participate in Research Study

Why is this study being done?
Pain is the primary reason that patients consult health practitioners. Research has shown the benefits, harms, and costs of numerous interventions for pain, but uptake of this knowledge is far from satisfactory. Optimizing pain-care requires ready access and use of best evidence within and across different disciplines and settings. The Pain PLUS information service is aimed at making it easier for clinicians to receive and access evidence-based articles on pain from health research, some of which will be clearly identified as having been pre-assessed for quality, clinical relevance and interest by practicing clinicians.

What is the purpose of this study?
The purpose of this study is to compare two different types of sharing pain research evidence, as well as the knowledge and decisions made by four different types of professionals—physicians, nurses, rehabilitation professionals, psychologists—involved in pain management. One method of sharing will be sending e-mail alerts. The other method will be providing web-based resources.

What is involved?
Study participation will run for 18 months. In the first 3 months, you will be provided web-based resources. You will be then assigned, using a process like tossing a coin, to 1 of 2 ways of sharing pain research information for 6 months. After six months, you will get the alternate way of sharing research information for an additional 6 months. You will finish the last 3 months of the study using both ways of sharing information.

During the study, your use of Pain PLUS will be measured for frequency of use (system log-ins), types of use (also assessed by online monitoring) and self-reported level of satisfaction (determined via periodic, very short, online questionnaires). In addition, you will be asked to complete surveys on recent pain evidence and evidence-based practice at 0, 3, 9, 15, and 18 months. These assessments will be completed online and will take a total of 20-30 minutes to do.

You may also be asked to do ONE of the following tasks:

1) At 0 and 9 months: A 30-minute telephone interview where you will be asked to create 2 case scenarios based on your practice. The interviewer will ask you questions about the management of these 2 "cases". You will receive a $20 gift card for doing the telephone interviews.

2) At 15 months: A 30-minute online search for evidence that will answer 2 clinical questions posed by the researchers. You will receive a $20 gift card for doing the online search.

Will I be paid to participate in this study?
You will receive a $45 gift card for completing at least 3 of the survey time points:
1) baseline assessment (Month 0),
2) one follow-up assessment (Months 3, 9 or 15),
3) final assessment (Month 18).

What will happen to my personal information?
All data is gathered and protected by the Health Information Research Unit (HIRU), a not-for-profit research entity of McMaster University, by way of protected database server computers in an alarm-protected facility controlled by HIRU. ***Individual identifiers are not stored in monitor databases and individual information will not be released to others by HIRU.***

Can participation end early?
Your participation is voluntary and you may withdraw your at any time without penalty or loss of benefits to which you are otherwise entitled.

Pain PLUS provides an educational service for practicing clinicians, designed to alert clinicians to important new research; however, we cannot warrant its accuracy. It is intended to support evidence-based decision making, by providing links to published research reports about the diagnosis, treatment, prediction and prognosis, etiology, and economics of medical conditions. However, "evidence does not make decisions". Clinicians making decisions about the care of their patients must take into account the limitations of evidence from research as well as the unique nature of their patients' circumstances and wishes. Users should also be aware that professionals in the field may have different opinions. Because of this fact and also because of regular advances in medical research, we strongly recommend that users independently verify any information they chose to rely on. Ultimately it is the users' responsibility to make their own judgments.

This study has been reviewed and approved by the McMaster Research Ethics Board. If you have any concerns or questions about your involvement you may contact the Office of the Chair of the Hamilton Health Sciences/Faculty of Health Sciences Research Ethics Board [redacted]

I understand the terms of registration as outlined above and by clicking on the Agree button below I am giving my consent to monitoring my use.

[Include an Agree and Submit button immediately following this statement]

CURRICULUM VITAE

NAME: VANITHA ARUMUGAM

PROFESSIONAL EDUCATION

- ***Bachelor of Physiotherapy (2002- 2007)*** *Tamil Nadu Dr. MGR Medical University, Chennai, India*
- ***Master of Physiotherapy (2007-2009)- Orthopaedic Physiotherapy*** *Tamil Nadu Dr. MGR Medical University, Chennai, India*
- ***Ph.D. (Expected Sept 2015)*** *University of Western Ontario, London, ON*

HONORS AND AWARDS

- **Western Graduate Research Scholarship (2011-2015)** 4 years, Western University, London, Ontario, Canada
- **Western Libraries Open access fund 2014,** Awarded by Western Libraries, Western University, London, Ontario, Canada
- **Society of Graduate Students (SOGS) – Student Travel Bursary Jan 2014**
- **Health and Rehabilitation Sciences HRS- Travel award Feb 2014**
- **"CIHR - Institute of Community Support (ICS) travel Award" (2013)** Awarded by the Institute of Musculoskeletal Health and Arthritis (CIHR). National competition. Amount $ 1000
- **Health and Rehabilitation Sciences (HRS) – Travel award June 2013**
- **Faculty of Health Sciences (FHS) – Travel award Dec 2013**
- **Health and Rehabilitation Sciences HRS – Travel award Jan 2013**
- **Society of Graduate Students (SOGS) – Student Travel Bursary Oct 2013**
- **Society of Graduate Students (SOGS) – Student Travel Bursary May 2013**
- **Society of Graduate Students (SOGS) – Student Travel Bursary Sep 2012**
- **"Best Scientific Poster award"** at the Canadian Society of Hand Therapists Annual Meeting, Toronto, ON(2012): Neural Mobilization of the Radial Nerve provides short term relief in computer users
- **"Second Best Scientific Poster award"** at the South India Conference "PHYSIOFEST-06", Chennai, India (2006): Effect of low level LASER therapy in Diabetic foot ulcers

- **"Second Best Scientific Poster award"** at the intracollege meet "PHYSIOFEST 2007": The healing energy on trigger points at the South India Conference.

RELATED WORK EXPERIENCE

- ***Designation:*** *Teaching Assistant* ***(Jan 2015-Apr 2015; Mar 2014-Jun 2014; Sep 2012-Dec2012, Jan 2012-Apr 2012)***
  Employer: *School of Physiotherapy, University of Western Ontario, London, ON*

- ***Designation:*** *Consultant Physiotherapist* ***(Oct 2009- June 2011)***
  Employer: *Squash Racket Federation of India, Chennai, India*

- ***Designation:*** *Consultant Physiotherapist-Perinatal* ***(Sep 2010- Feb 2011)***
  Employer: *Ojas foundations, Chennai, India*

- ***Designation:*** *Junior Physiotherapist****(Mar 2007- Oct 2007)***
  Employer: *Fitness Foundation Academy, YMCA , Chennai, India*

- ***Designation:*** *Consultant Physiotherapist****(Mar 2007- Oct 2007)***
  Employer: *Kala Physiotherapy Centre, Chennai, India*

PEER REVIEWED PUBLICATIONS (Total 8)

- MacDermid,J.C*, **V Arumugam,** Vincent, JI, KL Payne, AK So (2015) Reliability of three landmarking methods for dual inclinometry measurements of lumbar flexion and extension. BMC musculoskeletal disorders 16 (1), 121

- Arumugam, V*., MacDermid,(2014) Knowledge synthesis of various physical activity self report measures used in physiotherapy practice – A Scoping Review Protocol Journal Of Student Physical Therapy Research 7 (1), 1-7

- Arumugam, V*., MacDermid (2014) A theortical model to embrace physical activity counselling in primary care practice. HealthScienceInquiry

- Arumugam, V. *, Panirselvam, S.S., MacDermid, J.C., (2014)A Study to Analyse the Efficacy of Radial Nerve Mobilisation on lateral elbow pain in chronic keyboard users. Open Orthop J. 2014; 8: 368–371.doi: 10.2174/1874325001408010368

- MacDermid, J.C* ., **Arumugam, V.,** Vincent J., Caroll L. K., (2014) The reliability and validity of the computerized double inclinometer in measuring lumbar mobility. Open Orthop J. 2014 Oct 17;8:355-60. doi: 10.2174/1874325001408010355. eCollection 2014.

- **Arumugam, V*.,** MacDermid, (2013) Clinimetrics on Work Limitation questionnaire J.Physiother., 2013, 59, 4, 276-9553(13)70210-8,Australia

- **Arumugam, V*.,** MacDermid, (2013) Clinimetrics on Work instability questionnaire. Journal of physiotherapy (impact factor: 1.92). 06/2013; 59(3):212. DOI:10.1016/S1839553(13)70190

- **Arumugam, V*.**, MacDermid, J.C., Grewal R, (2013) Content analysis of work limitation, stanford presenteeism, and work instability questionnaire using international classification of functioning, disability, and health and item perspective framework. Source Rehabil.Res.Pract., 2013, 2013, 614825, United States

In Preparation for submission (Total 2)

- **Arumugam, V*.,** MacDermid, Haynes RB, Grewal R, Differences in perceptions of professionals involved in pain management towards evidence based practice. Implementation Science

- **Arumugam, V*.,** MacDermid, Haynes RB, Grewal R, Comparing the Efficiency and Effectiveness of Using Either PAIN+ or PubMed to Access Pain Research Evidence: A Randomized Crossover Trial

- **Arumugam, V*.,** MacDermid, Haynes RB, Grewal R, The search to alleviate pain: Understanding the experiences of clinicians accessing electronic databases to search for evidence on pain management using a mixed methods approach.

- **Arumugam, V*.,** MacDermid, Haynes RB, Grewal R, A structured classification of the types of studies valued by different professionals involved in pain management

- **Arumugam, V*.,** MacDermid., Corbett K., Lomatan M., Experiences of patients receiving pain medications in Carpal Tunnel Surgery (CTS).

Invited presentations (Total 1)

- **Arumugam V,*** A close look at the Indian health care system, Course No HS 4044 B-001 International Health system CMP, School of health studies, University of Western Ontario, London ON (Institutional)

Selected published peer-reviewed abstracts from conference proceedings (Total 3)

- Baseline predictors of work instability in patients with work-related upper extremity disorders (WRUED)V Arumugam, J MacDermid, QUALITY OF LIFE RESEARCH 22
- Linking of at-work disability scales to the ICF, V Arumugam, J MacDermid, R Grewal, QUALITY OF LIFE RESEARCH 21, 122-123
- ICF and work scales, V Arumugam., J MacDermid, R Grewal, JHT conference abstracts 2012

Selected Conference Presentations (* Presenting author) (Total 8)

- Arumugam, V., MacDermid, J.C., Grewal,(2013) Factors predicting work disability at the International Society of Quality of Life (ISOQOL) Miami, Florida.
- Arumugam, V., MacDermid, J.C., Grewal,(2013) Linking Presenteeism Scales at the Triennial Congress, International Society of Hand Therapist Meeting, New Delhi, India, March 2013
- Arumugam, V., Panirselvam, S.S., MacDermid,(2012)won the Best Scientific Poster Award for 2012 Neural Mobilization of the Radial Nerve provides short term relief in computer users with lateral elbow pain at the Combined Meeting of the Canadian Society of Hand Therapists and the Canadian Society for Surgery of the Hand, Toronto, ON. May, 2012.
- Arumugam, V., MacDermid, J.C., Grewal,(2012) Presented a poster on Content Validity of Work Disability Scales at the International Quality of Life and Research at Budapest, Hungary, Oct 2012
- Arumugam, V.,* (2007) Thoracic Outlet Syndrome. “ENTREVUE PHYSIOS-07” conducted by College of Physiotherapy, Mother Theresa Institute of Health Sciences, Pondicherry, India. Nov, 2007.

- Arumugam, V.,* (2006) Positional Release Technique. “ENTREVUE PHYSIOS-06” conducted by College of Physiotherapy, Mother Theresa Institute of Health Sciences, Puducherry, India. Oct, 2006.

- Arumugam, V.,*(2006), Cand Arumugam, V.,*(2006) The healing energy on trigger points at the South India Conference in the intra college meet “PHYSIOFEST 2007Arumugam, V.,* (2007) Core the anchor of the spine at the South India Conference “PHYSIOA(I)MS 2007” on 28.04.07 conducted by AMS College of Physiotherapy.

- Arumugam, V., (2006) Effects of laser on Diabetic foot ulcers at the South India Conference “PHYSIOFEST-06” on 09.12.2006 and 10.12.06 conducted by Govt. College of Physiotherapy

PROFESSIONAL AND RESEARCH ACTIVITIES:

- ***Reviewer,*** *Disability and Rehabilitation*

- ***Reviewer,*** *Regional Specialized Geriatric Services, June 12, 2014.*

- ***Member,*** *Cross-cultural adaptation special interest group*

- ***Member,*** *International Society for Quality of Life Research (ISOQOL)*

- ***Member,*** *American Society of Hand Therapists (ASHT)*

- ***Member,*** *International Federation for the Societies of Hand Therapists (IFSHT)*

- ***Member,*** *World Confederation Of Physical Therapy (WCPT)*

- ***Member,*** *The Indian Association of Physiotherapists (IAP)*

- ***Certified First Aider (CPR-AED)-*** *Canadian Red Cross*

SUPERVISORY EXPERIENCE

- Kathryn Corbett (Summer 2013) ., Experiences of patients receiving pain medications in Carpal Tunnel Surgery (CTS).

VOLUNTEERING ACTIVITIES

- *Volunteered at the Social Camps for Violence Control Against Women, Chennai, India*

- *Volunteered for writing exams of the blind, Chennai, India*