

**HOW DOES A PRACTICE-BASED RESEARCH NETWORK FACILITATE
EVIDENCE-INFORMED PRACTICE WITHIN THE CHIROPRACTIC PROFESSION
IN AUSTRALIA? A COMMENTARY**

Lyndon Gene Amorin-Woods¹, Craig Moore², Jon Adams³

HOW DOES A PRACTICE-BASED RESEARCH NETWORK FACILITATE EVIDENCE-INFORMED PRACTICE WITHIN THE CHIROPRACTIC PROFESSION IN AUSTRALIA? A COMMENTARY

ABSTRACT

This commentary summarises the background, rationale, structure and context of Practice-Based Research Networks (PBRNs) with an emphasis on chiropractic within the Australian health care setting. Following an overview of the importance and value of research based within practice-based settings and a summary of international developments in chiropractic PBRN's there is a brief description of the genesis, construction and implementation of the Australian Chiropractic Research Network (ACORN) project. The role of the ACORN PBRN is to help facilitate the development and promotion of a research agenda; improve the uptake of best clinical practice; address issues relevant to chiropractors and their patients; and build research capacity and output for the Australian chiropractic profession. The commentary identifies how the chiropractic profession in Australia is already starting to see the tangible results from the establishment of the ACORN PBRN. (*Chiropr J Australia* 2018;46:172-185)

Key Indexing Terms: *Research; Chiropractic; Complementary and Alternative Medicine; Evidence-Based Practice; Practice-Based Research Network*

INTRODUCTION

Delivering high quality health care in current times is challenging. While the Australian chiropractic profession must meet the same clinical and regulatory requirements as other nationally registered health care professions, it must seek to do so with the limited funding and personnel that characterises the reduced capacity of a smaller health profession. These circumstances therefore require the profession to more optimally utilise all of its constituent parts; academics, researchers, field practitioners and professional organisations working together effectively in order for the profession to be functional within the Australian health care system.

Critical to achieving this goal is the need for chiropractic research findings to lead to better patient health and well-being within society (1). However, a barrier to achieving this outcome is the potential for a disconnect to occur between the findings delivered by researchers and the implementation of those findings by practicing field practitioners (2, 3). Such concerns are magnified in circumstances where research academics dismiss field practitioners as ignorant or resistant to adopting research outcomes designed to improve evidence-based practice (4); or where field practitioners dismiss research academics as living in an 'ivory tower', divorced from understanding the circumstances and logistical challenges associated with real-world practice (3, 5) and become dismissive of research findings at the level of frontline health care delivery as a result. Other factors beyond this lack of acceptance or negative beliefs toward new research findings also include; a lack of provider awareness and knowledge of new research findings; provider motivational factors – both external and internal; new skills needed to adopt changes to routine practice

including those related resources and personnel; as well as factors associated with the external environment, both financial and political (6).

In exploring these issues, Larry Green, the first Director of the US Federal Office of Health Promotion under the Carter Administration, describes this 'research-practice gap' as one where frontline clinicians are too often assumed as passive 'empty vessels' who must suffer the one-way transmission of research information passed down via ever-changing practice guidelines (7). In raising these concerns Green suggests healthcare research findings undergo a greater level of preliminary vetting by field clinicians *prior* to their inclusion into clinical practice guidelines (CPG's) (5) which too often fail to engage field practitioners in daily practice (8). As a result of these challenges, it may be that the key to successfully translating the most effective research into practice is to gather practice-based evidence in the first place, or as Green is often quoted; "*If we want more evidence-based practice, we need more practice-based evidence*" (9).

It is paradoxical then that so much clinical research within health care continues to be embedded largely within institution-based tertiary centres that fail to sufficiently reflect real-world subjects and treatment delivery (10). While these concerns are not unique to healthcare or to chiropractic alone (11,12), such issues have led to a call for more '*translational research*', including by the chiropractic profession, to improve the acceptance and adoption of research findings by chiropractic field clinicians (13-16) in responding to that persistent question of; "*why, with the growing volume and apparent quality of evidence, would practitioners seem to be so resistant to using it?*" (7).

Practice-Based Research Networks

Primary care is described as the essential foundation of effective, efficient, and equitable health care systems (17). As such, the more recent introduction of health research within the real-world primary care frontline settings has been heralded as a significant development in overcoming many of these issues. Most notably, has been the willingness of health care disciplines to foster the establishment of PBRNs as the vehicle needed to better unite the worlds of community-based clinical practice and health research academia. Described as '*laboratories for primary care clinical research*' (10), PBRNs are "*groups of practices committed to improving clinical practice; groups of primary care clinicians and practices working together to answer community-based health care questions and translate research findings into practice*" (18). As such, PBRNs aim to directly engage clinicians as equal partners in quality improvement activities and an evidence-based-informed culture to help improve the health of the community. The significant growth in the number PBRNs over the last 30 years (19) has been attributed to the multiple advantages that PBRN-based research facilities have to offer (20-22), including those associated with the more practical and accessible transfer of knowledge gained from research collected within daily clinical practice and the ability of PBRNs to bring forward practice-relevant topics onto the official research agenda (23).

The National Dental Practice-Based Research Network in the USA is one example. This PBRN has over 6,500 dentists and dental hygienists as members (24). One of the key aims of the US dental PBRN was to "*improve the disconnect between clinical*

practice and published research" (25). The US Dental PBRN has now seen research published in over 39 different peer-reviewed scientific journals covering a wide range of clinical topics important to dental providers and their patients. This includes research examination of issues ranging from public health issues such as patient smoking (26); the use diagnostic procedures (27); clinical information management (28) through to better understanding how dental providers seek online information (29). As such this is an example of how PBRN research designs go far beyond RCT's (30-32) to include the testing theories and concepts and unintended consequences; all of which are necessary to do 'good science' in the real world (1, 33-37).

PBRN Research Opportunities for Chiropractic

Solving complex health problems is a significant challenge due to the many inter-related elements that are associated with the unique circumstances of each presenting patient (38-40). Improving our understanding of these inter-related elements provides a unique opportunity for chiropractic research designs to allow for how various elements impact upon the clinical encounter, and how these elements might be utilised to improve patient outcomes within real world circumstances which must above all be contextual to clinical practice (41-43).

Balancing the importance of internal and external validity i.e. the degree to which trial results are attributable to the treatment under examination (internal validity), while recognising there are outside influences (external validity) that are also associated with patient outcomes in real world settings is an important area for ongoing research enquiry. As Ammerman outlines; "*across the world funding is being tightened, and the traditional reliance on internal validity as being prioritized over external validity (44), is being challenged and further, that pragmatic clinical trials and systems modelling are among the emerging planning and analytic strategies that can help structure and integrate practice-based evidence*". Ammerman further points out that researchers must recognise both the opportunities and the limitations of these models to draw appropriate conclusions (1). As such, while clinical researchers recognise RCT designs as the gold standard to isolate the singular effects of one intervention alone, emerging concepts, for example of 'Whole Systems Research' (WSR) recognise the wider importance and influence of the entire clinical encounter.

WSR is described as that which "*entails the intention to include all aspects of any internally consistent approach to treatment, including its philosophical basis, patients, practitioners, setting of practice, and methods/materials used*" as *conceptually part of the investigative framework (45)*. As such, WSR designs recognise unique patient, family, community, and environmental features and viewpoints - factors that are more unique to practice-based clinical settings. Newell et al for example, recently presented a scientific model termed 'Contextually Aided Recovery' (CARE) contending that the circumstantial effects associated with the patient clinical encounter are not only powerful, but can elicit large clinical effects on pain, immune function and motor modulation (46). Newell presents the view that the compartmentalisation of specific and non-specific effects is a false dichotomy, both biologically and scientifically, and contends that the use of these non-specific effects

PBRN and EIP

Amorin-Woods, Moore and Adams

can be a skilful clinical art worthy of exploring within the multimodal approach to modern chiropractic care.

Broadly speaking, PBRNs provide an opportunity to facilitate wide variations in research designs; quantitative; qualitative; mixed and multi-methods; the possibilities encompass virtually all types of methodologies adapted to suit carefully developed (chiropractic) research agendas to incorporate basic science, clinical, public health and health services domains (47-49).

PBRNs in Action

In Australia before there were formal research institutes or networks of practices, there were individual practitioners who studied their patients' problems with scientific rigour. For example; the 1962-63 Australian National Morbidity Survey was conducted with 85 volunteer Australian general practitioners, and another over 6-years involved 50 full-time general practitioners and over one million patient contacts (50). In Australia while progress in PBRN development has been quite modest, the number of PBRN's is now growing quickly. An audit in 2010 documented six geographically defined PBRN's (51). By 2013 when The Australian Primary Care Research Network (APCRn) had superseded the Australian Primary Health Care Research Institute (APHCRI) (52) to provide a national support service for PBRNs across Australia, there were 19 registered PBRNs; SA (2), QLD (5), NSW (8), VIC (2), TAS (1) and 1 national, with others under construction.

International Chiropractic PBRN's

The Nordic chiropractors have established a relatively mature PBRN culture (including some non-voluntary) collecting data and reporting on outcomes from practitioners and patients for over 20 years (53). Quite a number of practice-based research projects have been performed among chiropractors in the Nordic countries in which data on patients have been collected mainly using questionnaires and mobile phones (54-61). Some of these studies were summarised by Axen (62) while presenting a manual of how to conduct chiropractic PBRN studies.

A proposed, but yet to be implemented project is a Canadian chiropractic PBRN. The model will draw on the work of Peterson et al. who described a model for the development of an electronic medical record, or EMR system, to support clinical research activities (63). The Canadian Memorial Chiropractic College (CMCC) has already successfully pilot-tested an EMR system which may be implemented across participating PBRN practices to facilitate data collection under this PBRN model (64). As yet, attempts to establish viable chiropractic PBRNs in the USA have not proven sustainable. The Integrated Chiropractic Outcomes Network (ICON) was an inter-institutional collaboration combining the expertise of experienced investigators who had conducted a number of practice-based research studies in other venues. The project was initiated in 2011 with a national coverage goal, however unfortunately languished due to a lack of funding (65).

The International Chiropractic Pediatric Association (ICPA) Practiced Based Research Network lays claim to being the largest PBRN in the chiropractic profession with more than 5,000 chiropractors and chiropractic students contributing to the ICPA mission with output of over 100 listed articles on its website research page dating back to 2004 (66). The ICPA was established in 1986 with a focus on; *“how chiropractic care positively impacts generations of families in areas related to general health, quality of life and the body's ability to express optimal human potential, particularly throughout pregnancy and childhood”*. The ICPA research division is grounded in a salutogenic model (67).

The Australian Chiropractic PBRN

Consequent to a 2010 summit at Macquarie University which discussed initiating an Australian research agenda (68), the Chiropractors Association of Australia-National (CAA-N) set out to maintain a robust commitment to supporting research including evidence-based practice and university led education programs for the profession. To this end CAA-N subsequently seed-funded a world leading independently-designed and conducted PBRN which has recently been established in Australia initially collecting data from over 2000 chiropractors about many aspects of chiropractic practice, being the Australian Chiropractic Research Network (ACORN) (69). The ACORN project was designed and established over three years by the Australian Research Centre in Complementary and Integrative Medicine (ARCCIM) based at the University of Technology Sydney (UTS) via a steering committee which included senior members of the profession. The ACORN PBRN now provides a platform for research with both chiropractors and their patients on issues such as effectiveness, safety and affordability. It is critical to note that the ACORN project has been designed to be administered independently from the chiropractic professional organisations. Although CAA-N provided seed funding, the project is administered and the data held and managed by ARCCIM, thus providing a robust, transparent, scientifically mature scaffold for future research headed by world-renowned independent scientists and researchers.

The ACORN PBRN offers the framework to further explore basic science and mechanistic research such as normal and abnormal spine biomechanics, biomechanical changes associated with the chiropractic adjustment and the related neurophysiological effects of chiropractic interventions on musculoskeletal pain, disability, function and neurological processes. For clinical research, topics for PBRN investigation can include examination of a range of management approaches toward a variety of clinical conditions including; those associated with particular patient groups such as children; older people; minority groups; pregnancy; athletes and sports people/injuries; trauma from traffic and work-related injuries and post-surgical rehabilitation. For public health and health services there is an opportunity to examine the epidemiology of musculoskeletal spinal disorders/conditions (patterns, causes and effects); access/barriers to chiropractic health services; cost-benefit analysis of chiropractic health services; chiropractic education and training; workforce and career pathways and societal impact of chiropractic care (both short and long-term).

Although PBRNs often share some core features, they nevertheless manifest in many different ways (70, 71). The ACORN (69, 72) project is built around a particular

PBRN approach and design—a ‘sub-study model’. The vast majority of PBRNs have typically adopted what is referred to as a ‘registry model’, whereby initial data collection is focused on establishing a centralised, coordinated patient record management system (73, 74). This approach tends to lend itself well to patient-focused data collection, allowing direct access to patient care and outcomes through time and consistently across PBRN practice sites. However, one limitation of an initial PBRN registry is that subsequent, related or new research interests are not easily accommodated once the patient record management system is operationalised, and it is often undesirable and inconvenient to introduce revisions to the established data collection management system (74). In contrast, the ACORN project initially employs a sub-study model to PBRN design whereby initial data collection was focused exclusively on practitioner-relevant information collected via self-report aimed at establishing a practitioner PBRN database (72). The model is designed to allow future researchers to utilise the database for various study designs. This approach recognises the dynamics of the Australian chiropractic profession where there are multiple initial patient data collection methods and combinations of paper-based and e-health record keeping (75, 76).

Researchers wishing to utilise the ACORN platform are invited to lodge applications via an Expression of Interest (EOI) process that is designed to help manage sub-study proposals. EOI submissions are encouraged from clinicians, researchers, potential funders and others with an interest. Both Australian and international investigators are welcomed. EOI submissions are then subject to scientific review by the ACORN Project Steering Committee to ensure quality, rigour, fit and other important criteria (77).

The ACORN project in Australia has already produced tangible results in terms of research and publication output. At the time of writing (Feb 2017), 6 ACORN based research papers have been published, all in different peer-reviewed journals (69, 72, 75, 76, 78, 79); 7 additional papers are currently in late draft preparation for submission; and 8 future follow-up sub-studies have been approved or currently under early implementation. These sub-studies examine topics as diverse as chiropractic management of workplace injuries, sports injuries, older patients, sciatica, neck pain, headaches, the use of nutritional advice, and the psychological profiles of chiropractors. These sub-studies include collaboration between researchers at all the current Australian universities with a chiropractic programme in concert with practitioners and researchers across Australia and overseas (Sweden, USA and Canada). In addition to research output, an important focus for the ACORN project has been to provide infrastructure that can help to advance research capacity building both for senior and emerging researchers. For example, the first PhD nested within the project is already collecting data and publications have commenced (78, 80).

Over a decade ago, Mold observed PBRNs had evolved from clinical laboratories into entire ‘*learning communities*’, proving grounds for more generalisable solutions to clinical problems, and engines for improvement of primary care delivery systems including quality improvement (QI) in patient diagnosis, treatment and disease prevention. Research within PBRNs focus on “*improvement of health outcomes of individuals and populations since the focus of clinicians, as opposed to academics, is on clinical outcomes, not research for its own sake*” (20). As such, successful

PBRNs have recognised that for researchers and clinicians to work together they must focus on outcomes that are relevant to clinical practice, that is, emphasis on solutions to the challenges that clinicians and their patients face on a frequent basis (20). As it matures as a PBRN, it is envisaged ACORN will fulfil this role as a learning community within Australian chiropractic.

CONCLUSION

There is increasing recognition of the need for a shift in the production of health care research that is more relevant to the needs of patients and the experiences of practitioners, payers, and policymakers. In other words, research that is more germane to the 'real world' of health care delivery. As a result, the establishment of PBRNs can mobilise both researchers and practitioners to facilitate clinical research on issues most relevant to chiropractors and their patients that are typical of daily practice settings. The flexibility of PBRN based chiropractic research can range from improving best practice through to exploring contextual factors associated with the entire chiropractic clinical encounter, including the significance of non-specific effects associated with the clinical encounter that influence patient outcomes. PBRNs can link chiropractors via databases to facilitate research and outcome measurement and build capacity of the chiropractic profession to participate in, conduct and implement research. The Australian chiropractic profession is already starting to see the results of the establishment of a world leading PBRN.

REFERENCES

1. Ammerman A, Woods Smith T, Calancie L. Practice-based evidence in public health: improving reach, relevance, and results. *Annu Rev Public Health* 2014;35(1):47-63
2. Steihaug S, Johannessen A-K, Ådnes M, Paulsen B, Mannion R. Challenges in achieving collaboration in clinical practice: the case of Norwegian health care. *Int J Integr Care* 2016;16(3):online
3. Xyrichis A, Lowton K. What fosters or prevents interprofessional teamworking in primary and community care? *Int J Nurs Stud*. 2008;45(1):140-53 (Epub 2007 Mar 26)
4. Walker BF. The new chiropractic. *Chiropr Man Ther* 2016;24:26
5. Scott N, Moga C, Harstall C. Managing low back pain in the primary care setting: The know-do gap. *Pain Res Manag* 2010;15(6):392
6. NICE. How to change practice; understand, identify and overcome barriers to change 2007 1/11/2017. Available from: <https://www.nice.org.uk/media/default/about/what-we-do/into-practice/support-for-service-improvement-and-audit/how-to-change-practice-barriers-to-change.pdf>
7. Green LW. Making research relevant: if it is an evidence-based practice, where's the practice-based evidence? *Fam Pract* 2008;25(suppl_1):i20-24

PBRN and EIP

Amorin-Woods, Moore and Adams

8. Green LA, Dovey SM. Practice based primary care research networks: They work and are ready for full development and support. *BMJ* 2001;322(7286):567-568
9. Green L, Ottosen J. From efficacy to effectiveness to community and back: evidence-based practice vs. practice-based evidence. Conference Proceedings: From Clinical Trials to Community: The Science of Translating Diabetes and Obesity Research. Bethesda MD 2004. Jan 12-13
10. Lindbloom EJ, Ewigman BG, Hickner JM. Practice-based research networks: the laboratories of primary care research. *Med Care* 2004;42(4):45-49
11. Tucker B, Parker L. In our ivory towers? The research-practice gap in management accounting. *Account Bus Res* 2014;44(2):104-143
12. Carter YH, Hilton S. Academic general practice: no time for ivory towers. *Fam Prac* 2000;17(4):283-284
13. What is translational research? : Cambridge University; Office for Translational Research (OTR) School of Clinical Medicine; [Available from: <http://otr.medschl.cam.ac.uk/about-the-office/translational-research/>]
14. Weber KA, He X. Chiropractic students and research: assessing the research culture at a North American chiropractic college. *J Chiropr Educ* 2010;24(1):35-45
15. Briggs JP, Killen J. Perspectives on complementary and alternative medicine research. *JAMA* 2013;310(7):691-692
16. Kawchuk G, Newton G, Srbely J, et al. Knowledge Transfer within the Canadian Chiropractic community. Part 2: narrowing the evidence-practice gap. *J Can Chiropr Assoc* 2014;58(3):206-214
17. Grumbach K, Mold JW. A health care cooperative extension service: Transforming primary care and community health. *JAMA* 2009;301(24):2589-2591
18. Practice-based research networks (PBRNs) Rockville (MD)2014 [Available from: <http://pbrn.ahrq.gov/>]
19. Agency of Healthcare Research and Quality: History of PBRNs [Available from: <https://pbrn.ahrq.gov/about/history-pbrns>]
20. Mold JW, Peterson KA. Primary care practice-based research networks: working at the interface between research and quality improvement. *Ann Fam Med* 2005;3 Suppl 1:S12-20
21. Green L, White L, Barry H, Nease D, Hudson B. Infrastructure requirements for practice-based research networks. *Ann Fam Med* 2005;3(supplement 1):S5-11
22. Lenfant C. Shattuck lecture--clinical research to clinical practice--lost in translation? *N Engl J Med* 2003;349(9):868-874
23. Gilbert G, Williams O, Rindal D, Pet al. The Creation and development of the dental practice-based research network. *J Am Dent Assoc* 2008;139(1):74-81

24. National Dental Practice-Based Research Network [Available from: <https://www.nationaldentalpbrn.org/>]
25. Norton WE, Funkhouser E, Makhija SK, Gordan VV, Bader JD, Rindal DB, et al. Concordance between clinical practice and published evidence: findings from The National Dental Practice-Based Research Network. *J Am Dent Assoc* 2014;145(1):22-31
26. Ray MN, Funkhouser E, Williams JH, et al. Smoking cessation e-referrals: a national dental practice-based research network randomized controlled trial. *Am J Prev Med* 2014;46(2):158-165
27. Gordan VV, Riley JL, De Carvalho RM, et al. Methods used by dental practice-based research network dentists to diagnose dental caries. *Tex Dent J* 2013;130(4):321-332
28. Schleyer T, Song M, Gilbert GH, Rindal DB, Fellows JL, Gordan VV, et al. Electronic dental record use and clinical information management patterns among practitioner-investigators in The Dental Practice-Based Research Network. *J Am Dent Assoc* 2013;144(1):49-58
29. Funkhouser E, Agee BS, Gordan VV, et al. Use of online sources of information by dental practitioners: findings from the Dental Practice-Based Research Network. *J Public Health Dent* 2014;74(1):71-79
30. Kessler R, Glasgow RE. A proposal to speed translation of healthcare research into practice: dramatic change is needed. *Am J Prev Med* 2011;40(6):637-644
31. Tonelli MR, Callahan TC. Why alternative medicine cannot be evidence-based. *Acad Med* 2001;76(12):1213-1220
32. Pawson R, Greenhalgh T, Harvey G, Walshe K. Realist review--a new method of systematic review designed for complex policy interventions. *J Health Serv Res Policy* 2005;10 Suppl 1:21-34
33. Green L, Glasgow R. Evaluating the relevance, generalization, and applicability of research: issues in external validity and translation methodology. *Eval Health Prof* 2006;29(1):126-153
34. Khoury M, Gwinn M, Yoon P, Dowling N, Moore C, Bradley L. The continuum of translation research in genomic medicine: how can we accelerate the appropriate integration of human genome discoveries into health care and disease prevention? *Genet Med* 2007;9(10):665-674
35. Glasgow R, Green L, Klesges L, et al. External validity: we need to do more. *Ann Behav Med* 2006;31(2):105-108
36. Thorpe K, Zwarenstein M, Oxman A, et al. A pragmatic- explanatory continuum indicator summary (PRECIS): a tool to help trial designers. *Canadian Med Assoc J* 2009;180(10):E47-57

37. Capra F. The hidden connections. a science for sustainable living. New York: Anchor Books (Random House); 2002
38. Emanuel E, Wendler D, Killen J, Grady C. What makes clinical research in developing countries ethical? The benchmarks of ethical research. *J Infect Dis* 2004;189(5):930-937
39. Benatar S. Avoiding exploitation in clinical research. *Camb Q Health Ethics* 2000;9(4):562-565
40. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* 2008;337:a1655
41. Amorin-Woods LG. Sophisticated research design in chiropractic and manipulative therapy; “what you learn depends on how you ask.” Part A. Quantitative research: size does matter. *Chiropr J Aust* 2016;44(2):85-105
42. Amorin-Woods LG. Sophisticated research design in chiropractic and manipulative therapy; “what you learn depends on how you ask.” Part B: Qualitative research; quality vs. quantity. *Chiropr J Aust* 2016;44(2):106-120
43. Amorin-Woods LG. Sophisticated research design in chiropractic and manipulative therapy; what you learn depends on how you ask. Part C: Mixed Methods: “why can’t science and chiropractic just be friends?” *Chiropr J Aust* 2016;44(2):121-141
44. Glasgow R, Green L, Klesges L, et al. External validity: we need to do more. *Ann Behav Med* 2006;31:105-108
45. Rittenbaugh C, Verhoef M, Fleishman S, Boon H, Leis A. Whole systems research: a discipline for studying complementary and alternative medicine. *Altern Ther Health Med* 2003;9(4):32-36
46. Newell D, Lothe LR, Raven TJL. Contextually aided recovery (CARE): a scientific theory for innate healing. *Chiropr Man Therap* 2017;25(1):6
47. Johnson CD, Green BN. Association of Chiropractic Colleges Educational Conference and Research Agenda Conference 2015. *J Chiropr Educ* 2016;30(1):42-47
48. Rubinstein S, Bolton J, Webb A, Hartvigsen J. The first research agenda for the chiropractic profession in Europe. *Chiropr Man Therap* 2014;22(9)
49. French SD, Beliveau PJH, Bruno P, Passmore SR, Hayden JA, Srbely J, et al. Research priorities of the Canadian chiropractic profession: a consensus study using a modified Delphi technique. *Chiropr Man Ther* 2017;25(1):38
50. Green LA, Hickner J. A Short History of Primary Care Practice-based Research Networks: From Concept to Essential Research Laboratories. *J Am Board Fam Med* 2006;19(1):1-10

51. Soós M, Temple-Smith M, , Gunn J, et al. Establishing the Victorian Primary Care Practice Based Research Network. *Aust Fam Physician* 2010;39:857-862
52. Temple-Smith M, Appleby N, Murathodzic M, Zwar N, Pond D. The Australian Primary Care Research Network: Ready for Action! : The Australian Primary Care Research Network; 2014 [Available from: <http://www.apcren.org.au/wp-content/uploads/2014/01/APCReN-PHC-Research-Conference-2014-.pdf>]
53. Leboeuf-Yde C, Hennius B, Rudberg E. Chiropractic in Sweden: a short description of patients and treatment. *J Manipulative Physiol Ther* 1997;20
54. Leboeuf-Yde C, Axen I, Ahlefeldt G, Lidfeldt P, Rosenbaum A, Thurnherr T. The types and frequencies of improved nonmusculoskeletal symptoms reported after chiropractic spinal manipulative therapy. *J Manipulative Physiol Ther*. 1999;22(9):559-564
55. Leboeuf-Yde C, Hennius B, Rudberg E, Leufvenmark P, Thunman M. Chiropractic in Sweden: a short description of patients and treatment. *J Manipulative Physiol Ther* 1997;20(8):507-510
56. Leboeuf-Yde C, Axen I, Jones J, Rosenbaum A, Lovgren P, Halasz L, et al. The Nordic back pain subpopulation program: the long-term outcome pattern in patients with low back pain treated by chiropractors in Sweden. *J Manipulative Physiol Ther*. 2005;28(7):472-478
57. Axen I, Rosenbaum A, Robech R, Wren T, Leboeuf-Yde C. Can patient reactions to the first chiropractic treatment predict early favorable treatment outcome in persistent low back pain? *J Manipulative Physiol Ther* 2002;25(7):450-454
58. Axen I, Jones J, Rosenbaum A, Lovgren P, Halasz L, Larsen K, et al. The Nordic Back Pain Subpopulation Program: validation and improvement of a predictive model for treatment outcome in patients with low back pain receiving chiropractic treatment. *J Manipulative Physiol Ther* 2005;28(6):381-385
59. Axen I, Rosenbaum A, Robech R, Larsen K, Leboeuf-Yde C. The Nordic back pain subpopulation program: can patient reactions to the first chiropractic treatment predict early favorable treatment outcome in nonpersistent low back pain? *J Manipulative Physiol Ther*. 2005;28(3):153-158
60. Leboeuf-Yde C, Gronstvedt A, Borge J, Lothe J, Magnesen E, Nilsson O, et al. The Nordic back pain subpopulation program: a 1-year prospective multicenter study of outcomes of persistent low-back pain in chiropractic patients. *J Manipulative Physiol Ther* 2005;28(2):90-96
61. Malmqvist S, Leboeuf-Yde C, Ahola T, Andersson O, Ekstrom K, Pekkarinen H, et al. The Nordic back pain subpopulation program: predicting outcome among chiropractic patients in Finland. *Chiropr Osteopat* 2008;16:13
62. Axén I, Leboeuf-Yde C. Conducting practice-based projects among chiropractors: a manual. *Chiropr Man Ther* 2013;21(1):8

PBRN and EIP

Amorin-Woods, Moore and Adams

63. Peterson K, Delaney B, Arvanitis T, et al. A model for the electronic support of practice-based research networks. *Annals Fam Med* 2012;10(6): 560-567
64. Bussi eres A, C ot e P, French S, Godwin M, Gotlib A, Graham I, et al. Creating a chiropractic practice-based research network (PBRN): enhancing the management of musculoskeletal care. *J Canadian Chiropr Assoc* 2014;58(1):8-15
65. Hawk C, Evans M, Rupert R, Ndetan H. Opportunities to integrate prevention into the chiropractic clinical encounter: a practice-based research project by the Integrated Chiropractic Outcomes Network (ICON). *Top Integrative Health Care* 2011;2(3):1-19
66. ICPA/PBRN. Providing clinical, evidenced-based research for the chiropractic profession: International Chiropractic Pediatric Association; 2010 [Available from: <http://icpa4kids.com/research/PBRN/PBRN.htm>]
67. ICPA Research 2017 [Available from: <https://icpa4kids.com/research/>]
68. ACC Research Summit; Macquarie University, Sydney Australia. 2010
69. Adams J, Steel A, Chang S, Sibbritt D. Helping address the national research and research capacity needs of Australian chiropractic: introducing the Australian Chiropractic Research Network (ACORN) project. *Chiropr Man Therap* 2015;23(12)
70. Barkham M. Practice-based research networks: origins, overview, obstacles, and opportunities. *Counsel Psychother Res* 2014;14(3):167-173
71. Curro F, Robbins, DA., Millenson, ML., Fox, CH., Naftolin, F., . Person-centric clinical trials: an opportunity for the good clinical practice (GCP)-practice-based research network. *J Clin Pharmacol* 2013;53(10):1091-1094
72. Adams J, Steel A, Moore C, Amorin-Woods L, Sibbritt D. Establishing the ACORN National Practitioner Database: strategies to recruit practitioners to a national practice-based research network. *J Manipulative Physiol Ther* 2016;16(S0161-4754(16)30002-1):[Epub ahead of print]
73. Pomernacki A, Carney DV, Kimerling R, Nazarian D, Blakeney J, Martin BD, et al. Lessons from Initiating the First Veterans Health Administration (VA) Women's Health Practice-based Research Network (WH-PBRN) Study. *J Am Board Fam Med* 2015;28(5):649-57
74. McAleavey A, Lockard A, Castonguay L, Hayes J, Locke B. Building a practice research network: obstacles faced and lessons learned at the Center for Collegiate Mental Health. *Psychother Res* 2015;25(1):134-51
75. Adams J, Lauche R, Peng W, et al. A workforce survey of Australian chiropractic: the profile and practice features of a nationally representative sample of 2,005 chiropractors. *BMC Complement Altern Med* 2017;17(1):14
76. Adams J, Peng W, Steel A, et al. A cross-sectional examination of the profile of chiropractors recruited to the Australian Chiropractic Research Network (ACORN): a sustainable resource for future chiropractic research. *BMJ Open* 2017;7(9)

77. ACORN Australian Chiropractic Research Network (Researcher Information) 2017 [Available from: <http://www.acorn-arccim.com/researcher-info/>]
78. Moore C, Adams J, Leaver A, Lauche R, Sibbritt D. The treatment of migraine patients within chiropractic: analysis of a nationally representative survey of 1869 chiropractors. *BMC Complement Altern Med* 2017;17(1):519
79. Lee MK, Amorin-Woods L, Cascioli V, Adams J. The use of nutritional guidance within chiropractic patient management: a survey of 333 chiropractors from the ACORN practice-based research network. *Chiropr Man Ther* 2018;26(1):7
80. Moore CS, Sibbritt DW, Adams J. A critical review of manual therapy use for headache disorders: prevalence, profiles, motivations, communication and self-reported effectiveness. *BMC Neurol* 2017;17(1):61

Copyright of Chiropractic Journal of Australia is the property of Copyright Agency Limited and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.