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Challenges in Applying Best Evidence to Physiotherapy Practice: Part 2 – Health and Clinical Reasoning Models to Facilitate Evidence-Based Practice

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Abstract

Purpose: As the second of two papers addressing challenges in applying best evidence to physiotherapy practice, the purpose of this paper is to explore health and clinical reasoning models that can facilitate evidence-based practice. Summary of Key Points: The challenge and importance of using skilled clinical reasoning in applying research evidence and managing patients that fall outside the available evidence are discussed. The importance of a holistic understanding of health and illness is emphasised and three models of health and disability are considered and the concept of “hypothesis categories” is proposed to assist therapists to transfer these conceptual models to actual decision making in practice. Next, research supporting therapists’ use of “Clinical Reasoning Strategies” is reviewed distinguishing between diagnostic reasoning and narrative reasoning. Lastly, the organisational behaviour management practice of benchmarking is proposed as an important strategy to further facilitate application of research evidence in practice behaviour. Conclusion: A key challenge facing the profession is how best to assist clinicians’ application of research findings to practice and how to optimise experience-based evidence when research evidence is either poor or missing. To practice in a truly holistic patient-centred, evidence-based way clinicians need good conceptual understandings of health, pain and disability and equally good critical and reflective reasoning and management skills.

Introduction

This is the second of two papers that addresses the challenges that clinicians face in applying evidence-based practice and researchers and clinicians face in producing relevant and sound evidence for practice (see volume 4 number 3). This second paper highlights models of health and clinical reasoning that can facilitate evidence-based practice.

The challenge and importance of using skilled clinical reasoning in applying research evidence and managing patients that fall outside the available evidence

The value of clinical expertise is emphasised by Sackett in the statement ‘*external clinical evidence can inform, but never replace, individual clinical expertise. [This] expertise will assist the practitioner in deciding whether*

the external evidence applies to the individual client at all and, if so, how it should be integrated into the clinical decision’ (p. 73).¹ Unfortunately clinical expertise is still under-researched and experts, like everyone, are subject to human bias and error.²⁻⁶ Expertise clearly is more than the mere sum of knowledge and skills. Rather, expertise is perhaps best conceptualised as a continuum along multiple dimensions including clinical outcomes, personal attributes such as professional judgement, technical clinical and critical thinking skills, communication and interpersonal skills, and knowledge base as well as cognitive and metacognitive proficiency.⁷

While further research is needed to explore what constitutes expertise, the importance of drawing on expert opinion and personal experience-based evidence in order to apply the results of research in clinical

practice is very strong. The difficulty of applying research results in practice is nicely summarised by Cox.⁸

“Scientific method focuses on one variable at a time across a hundred identical ...(subjects) to extract a single, generalisable “proof”. ... Clinical practice deals with a hundred variables at a time within one ...(subject) ... in order to optimise a mix of outcomes intended to satisfy the particular ...(subject’s) current needs and desires.”

Evidence-based practice requires professional judgment and sound clinical reasoning. Reasoning is needed to evaluate the quality of evidence, to apply that evidence and to manage those patients whose unique clinical presentation fall outside the population characteristics where evidence does exist—what Schön calls the grey zones of practice.⁹ But just how big is the grey zone of clinical practice? Medical research using expert panels to develop criteria for assessing the appropriateness of clinical procedures reveals as much as 38% of some well established procedures are carried out in situations of uncertainty.¹⁰ In physiotherapy, most patient problems are multifactorial, often with more than one source of pain or impairment and typically with their own unique mix of environmental, psychosocial, cultural and physical contributing factors, and patients’ problems are rarely managed with a single procedure. Thus we can readily agree that the degree of uncertainty, the grey zones, in physiotherapy practice is also considerable. According to David, clinical practice seems to consist of a few things we know, a few things we think we know (but probably don’t), and lots of things we don’t know at all.¹⁰ Even with the growing database of research findings the requirement for clinicians to make decisions under conditions of uncertainty will continue. Evidence-based

practice is not cook-book practice and therapists need appropriate knowledge and skill in clinical reasoning if they are to successfully and critically apply the evidence that is available from both research and their own experience-based knowledge. Rigorous strategies can be applied to the task of deriving knowledge from practice experience, this experience-based knowledge comprising valuable evidence for practice.¹¹

Challenges to clinicians’ conceptualisations of health and disability

Successfully applying research evidence to practice and managing patients whose presentations fall outside the research evidence available requires a holistic understanding of health and disability and clinical reasoning proficiency to recognise when factors are and are not relevant to the individual patient. A variety of health and disability models are now available to assist therapists understanding of the multiple determinants of health. Three example models of health and disability are presented that can assist clinicians to appreciate the scope of focus their clinical reasoning must encompass. Perhaps the most generic of these is the World Health Organisation model (Figure 1) that formed the basis for their International Classification of Functioning, Disability and Health.¹²

Here the patient’s health condition can be seen to both influence and be influenced by their body functions and structures (or physical status), their capacity and performance of functional activities of life, and their subsequent ability to participate in their family, work, and leisure roles. Importantly, the two boxes at the bottom of Figure 1 also emphasise the potential significance that contextual environmental and personal factors can have on the person’s physical status, activities and participation, and their health condition.

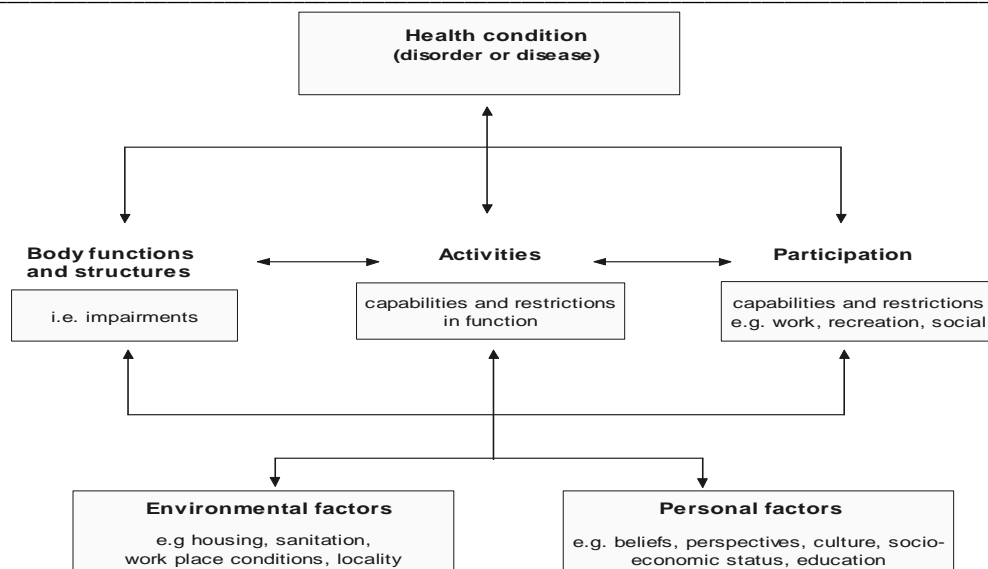


Figure 1: World Health Organisation model of Health and Disability (World Health Organization, 2001, p. 18)

Gifford's Mature Organism Model (Figure 2) provides another model of health and disability that again highlights the multifactorial nature of health and introduces therapists to the important construct of pain mechanisms that provide a physiological basis for how the various physical, environmental, and psychological factors inter-relate.¹³ The circle labeled "Tissues," that can produce symptoms in their own right through input sensory mechanisms in what has been called "nociceptive" and "neurogenic" pain, reflects an individual's physical health. The 'Environment' circle, like the W.H.O. model, highlights how environmental

influences, be they physical or psychosocial, can influence the patient's pain or disability experience and clinical presentation both positively and negatively. The relevance that physical and psychosocial factors ultimately have to the individual is determined in part by the person's central processing of events.¹³ Where one patient successfully adjusts to life's physical, environmental, and psychosocial obstacles, another is threatened (consciously or unconsciously) with the negative effect of altered neural processing contributing to the maintenance of their pain and disability.

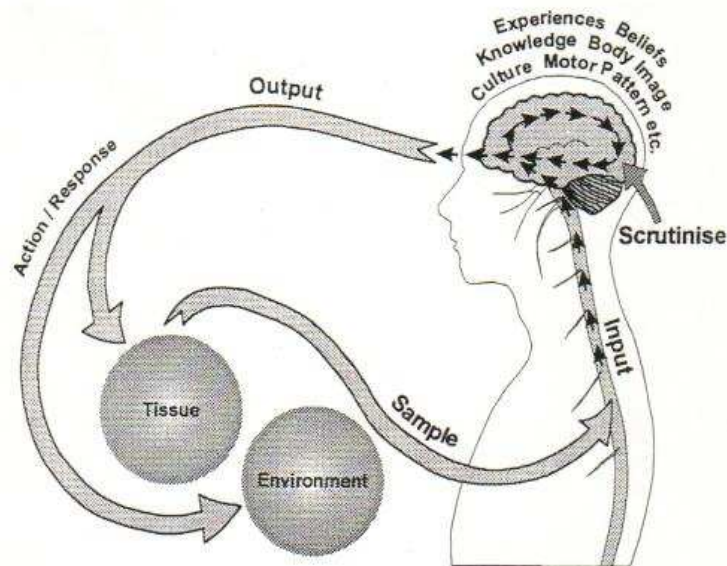


Figure 2: Mature Organism Model (Gifford, 1998)

A third model (Figure 3, next page) of health and disability that is helpful in conceptualising the interaction of the different variables that can contribute to a patient's pain and disability experience, and clinicians must therefore consider in their clinical reasoning, is the model by Main et al.¹⁴ This model highlights the familiar sequence of events where injury and the associated pain and physical impairments that ensue often lead to altered movement and motor function and reduced physical activity. If allowed to continue, the longer-term consequence is withdrawal from work and social activities and ultimately physical deconditioning. The boxes surrounding this central common cycle of events represent the numerous factors that can work to the patient's advantage or disadvantage in determining how they cope with their physical injury. Their own beliefs, attributions, emotions, and coping strategies, combined with family, work, and socio-economic factors, can all

impact on their health condition. All three models of health and disability presented are consistent with a biopsychosocial philosophy of practice.¹⁵⁻¹⁷

Challenges to practicing within these holistic models of health and disability

Hypothesis Categories

Applying research evidence to practice when research evidence is either poor or absent, we argue, requires being able to assess and weigh the relevance of the different variables depicted within the above models of health and disability. Clinical patterns exist and can be learned within every aspect of each of these models, whether it is the symptoms and signs of a specific tissue disorder, the ergonomic or training factors predisposing to a pain state or the psychosocial influences that contribute to turning a relatively benign musculoskeletal pain into a chronic disability. To assist therapists to

transfer these conceptual models to actual decision making in practice, the concept of "Hypothesis Categories" has been put forward to represent the 1).¹⁸

categories of decisions needed when taking into account the range of variables portrayed in these three models (Table

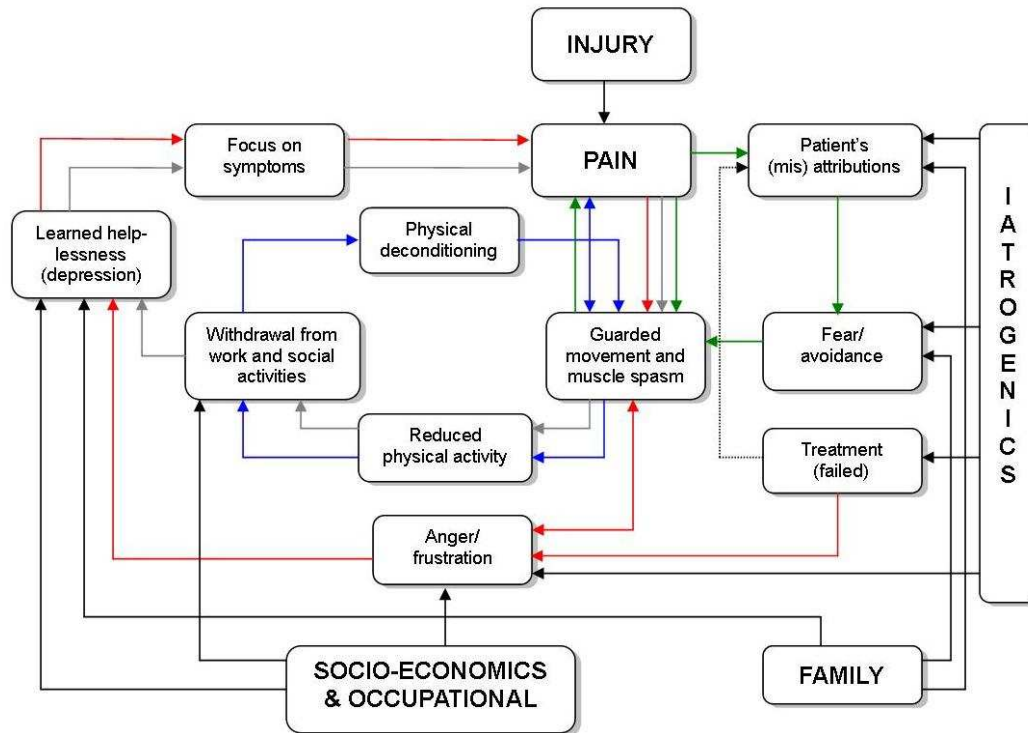


Figure 3: Model of health and disability illustrating influences of biomedical, physiological, psychological, socioeconomic and iatrogenic factors on disability (Main et al 2000 p 104)

Table 1: Hypothesis categories: categories of judgments considered by manual therapists that assist in understanding the patient as a person and their problem(s) (Jones and Rivett 2004 p. 14)

<ul style="list-style-type: none"> • Activity capability/restriction (abilities and difficulties an individual may have in executing activities) and Participation capability/restriction (abilities and problems an individual may have in involvement in life situations)
<ul style="list-style-type: none"> • Patients' perspectives on their experience
<ul style="list-style-type: none"> • Pathobiological mechanisms (tissue healing mechanisms and pain mechanisms)
<ul style="list-style-type: none"> • Physical impairments and associated structure/tissue sources
<ul style="list-style-type: none"> • Contributing factors to the development and maintenance of the problem
<ul style="list-style-type: none"> • Precautions and contraindications to physical examination and treatment
<ul style="list-style-type: none"> • Management and treatment
<ul style="list-style-type: none"> • Prognosis

Where activity and participation restrictions will often correlate with patients' goals, it is their capabilities that usually provide the point from where retraining or reactivation must commence. Cognitive-behavioural strategies such as pacing, incrementing and motor

retraining build upon patients' current capabilities to develop and implement programs of reactivation and retraining.^{19,20,21} If patients are only directed to those activities they can no longer perform the result is often continued unsuccessful performance and failure.

Therefore, management of specific impairments such as inadequate motor control are commenced from postures or activities with which the patient can succeed and, similarly, general physical and social reactivation commences from what the patient can do and from there, aims to progressively increase their activity and participation levels.

The Hypothesis Category "Patients' Perspectives on their Experience" is designed to cue therapists to specifically screen for and come to understand the person behind the problem.¹⁸ It is now well recognized that patients' perspectives can be obstacles to their recovery, either as antecedents to their pain or health states and activity/participation restrictions or as consequences.^{14,22,23,24,25,26,27} Patients' perspectives (e.g. understandings, beliefs, emotions) must be considered, and hence screened for when attempting to understand the factors that may be causing or contributing to their activity and participation restrictions. If a particular perspective has been hypothesized to be potentially relevant as an antecedent to a patient's pain or disability, the therapist must then, with the patient, endeavor to understand those factors in the patient's life which are responsible for, or have contributed to, the identified perspective. These may include such things as past and present negative personal experiences (e.g. abusive relationships, conflicting or disempowering medical management) that have contributed to shaping the patient's present beliefs, attributions, and self-efficacy. Questionnaires are now available to screen for such factors, but at best all they can do is highlight when these factors appear to be present. To establish the existence and relevance of such factors and if needed, address them through the course of management, therapists must return to their own inquiry skills to discover with the patient the basis and significance of those perspectives to their pain and disability experiences.

Patients' activity and participation capabilities and restrictions, associated perspectives, psychosocial problems, and specific physical impairments are an expression of their pathobiology and life circumstances. The hypothesis category "Pathobiological Mechanisms" is composed of data about tissue mechanisms and also pain mechanisms.²⁸ It was designed to prompt therapists to include in their reasoning consideration of the mechanisms by which the patient's symptoms and signs are being initiated and/or maintained. Tissue mechanisms relate to issues of tissue health and stages of tissue healing where pain mechanisms refer to the different input, processing and output mechanisms underlying the patients' activity/participation restrictions, unhelpful perspectives and physical impairments.

The "Physical Impairments and Associated Structures/Tissue sources" category relates to recognising patterns of physical impairment that result in pain and disability, and when possible, identifying the precise sources of the pain. While research will continue to clarify the differentiating features of specific musculoskeletal conditions, at present exact tissue sources in many pain states cannot be clinically isolated. As such, the impairment system of categorisation adopted by the American Physical Therapy Association is arguably the most valid depiction of what clinicians can accurately identify.²⁹

The remaining Hypothesis Categories: "Contributing Factors," "Precautions and Contraindications," "Management and Treatment," and "Prognosis" are self-explanatory and will not be elaborated on here. From this overview of the range of decisions therapists must make to successfully recognise and work with patients in the management of their problems, it should be evident that research is unlikely to ever provide prescription for management of the countless interactions of the variables contributing to an individual's pain state – nor is it the aim of research to do this. Rather, research and the clinical guidelines that emanate from this research, assists clinicians to recognise clinical patterns of presentation along with general, and sometimes more specific, strategies of management. It is then up to clinicians to use their knowledge of this evidence along with their reasoning and therapeutic skills to apply, and as required, make modifications according to the unique presentations and circumstances of their own patients. Where research evidence is lacking clinicians must draw on their own experience-based knowledge minimising error by adopting critical and reflective reasoning processes. Just as the models of health and disability and the hypothesis categories can assist clinicians in applying research findings to clinical practice, so too can greater awareness by the clinician of the focus of their reasoning throughout interactions with patients assist in application of research results and management of those patients for whom formal research investigating their presentation is still lacking.

Clinical Reasoning Strategies

In a qualitative study using a grounded theory, case study methodology, Edwards examined the nature and scope of clinical reasoning of expert physiotherapists working in three physiotherapy settings, manipulative physiotherapy, neurological physiotherapy and domiciliary care.^{30,31} This study found that these expert physiotherapists employed a number of clinical reasoning strategies in their clinical practice regardless of setting (Table 2).

Table 2: Clinical reasoning strategies representing different foci of thinking or action used in clinical practice (Edwards et al 2004)

- *Diagnostic reasoning:* the formation of a diagnosis related to physical disability and impairment with consideration of associated pain mechanisms, tissue pathology and the broad scope of potential contributing factors.
- *Narrative reasoning:* the apprehension and understanding of patients' illness experiences, 'stories', contexts, beliefs and cultures.
- *Reasoning about procedure:* the determination and implementation of treatment procedures
- *Interactive reasoning:* the purposeful establishment and ongoing management of therapist-patient rapport
- *Collaborative reasoning:* the nurturing of a consensual approach towards the interpretation of examination findings, the setting of goals and priorities and the implementation and progression of treatment.
- *Reasoning about teaching:* the activity of individualized and context sensitive teaching
- *Predictive reasoning:* the active envisioning of future scenarios with patients including the exploration of their choices and the implications of those choices
- *Ethical reasoning:* the apprehension of ethical and practical dilemmas that impinge on both the conduct of treatment and its desired goals, and the resultant action towards their resolution.

For the purposes of this paper the distinction between two of these reasoning strategies, diagnostic and narrative reasoning, is highlighted to emphasise the importance of skilled clinical reasoning to evidence-based practice. Through a process of inquiry, examination and reflective management, the therapist attempts to understand the patient's problem, while at the same time trying to understand the patient's personal story/narrative or the context of the problem beyond the mere chronological sequence of events. Understanding the context, also called 'narrative reasoning', requires attempting to understand the patient as a person, including their perspective of the problem and their experiences (e.g. understanding, beliefs, desires, motivations, emotions), the basis of their perspectives, and how the problem is affecting their life (i.e. their pain or disability experience).³² This dimension of reasoning and understanding requires more than a good biomedical knowledge base and technical skills. Successful narrative reasoning, aimed at understanding the person, requires a good organisation of biopsychosocial knowledge and the communication skills to successfully apply that knowledge.

Patients' understanding, beliefs, attitudes, emotions and expectations represent what Mezirow has called a person's "meaning perspective" (synonymous with "frame of reference").^{33,34} Understanding a patient's meaning perspective is the basis of narrative reasoning. An individual's meaning perspective is acquired and evolves from a combination of personal, societal, and cultural experiences where conscious and unconscious interpretations, attributions, and emotions coalesce to make up their views and feelings. Mezirow states:

*"...that it is not so much what happens to people but how they interpret and explain what happens to them that determines their actions, their hopes, their contentment and emotional well-being, and their performance."*³⁴

In this sense, patients' meaning perspectives create sets of habitual expectations that serve as a (usually tacit) belief system for interpreting and evaluating the meaning of experience. In the context of physiotherapy, patients' meaning perspectives become filters through which their perceptions and comprehension of any new experience must pass. Therefore, if a patient's meaning perspective is judged to be unhelpful or counter-productive to recovery, such as "pain equals further damage," as is commonly found in patients with chronic pain, this then can influence their other perceptions regarding such things as therapeutic interventions, self-management and expectations for what the future holds.

Analogous to attempting to identify underlying physical contributing factors to patients' symptomatic structures, it is necessary for physiotherapists to delve into the basis of patients' meaning perspectives (i.e. their understanding, emotions, beliefs, and attributions) in order to understand these perspectives and to provide information or discuss matters (of confusion or misinterpretation) which are impeding effective collaboration. That is, patients' meaning perspectives are reflected in their "story" or the context in which those views were shaped. While sometimes the information comes forward spontaneously, therapists must be able to listen for and inquire about (i.e. screen) patients' meaning perspectives and their basis, so as to identify patterns suggestive of potential obstacles to recovery that may require attention. While some patients' perspectives will fit recognisable patterns, others will be unique and defy some universal truth of "normal" or "unhelpful." In other words, narrative reasoning decisions cannot be reduced to a correct or incorrect empirical judgment. Rather, therapists' hypotheses regarding patients' meaning perspectives can only be validated through therapist-patient consensus or what has been labeled communicative (as opposed to procedural) management.^{31,35,36}

A distinction can then be made between understanding and managing the problem to effect change (requiring biomedically driven cause and effect thinking and action, or “diagnostic reasoning” and “procedural management”) versus understanding and interacting with the person to effect change (requiring biopsychosocially driven “narrative reasoning” and “communicative management.”) In reality, a comprehensive diagnosis should encompass what is learned from both the diagnostic reasoning regarding the physical problem and the narrative reasoning regarding the person. In practice, clinicians regularly move between these two key areas of thinking through all aspects of their assessment and management.^{30,31}

The challenge of promoting change in practice

The need for strategies to promote change in clinical practice once research evidence is available has been identified as one of the greatest challenges facing evidence-based practice.³⁷ The development of practice guidelines is steadily increasing. For example, Maher, in a keynote Musculoskeletal Physiotherapy Australia conference, provided statistics from the physiotherapy-evidence database (PEDRO) illustrating a steady increase in low back pain research and subsequent practice guidelines with 422 RCTs, 98 systematic reviews and 19 published practice guidelines.³⁸ However, published research and practice guidelines alone are insufficient to promote change in practice. Recognising and addressing barriers to uptake of new information is an emerging area of therapy research in itself.^{39,40} This ranges from the need to present new practice information in a manner that promotes its uptake to providing snapshots of current best evidence as a practice prompt (as is found in clinical guidelines) to individual clinicians identifying what drives them to adopt new research evidence and discontinue usual clinical practice.⁴¹

One of the greatest impediments in clinical practice to doing things differently is not knowing what is usual practice, or whether it could be improved. Reviews of individual patient progress notes occurs (usually in the form of a discharge summary, or a letter to the referring doctor), but it is rare that notes of groups of patients are reviewed in the sense of cost of treatment, outcomes provided by treatment, reasons for outliers, treatment responses in a subgroup of patients, or the influence of specific risk factors.⁴⁰ Data mining has been described recently as an important element to scientific enquiry of clinical practice where numerous illustrations of poor or harmful practices were identified by careful review of patient notes.⁴² What is required for effective data mining is of course, data, thus adequate patient notes would include as much detail as possible about the patient, his/her response to each treatment, details of the treatments provided, and measures of outcome that reflected the individual patient response to therapy.

Keeping abreast of current evidence is challenging in

itself and instituting genuine change in practice standards is particularly difficult in today's economic climate. In fact a paradox of good practice has always been the cost associated with quality care. Taking more time to understand patients and their problems and addressing both physical and psychosocial factors, while encouraging patient understanding, shared decision making and self-management, is time-consuming and as such can appear cost-prohibitive. The challenge is for clinicians to provide holistic health care that is evidence-based and cost effective for the patient but also for their own business or workplace requirements. Simply providing the latest association developed information card or practice guideline is insufficient to promote significant change in practice behaviour.³⁷

Benchmarking, initially developed from within industry, is increasingly used in health care to promote best practice. Clinical practice benchmarking is a structured system of comparing and sharing available evidence across institutions with value placed on all levels of evidence for the purpose of identifying standards of excellence and promoting change (Ellis, 2000). The benchmarking process commences with the group, typically formed across several institutions such as hospitals or private practices, identifying areas of practice to be targeted and then specific patient-focused outcomes of interest such as pain, motor control or psychosocial assessment and management. Structures or processes are then identified as factors necessary to support the attainment of those outcomes.

Next, the benchmark for each factor is constructed through review of all levels of evidence, from systematic reviews of quantitative research to qualitative studies and consensus experience-based opinion of the benchmark group members. Where possible, patients' views are also sought. Once benchmarks have been agreed on, current practice is then scored against those benchmarks to establish a baseline against which change in practice can then be determined. At this point, the benchmarking literature simply describes the process continuing with group members sharing examples of best practice and developing plans for promoting implementation of best practice.⁴³ Since understanding alone is not always sufficient to change practice, mentoring or external consultation with clinicians more experienced in the target area demonstrating and then co-assessing/managing patients as takes place in postgraduate education may be necessary. Evidence-based Practice organisations such as the Joanna Briggs Institute now provide training packages to facilitate benchmarking.

Conclusion

Research and practice guidelines are never intended to be prescriptive of practice for an individual patient with unique physical features and unique pain and disability experiences. A key challenge facing the profession is how best to assist clinicians' application of research

findings to practice and how to optimise experience-based evidence when research evidence is either poor or missing. Different strategies of reasoning are needed to be able to use this knowledge or evidence in practice. This is especially so if future research moves beyond simply classifying populations along traditional diagnostic criteria and contextual dimensions of patient problems such as psychosocial factors are more thoroughly assessed.

To practice in a truly holistic patient-centred, evidence-based way, clinicians need good conceptual

understanding of health, pain and disability, and equally good critical and reflective reasoning and management skills in order to understand and manage the physical problem to effect change (requiring “diagnostic reasoning” and “procedural management”) while also being able to understand and interact with the person to effect change (requiring “narrative reasoning” and “communicative management”). Lastly, the organisational behaviour management practice of benchmarking is put forward as an important strategy to further facilitate application of research evidence and change in practice behaviour.

References

1. Sackett D, Strauss S, Richardson W et al. Evidence-based Medicine. How to practice and teach EBM. 2nd ed. Edinburgh: Churchill Livingstone; 2000.
2. Elstein AS, Shulman LS, Sprafka SS. Medical Problem Solving: an analysis of clinical reasoning. Cambridge, MA: Harvard University Press; 1978.
3. Jones MA. Clinical reasoning in manual therapy. *Physical Therapy* 1992; 72:875–884.
4. Ramsden EL. Basis for clinical decision making: perception of the patient, the clinician’s role, and responsibility. In: Wolf SL, editor. *Clinical Decision Making in Physical Therapy*. Philadelphia: FA Davis Co; 1985. p. 25-60.
5. Scott I. Teaching clinical reasoning: a case-based approach. In: Higgs J, Jones M, editors. *Clinical Reasoning in the Health Professions*. 2nd ed. Oxford: Butterworth Heinemann; 2000. p. 290–297.
6. Watts N. Teaching clinical decision analysis in physiotherapy. In: Higgs J, Jones M, editors. *Clinical Reasoning in the Health Professions*. 2nd ed. Oxford: Butterworth Heinemann; 2000. p. 236-241.
7. Higgs J, Jones M. Clinical reasoning in the health professions. In: Higgs J, Jones M, editors. *Clinical Reasoning in the Health Professions*. 2nd ed. Oxford: Butterworth Heinemann; 2000. p. 3-14.
8. Cox K. Doctor and Patient: Exploring Clinical Thinking. Sydney: University of New South Wales Press; 1999.
9. Schön DA. *The Reflective Practitioner: How Professionals Think in Action*. London: Temple Smith; 1983.
10. David NC. Grey zones of clinical practice: some limits to evidence-based medicine. *Lancet* 1995; 345:840-845.
11. Higgs J, Fish D, Rothwell R. Practice knowledge – critical appreciation. In: Higgs J, Richardson, B, Abrandt Dahlgren M, editors. *Developing Practice Knowledge for Health Professionals*. Butterworth-Heinemann: Oxford; 2004. p. 89–105.
12. World Health Organization. ICF Checklist Version 2.1a, clinician form for international classification of functioning, disability and health. Available at: <http://www.who.int/en/>. Accessed April 15, 2002.
13. Gifford LS. The mature organism model. In: Gifford LS, editor. *Topical Issues in Pain 1*. Falmouth: CNS Press; 1998. p. 45–56.
14. Main CJ, Spanswick CC, Watson P. The nature of disability. In: Main CJ, Spanswick CC, editors. *Pain Management: An Interdisciplinary Approach*. Edinburgh: Churchill Livingstone; 2000. p. 89–106.
15. Engel G. The need for a new medical model: a challenge for biomedicine. *Science* 1997; 196:129 – 136.
16. Engel G. The biopsychosocial model and the education of health professionals. *Annals New York Academy of Sciences* 1998; 310:535 – 544.
17. Borrell-Carrió F, Suchman AL, Epstein RM. The biopsychosocial model 25 years later: Principles, practice, and scientific inquiry. *Annals of Family Medicine* [online] 2004;2:[6 screens]. Available from: <http://www.annfam.org/>. Accessed June, 2005.
18. Jones MA, Rivett D. Introduction to clinical reasoning. In: Jones MA, Rivett D, editors. *Clinical Reasoning for Manual Therapists*. Oxford: Butterworth Heinemann; 2004. p. 3 – 24.
19. Harding V. Minimising chronicity after whiplash injury. In: Gifford LS, editor. *Topical Issues in Pain 1*. Falmouth: CNS Press; 1998. p. 105-114.
20. Shorland S. Management of chronic pain following whiplash injuries. In: Gifford LS, editor. *Topical Issues in Pain 1*. Falmouth: CNS Press; 1998. p. 115-134.
21. Shumway-Cook A, Woollacott, M.H. *Motor Control: Theory and Practical Applications*, 2nd ed. Baltimore, Lippincott: Williams and Wilkins; 2001.
22. Butler DS. *The Sensitive Nervous System*. Adelaide, Australia: Noigroup Publications; 2000.
23. Gifford LS. *Topical Issues in Pain 2*. Falmouth: CNS Press; 2000.
24. Main CJ, Booker CK. The nature of psychological factors. In: Main CJ, Spanswick CC, editors. *Pain Management: An Interdisciplinary Approach*. Edinburgh: Churchill Livingstone; 2000. p. 19-42.
25. Main CJ, Burton AK. Economic and occupational influences on pain and disability. In: Main CJ, Spanswick CC, editors. *Pain Management: An Interdisciplinary Approach*. Edinburgh: Churchill Livingstone; 2000. p. 63-87.
26. Main CJ, Parker H. Social and cultural influences on pain and disability. In: Main CJ, Spanswick CC, editors. *Pain Management: An Interdisciplinary Approach*. Edinburgh: Churchill Livingstone; 2000. p. 43-61.

27. Unruh AM, Henriksson C. Psychological, environmental and behavioural dimensions of the pain experience. In: Strong J, Unruh AM, Wright A, Baxter GD, editors. *Pain, A Textbook for Therapists*. Edinburgh: Churchill Livingstone; 2002. p. 65-80.
28. Gifford LS. Pain. In: Pitt-Brooke J, Reid H, Lockwood J, Kerr K, editors. *Rehabilitation of Movement: Theoretical Bases of Clinical Practice*. London: WB Saunders Company; 1997. p. 196-232.
29. Guide to Physical Therapist Practice. *Physical Therapy* 2001; 81: 9-744.
30. Edwards IC. Clinical reasoning in three different fields of physiotherapy - a qualitative case study approach. Vols. I and II. Available at: <http://www.library.unisa.edu.au/adt%2Droot/public/adt%2DSUSA%2D20030603%2D090552/>. Accessed June 2005.
31. Edwards I, Jones MA, Carr J, Braunack-Mayer A, Jensen GM. Clinical reasoning strategies in physical therapy. *Physical Therapy* 2004; 84:312 – 335.
32. Fleming MH, Mattingly C. Action and narrative: two dynamics of clinical reasoning. In: Higgs J, Jones M, editors. *Clinical Reasoning in the Health Professions*. 2nd ed. Oxford: Butterworth Heinemann; 2000. p. 54-61.
33. Mezirow J. *Fostering Critical Reflection in Adulthood: A Guide to Transformative and Emancipatory Learning*. San Francisco: Jossey-Bass Publishers; 1990.
34. Mezirow J. *Transformative Dimensions of Adult Learning*. San Francisco: Jossey-Bass Publishers; 1991.
35. Edwards I, Jones M, Hillier S (*invited article, submitted*) The interpretation of experience and its relationship to body movement: a clinical reasoning perspective. *Manual Therapy*.
36. Jones M and Edwards I (*in press*) Learning to facilitate change in cognition and behaviour. In: Gifford, LS (ed.) *Topical Issues in Pain 5*. Falmouth, CNS Press.
37. Linton SJ. In defence of reason, meta-analysis and beyond in evidence-based practice. *Pain Forum* 1998; 7:46-54.
38. Maher CG. Evidence-based practice and low back pain. *Proceedings of the Musculoskeletal Physiotherapy Australia 13th Biennial Conference*; 2003 Nov 27-30; Sydney Australia; 2003. p. 35.
39. Bialocerkowski AE, Grimmer KA, Milanese S and Kumar S. Applicability of current research evidence to clinical physiotherapy practice. *Journal of Allied Health* 2004; 33: 230-237.
40. Grimmer KA, Bialocerkowski AE, Kumar S, Milanese S. Producing and implementing evidence in clinical practice: the therapies' dilemma. *Physiotherapy* 2004; 90:189-194.
41. Grimshaw JM, Shirran L, Thomas R, Mowatt G, Fraser C, Bero L, Grilli R et al. Getting evidence into practice. *Effective Health Care* 1999;5:1-16
42. Epstein I, Blumenfield S. Clinical Data-mining in practice-based research: social work in hospital settings. *Social Work in Health Care* 2001; 1-11.
43. Ellis J. Sharing the evidence: clinical practice benchmarking to improve continuously the quality of care. *Journal of Advanced Nursing* 2000; 32:215-225.