▲ Application of Current Research Evidence to Clinical Physiotherapy Practice

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This paper reviews the nature of physiotherapy intervention studies published in core physiotherapy journals (*Australian Journal of Physiotherapy*, *Physiotherapy Theory and Practice*, *Physical Therapy*, *Physiotherapy*, and *Physiotherapy Canada*) between October 2001 and September 2002. The clinical applicability of their evidence was considered in light of the clinical relevance of diagnostic criteria used for subject recruitment, the nature of the interventions tested, and the outcome measures used to determine effectiveness of the intervention. Most studies investigated a "package of care" and used clinician-oriented measures of outcomes to determine the effectiveness of an intervention. This mirrors current clinical practice. However, few studies used tissue-based diagnostic criteria for subject recruitment, tested interventions within an episode-of-care model, or measured outcome from multiple stakeholders' perspectives. These findings highlight potential barriers for clinicians in the uptake and sustained application of research evidence in the clinical setting. Both clinical and research physiotherapists need to be involved in producing generalizable research findings to ensure that evidence-based practice can be widely and readily adopted. J Allied Health 2004; 33:230–237.

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OVER THE PAST DECADE, an increasing amount of experimental research has been undertaken to provide "evidence" on which health care should be based.[1–4] The incorporation of the best available research evidence into clinical practice has been termed "evidence-based practice."[5] However, the uptake of research "evidence" into clinical practice is dependent on the clinical applicability, and therefore relevance, of the research.[6–8]

Many barriers have been identified that limit the implementation of research evidence into clinical practice in a sustainable manner.[9,10] In a survey of English physiotherapists, Metcalfe et al.[11] found that, despite most believing that research is important for professional practice, barriers to uptake and implementation of evidence included difficulties accessing research, inadequate evaluative skills in assessing the quality of research findings, insufficient time to devote to "research" activities, and the lack of relevance or applicability of the research findings to the clinical setting. To encourage sustainable uptake of appropriate "evidence" into clinical practice, clinical and research physiotherapists should recognize and address such barriers. This paper specifically considers one such barrier: the applicability of research findings to the clinical setting. Of the range of factors that potentially contribute to the applicability of research findings to clinical practice,[9–11] three are explored in this paper: diagnostic criteria, interventions, and outcomes.

In regard to diagnostic criteria, clinical physiotherapists generally use clinical reasoning, based on their knowledge of tissue pathologies, to arrive at a diagnosis and treatment plan.[12] However, physiotherapy research diagnostic criteria are poorly defined in terms of tissue pathology, focusing mostly on generalized descriptors such as location and nature of symptoms.[13] This raises the issue of whether subjects with the same symptom classification but different tissue pathologies (such as low back pain resulting from a muscle strain or a disc herniation) would respond to the same intervention in the same way.[14,15] This may constrain the generalizability of research evidence across different patient groups (as shown in the clinical guidelines for low back pain produced by

Agency for Health Care Policy and Research[16] and Institute of Clinical Systems Improvement[17]).

Considering the interventions tested raises two issues. First, unlike the common medical ambulatory single session (occasion-of-service) costing model,[18,19] most ambulatory physiotherapy contacts consist of several congruent treatment sessions (an episode of care) to manage a presenting condition.[20,21] However, episodes of care are variably addressed in the physiotherapy research literature, thus failing to address clinically important questions such as "is a particular intervention similarly effective when applied to the same subject with the same presenting symptoms on repeated occasions of service?"

The second issue relates to the type of treatment administered. Common practice in experimental research is to test only one intervention on one treatment group in an attempt to simplify the research question and to minimize the effect of confounders.[22] However, clinical physiotherapists usually chose from a range of treatment approaches to manage a presenting condition, and few physiotherapists would use only one method of management even within one occasion of service.[1,23] Therefore, single research interventions are unlike the "packages of care" that are common to clinical practice[1,24] and fail to answer questions such as "if two effective interventions are applied within the one treatment session, is the treatment effect enhanced?" and "is the order of treatment application important?"

Outcome measures are used to estimate the effectiveness of an intervention.[25,26] As such, outcome measures should be valid, reliable, and sensitive to change in order to detect the true effect of the intervention.[27–29] Thus, researchers should seek to justify their choice of outcome measures to provide clinicians with confidence that the effectiveness of the tested intervention has been reported in the most appropriate manner.

There are several considerations when choosing outcome measures. First, outcome measures assess different aspects of functioning, such as impairments, activity limitations, and participation restrictions.[30,31] In order to appreciate the full effects of the intervention, it is recommended that more than one aspect of functioning is assessed.[27,31,32] Moreover, physiotherapy stakeholders (physiotherapist, patient, caregiver, physician)[33] measure the effectiveness of treatment in different ways.[34,35] Because disease management is generally based on the philosophy of integrated care,[36] all stakeholders' perspectives should be considered in the choice of outcome measures and, at a minimum, they should reflect physiotherapists' and patients' perspectives.[1]

Second, the point in time in which each stakeholder uses an outcome measure also differs.[20,24] For example, patients measure outcome over the short term, usually on a day-to-day basis ("How am I compared to an hour ago or this morning?"), whereas physiotherapists relate outcome to occasions of service ("How much improvement has there been since the last treatment?"). Therefore, an evaluation of the applicability of research evidence to the clinical setting should include an assessment of the appropriateness of the point in time when outcome measures are used for each stakeholder.[36]

Finally, outcome measures should be evaluated for their appropriateness in all sample subgroupings to ensure that the effectiveness of the intervention is measured in an equally appropriate manner for all subjects.[7,37] While different treatment effects within subgroups may well attenuate the overall effectiveness of interventions (resulting in null research findings), this information is vital to clinicians when treating individual patients.[4]

This aim of this study was to investigate the clinical applicability of current research evidence regarding the effectiveness of physiotherapy interventions. Our analysis was based on the diagnostic criteria used, interventions tested, and outcomes measured. We hypothesized that (1) diagnostic criteria should be defined in terms relevant to clinical practice (for instance, referencing tissue-based pathology relevant to physiotherapists); (2) interventions should be tested using an episode-of-care model and reflect packages of care that are relevant to clinical practice; and (3) outcome measures should reflect at least clinician and patient perspectives; be applied at appropriate time frames; be reported as valid, reliable, and sensitive to detect change over time; and be appropriate for all subgroups of patients.

Methods

All papers from October 2001 to September 2002 from five core physiotherapy journals (*Australian Journal of Physiotherapy*, *Physiotherapy Theory and Practice*, *Physical Therapy*, *Physiotherapy*, and *Physiotherapy Canada*) were investigated. These are considered as core physiotherapy journals due to the high methodological quality of their published experimental studies.[38] Moreover, we considered them to be representative of key physiotherapy research publications from three geographically distinct continents: Australia, North America, and the United Kingdom.

Two experienced systematic reviewers independently identified papers that assessed the effectiveness of a physiotherapy intervention and classified them according to the National Health and Medical Research Council's hierarchy of evidence[8] (Table 1). These studies were subsequently sorted into two groups: systematic reviews and lower-order intervention studies. Systematic reviews were considered separately from lower-order intervention studies because of the complexity involved with collating information from the multiple studies contained within them.

Both reviewers then analyzed the systematic reviews and lower-order intervention studies with respect to their clinical applicability. The key constructs that guided their investigation included the following:

- Diagnostic criteria used to recruit subjects into the studies
- Number of interventions delivered to subjects
- Type of intervention (single intervention vs. a package of care) delivered to subjects

TABLE 1. Number of Intervention Studies Published in Core Physiotherapy Journals* Between October 2001 and September 2002

Level of Evidence		*Australian Journal of Physiotherapy*		*Physiotherapy Theory and Practice*		*Physical Therapy*		*Physiotherapy*		*Physiotherapy Canada*		
Number	Description	N	Ref	N	Ref	N	Ref	N	Ref	N	Ref	Total
I	Systematic review	0		0		4	59–62	1	66	0		5
II	Randomized controlled trial	2	40,41	1	47	4	55–58	5	64,65,68, 70,71	0		12
III-1	Pseudorandomized controlled trial	0		1	48	0		0		0		1
III-2	Comparison study with a control	0		1	45	1	65	0		0		2
III-3	Comparison study without a control	3	39,42,44	1	46	2	52,57	1	69	1	72	8
IV	Case series	1	43	0		4	49,51,53,54	1	67	0		6
Total no. of experimental studies		6		4		15		8		1		34
Total no. of papers published		27		22		69		65		27		210

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N, number of papers; Ref, reference number.

- The constructs represented by the outcome measure used, using the definitions of "impairment," "activity limitation," and "participation restriction" defined by the World Health Organization[31]
- The reported psychometric properties (validity, reliability, and sensitivity to detect change over time) for each of the outcome measures used
- Number of outcome measures used per study
- Stakeholder perspective represented by each outcome measure
- Timing of use of each outcome measure within the episode of care
- Whether the effectiveness of the intervention was assessed for sample subgroups.

In the case of disagreement between the reviewers, consensus was research by discussion. Findings were summarized for each journal and study design.

Results

The total number of original papers (of any research design) published between October 2001 and September 2002 ranged from 22 in *Physiotherapy Theory and Practice* to 69 in *Physical Therapy*. These numbers reflect the frequency of journal publication, with the *Australian Journal of Physiotherapy*, *Physiotherapy Theory and Practice*, and *Physiotherapy Canada* published quarterly and *Physical Therapy* and *Physiotherapy* published monthly. Sixteen percent (n = 33) of the papers published in these journals assessed the effectiveness of a physiotherapy intervention[39–72] (Table 1). The most frequently used design was the randomized controlled trial (n = 12)[40,41,47,55–58,64,65,68,70,71] (Table 1). Five systematic reviews[59–62,66] were published in the one-year time frame, with most of them published in *Physical Therapy* (n = 4)[59–62] (Table 1).

Diagnostic Criteria

Systematic Reviews

Tissue-based pathologies were not used as the basis for inclusion criteria in any systematic review.[59–62,66] Mostly, inclusion criteria (diagnosis) were nonspecific symptoms located in specific body regions (lower back, shoulder, knee, neck)[59–62] or related to a disorder that was likely to respond to a particular intervention (hydrotherapy).[66]

Lower-Order Intervention Studies

Of the 29 lower-order intervention studies identified in this review, only four used tissue-based pathologies as a basis for subject recruitment.[44,64,70,72] For example, Adedoyin et al.[64] recruited subjects with radiologically confirmed osteoarthritis of the knee, and Williams et al[44] studied children diagnosed pathologically with cystic fibrosis (Table 2). In the remaining studies, nonspecific inclusion criteria were applied, such as right hemiparesis,[67] individuals older than 60 years of age,[40] and individuals recovering from an anterior cruciate ligament reconstruction.[58] Thus, these findings do not support our hypothesis that research diagnostic criteria should be defined in terms of tissue-based criteria relevant to physiotherapists.

Intervention Criteria

Systematic Reviews

None of the systematic reviews provided details regarding the number of interventions in each trial or the time period

TABLE 2. Types of Diagnostic Criteria and Interventions Used in Intervention Studies (Levels II–IV[8]) Published in Core Physiotherapy Journals* Between October 2001 and September 2002

	Australian Journal of Physiotherapy		*Physiotherapy Theory and Practice*		*Physical Therapy*		*Physiotherapy*		*Physiotherapy Canada*		
	N	Ref	N	Ref	N	Ref	N	Ref	N	Ref	Total
Inclusion criteria based on tissue pathology	1	44	0		0		2	64,70	1	72	4
Use of episode-of-care treatment model	2	40,41	1	47	9	49,51–54, 56-58,63	5	64,65,68, 70,71	1	72	18
Use of "packages of care" for treatment	3	40,41,44	1	47	5	50,52,53, 56,58	4	64,65,68,70	1	72	14
Total no. of papers (levels II–IV) from each journal	6		4		11		7		1		29

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N, number of papers; Ref, reference number.

over which the intervention was delivered. Moreover, the majority of studies contained within these systematic reviews investigated the effect of a single intervention.

Lower-Order Intervention Studies

Sixty-two percent (n = 18) of lower-order intervention studies based their intervention on the episode-of-care model.[40,41,47,49,51–54,56–58,63–65,68,70–72] This approach varied in frequency according to the journal of publication, with one half of these studies appearing in *Physical Therapy* (Table 2). The number of contacts with subjects also varied, ranging from two sessions of stretching spastic dorsiflexors[51] to 100 inpatient treatments following a cerebrovascular accident.[56] These findings support our hypothesis that research interventions should be considered within an episode-of-care model.

Less than one half of the lower-order interventions (n = 14) investigated the effect of a package of care (compared with a single intervention).[40,41,44,47,50,52,53,56,58,64,65,68,70,72] For example, Chapman-Jones and Hill[65] investigated the effect of electrical stimulation in conjunction with "current management" for individuals with lateral elbow pain. "Current management" included a variety of techniques based on the physiotherapists' discretion. Barratt and Smerdely[40] compared the effect of progressive resistance training and nonspecific exercise on individuals older than 60 years of age, where both exercise groups underwent a range of exercises for different muscle groups. These types of interventions appear to reflect clinical practice more appropriately than studies that investigate the effect of one treatment in isolation. However, 15 of the 29 intervention studies investigated the effect of a single intervention, such as the effect of low-dye taping on foot biomechanics,[43] effect of cuing/scanning for the treatment of visual neglect,[49] and effect of biofeedback on the frequency of urinary incontinence and strength of pelvic floor contractions.[71] Therefore, these findings do not support our hypotheses that research interventions should reflect a package of care that is relevant to clinical practice.

OUTCOME MEASUREMENT CRITERIA

Systematic Reviews

Overall, insufficient information was provided regarding outcome measures used in the systematic reviews. No information was provided regarding the justification of outcome measures or the time frames of assessment in the systematic reviews published in *Physical Therapy*.[59–62] However, Geytenbeek[66] tabulated a variety of information from the studies she reviewed and found that only 58% of the outcome measures were reported as reliable. Information pertaining to the timing of outcome measurement, psychometric properties of outcome measures, and appropriateness to subgroups was not detailed.

Lower-Order Intervention Studies

A variety of outcome measures was reported, ranging from one measure[55,64] to 10[39,47,52] (Table 3). Outcome measures represented a range of constructs, from impairment to participation restriction. However, in the majority of papers (n = 19), outcome measures solely assessed impairments[42–46,48–55,57,58,64,67,69,70] (Table 3). This does not support our hypothesis that batteries of outcome measurement should be used to address aspects of activity limitations/participation restrictions as well as impairments.

Different stakeholder perspectives, such as the clinician, patient, and caregiver, were represented in the outcome measures used (Table 3). Most outcome measures (n = 17) addressed the clinician's perspective.[42-46,49–57,67] However, in 10 studies, outcome measures were used to document both the clinicians' and patients' perspective.[40,41,47,48,53,58,63,65,68,71] One paper, by Ackerman et al,[39] assessed three stakeholder perspectives (the patient [violinist], the clinician, and the lis-

TABLE 3. Characteristics of Outcome Measures Used in Intervention Studies (Levels II–IV[8]) Published in Core Physiotherapy Journals* Between October 2001 and September 2002

	Australian Journal of Physiotherapy		*Physiotherapy Theory and Practice*		*Physical Therapy*		*Physiotherapy*		*Physiotherapy Canada*		
	N	Ref	N	Ref	N	Ref	N	Ref	N	Ref	Total
Composition of outcome measures per study											
Impairment only	3	42–44	3	45,46,48	9	49–55,57,58	4	64,67,69,70	0		19
Impairment + activity limitation	1	41	0		2	56,63	1	68	0		4
Impairment + participation restriction	2	39,40	0		0		2	65,71	1	—	5
Impairment + activity limitation + participation restriction	0		1	47	0		0		0		1
Composition of stakeholders' perspectives represented in outcome measures per study											
Clinician only	3	42–44	2	45,46	9	49–57	3	67,69,70	0		17
Patient only	0		0		0		1	64	0		1
Patient + clinician	2	40,41	2	47,48	3	53,58,63	3	65,68,71	0		10
Patient + clinician + others	1	39	0		0		0		1	—	2

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N, number of papers; Ref, reference number.

tener), whereas Jaglal et al.[72] assessed outcome following hip fracture from the patient, clinician, caregiver, and administrative perspective. When all of the outcome measures were accumulated, 70% (n = 88) represented the clinician's perspective. This finding does not support our hypothesis that the patient's and clinician's perspective should be incorporated in outcome measurement.

All outcome measures were taken in the same time frame, irrespective of the construct or stakeholders' perspective that was evaluated. Thus, our hypothesis that the time frame of outcome assessments should be dependent on the construct and stakeholders' perspective that it evaluates was not supported.

The psychometric properties of outcome measures were rarely reported. Reliability of the measure was reported in 29% of all outcome measures (n = 36), whereas validity of the measure was less frequently cited (n = 11). The sensitivity to detect change over time was reported for only one outcome measure: energy expenditure measured by indirect calorimetry.[44] Thus, this finding does not support our hypothesis that outcome measures used to assess the effectiveness of a physiotherapy intervention should be demonstrably valid, reliable, and sensitive to detect change over time and that psychometric properties should be documented.

The behavior of outcome measures across subgroups and differences in the effectiveness of intervention across subgroups were not investigated in any of the reviewed studies. Therefore, our hypothesis that outcome measures should be appropriate for all subgroups of patients was not supported.

Discussion

The results of this study suggest that there is a mismatch between the output of physiotherapy research and the requirements of clinical practice. We hypothesized the following for intervention studies.

- Diagnostic criteria should be defined in terms relevant to clinical practice (for instance, referencing tissue-based pathology relevant to physiotherapists).
- Interventions should be tested using an episode-of-care model and reflect packages of care that are relevant to clinical practice.
- Outcome measures should reflect at least clinician and patient perspectives; be applied at appropriate time frames; be reported as valid, reliable, and sensitive to detect change over time; and be appropriate for all subgroups of patients.

However, we found evidence to support only one of our hypotheses, that interventions should reflect packages of care relevant to clinical practice. Thus, there seems to be limited potential to apply current research findings to clinical practice.

We propose that the key to producing clinically relevant research is to understand the nature of clinical practice and to ensure that this is addressed in research studies. This information is best provided by clinicians and would provide researchers with a sound framework from which to develop research agendas. As such, researchers require access to clinical information, such as clinical descriptions

of tissue-based pathologies treated by physiotherapists; number, types, and frequencies of usual interventions; and the most appropriate outcome measures used to assess the effectiveness of intervention. Sim et al.[10] noted that sources of this information are not widely available to researchers. Armed with relevant clinical information, researchers could make more informed choices regarding the intent, design, and generalizability of their research. For example, more research could be directed to answer clinical questions that focus on particular diagnostic groups that are defined by tissue-based pathologies. Interventions could reflect those that are delivered in clinical practice[1] (reflecting the occasion-of-service model and packages of care) and are most likely to change clinical practice.

Moreover, clinicians often fail to recognize their role in producing clinical evidence that informs research evidence.[4] Physiotherapists use patient records to record a wealth of information from patients and other relevant stakeholders regarding diagnosis and outcome measurement. This information potentially could be used to identify aspects of diagnosis that may predict poor outcomes (risk factors) as well as inform higher quality and more relevant research studies.[6,73] However, for clinical evidence to guide research effectively, clinical information should be collected and recorded in a standardized and reliable manner across sites.

Further investigation is required to determine the most appropriate outcome measures to use in clinical and research settings to demonstrate the effectiveness of physiotherapy interventions. Because a common aim of physiotherapy is to increase an individual's ability to function as independently as possible in his or her environment,[29,74] outcome measures should focus on physical, emotional, and holistic aspects of patient functioning as well as the perspective of other stakeholders such as caregivers.[34,35] This is in contrast with the findings of this paper, where most outcomes were those valued by clinicians (objectively measured impairments). This finding may be reflective of the philosophical underpinnings of physiotherapy, which traditionally has been an impairment-based profession.[75]

It seems essential that evidence is provided in every research paper regarding the validity, reliability, and sensitivity to detect change over time of chosen outcome measures. Without documentation of important psychometric properties, physiotherapists cannot be certain that the outcome measure is useful and appropriate in determining the effectiveness of the intervention.[27–29]

The implications of this study impact on both clinical and research physiotherapists. Researchers need to provide research evidence that has the potential to be applied to the clinical setting by selecting clinically relevant diagnostic criteria, interventions tested, and outcomes measured. When this is achieved, one of the barriers to evidence-based practice will be reduced. However, other barriers, such as difficulties with accessing information and lack of supportive environments to facilitate transfer of research evidence into clinical practice,[10,11,76] also need to be addressed to facilitate an evidence-based culture within the physiotherapy profession.

Conclusions

Clinicians and researchers should be involved in producing research that is applicable to clinical practice and likely to influence practice. Without effective communication between both groups and without recognition of the imperatives of research and clinical practice, barriers will continue to be experienced when attempting to apply evidence-based practice to real-life situations.

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