The influence of the therapist-patient relationship on treatment outcome in physical rehabilitation: a systematic review

Authors: Amanda M. Hall, Paulo H. Ferreira, Christopher G. Maher, Jane Latimer and Manuela L. Ferreira
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Abstract:

Background. The working alliance, or collaborative bond, between client and psychotherapist has been found to be related to outcome in psychotherapy.

Purpose. The purpose of this study was to investigate whether the working alliance is related to outcome in physical rehabilitation settings.

Data Sources. A sensitive search of 6 databases identified a total of 1,600 titles.

Study Selection. Prospective studies of patients undergoing physical rehabilitation were selected for this systematic review.

Data Extraction. For each included study, descriptive data regarding participants, interventions, and measures of alliance and outcome--as well as correlation data for alliance and outcomes--were extracted.

Data Synthesis. Thirteen studies including patients with brain injury, musculoskeletal conditions, cardiac conditions, or multiple pathologies were retrieved. Various outcomes were measured, including pain, disability, quality of life, depression, adherence, and satisfaction with treatment. The alliance was most commonly measured with the Working Alliance Inventory, which was rated by both patient and therapist during the third or fourth treatment session. The results indicate that the alliance is positively associated with: (1) treatment adherence in patients with brain injury and patients with multiple pathologies seeking physical therapy, (2) depressive symptoms in patients with cardiac conditions and those with brain injury, (3)

treatment satisfaction in patients with musculoskeletal conditions, and (4) physical function in geriatric patients and those with chronic low back pain.

Limitations. Among homogenous studies, there were insufficient reported data to allow pooling of results.

Conclusions. From this review, the alliance between therapist and patient appears to have a positive effect on treatment outcome in physical rehabilitation settings; however, more research is needed to determine the strength of this association.

Full Text:

The Therapist-Patient Relationship in Physical Rehabilitation The relationship between patient and therapist traditionally has been viewed as an important determinant of treatment outcome and is considered central to the therapeutic process. (1,2) More recently, this concept has been evaluated in research studies, where it is commonly referred to as the therapeutic alliance, helping alliance, or working alliance. (3) For simplicity, this review will refer to this construct as the alliance.

The construct of the alliance in therapeutic situations is derived from theories of transference first outlined by Freud in 1912 and refers to the sense of collaboration, warmth, and support between the client and therapist. (4,5) Following on from this concept, Bordin (1) in 1979 defined the 3 main components that contribute to the alliance construct as: (1) the therapist-patient agreement on goals of treatment, (2) the therapist-patient agreement on interventions, and (3) the affective bond between patient and therapist. Using this definition, researchers began to measure the alliance in clinical practice and formally assess its impact on treatment outcomes. The majority of this evaluation has been conducted in psychology, counseling, or general medicine settings, where the intervention is typically centered on a one-to-one interaction between the patient and the treating physician or therapist. (3,6-12) The research to date has used a variety of different tools to measure the alliance, and there has been some argument that each tool represents conceptually different, although overlapping, constructs. Elvins and Green (13) recently conducted an extensive review to investigate the conceptualization and measurement of the alliance. They identified a broad consensus as to the key concepts of the alliance among the various measures, but no single unifying alliance model or a single measure that comprehensively addressed all of the key concepts. The most successfully

comprehensive measures of the alliance identified in the review were the Working Alliance Inventory (WAD, the Vanderbilt Scales, and the California Scales. (13)

Several research studies using the above-mentioned alliance measures have found that a positive alliance is associated with positive health outcomes for variables such as depression, (14,15) anxiety, (15) mood, (16) interpersonal problems, (17) and general psychological functioning. (17) A meta-analytic review of 68 studies conducted in 2000 indicated that the weighted association of the alliance with overall outcome (including outcomes of mood, anxiety, and global assessment scales) was moderate (r=.22). (3) In 2001, a further meta-analysis of the relationship between the alliance and the psychotherapy outcome included 90 independent clinical investigations, from which the author reported that the alliance may account for up to half of the beneficial effects of psychotherapy. (7)

In the medical profession, trust is seen as a global attribute of treatment relationships, encompassing satisfaction, communication, competency, and privacy, (11) and has long been viewed as vital to cooperation with treatment and physician recommendations. (18) Several studies attempted to measure how trust affects clinical outcomes and found that the patient's trust in his or her physician is positively correlated with self-reported measures of health status, (19) symptom status, (20) and overall quality of life. (21) A recent high-quality study examined how patients' trust in their physicians affected both self-report and "objective" measures of health status in 480 patients with diabetes. (10) The authors reported that patient trust was positively correlated with stronger outcome expectations (r=.46, P<.01) and self-efficacy (r=.45, P<.01), which, in turn, predicted better treatment adherence, leading to better clinical outcomes of improved body mass index, blood glucose, blood lipids, and diabetes-related complications, as well as improved self-reports of mental and physical health.

It would appear from the previous research that the alliance is positively associated with treatment outcome and could potentially be used as a predictor of treatment outcome in psychotherapy and general medicine settings. However, the degree to which the alliance relates to outcome in other treatment settings is not clear. Physical rehabilitation, like psychotherapy and general medicine, includes a high level of patient-clinician interaction; however, the characteristics of the patient population, as well as the intervention, are arguably different. It is plausible, therefore, that the

relationship between the alliance and the outcome seen in psychotherapy or general medicine settings is not transferable to physical rehabilitation settings. It is thus of great importance to determine whether the alliance of rehabilitation therapists is similar to that of psychotherapists and general practitioners and whether this alliance influences outcome in the physical rehabilitation setting. To our knowledge, there has been no systematic review of the primary research in this area.

The aims of this study were: (1) to identify and summarize studies that have used and analyzed the alliance as a predictor of outcome and adherence in physical rehabilitation settings and (2) to determine whether there is an association between the alliance and the treatment outcome of physical rehabilitation programs. We hypothesized that the patient-therapist alliance would have a positive correlation with treatment outcome.

Method

Data Sources and Searches

An electronic database search using the search strategies outlined in Appendix 1 was conducted for 6 data bases (EMBASE, PEDro, PsychINFO, MEDLINE, CINAHL, and LILACS) from the earliest record to February 2009. Citation tracking was performed by manually screening reference lists of eligible trials. Theses and conference proceedings also were included. Additionally, personal communication with content experts in the therapeutic alliance field was conducted. Study inclusion was not restricted by language. The search strategy and exclusion process are illustrated in the Figure.

Study Selection

From the titles identified by the search strategy, original studies were included if they: (1) were prospective, longitudinal studies (randomized controlled trials, controlled trials, or cohort studies); (2) included patients who were managed with physical rehabilitation and there were no restrictions to diagnosis; (3) included at least one measure of therapeutic alliance or therapist-patient interaction/bonding; and (4) used at least one measure of treatment outcome such as pain, disability, physical performance, quality of life, global perceived effect of treatment, and adherence. Physical rehabilitation is defined as an intervention that aims to enhance and restore functional ability and quality of life in those with

physical impairments or disabilities. It can include a combination of physical moralities, therapeutic exercise, activities modification, assistive devices, orthoses, and prostheses. The interventions can be delivered by a single therapist or a combination of therapists in a multidisciplinary setting, including physical therapists, occupational therapists, psychologists, chiropractors, speech pathologists, and recreation therapists. (22)

Data Extraction and Quality Assessment

For each included trial, 2 reviewers independently extracted quantitative data such as change or final scores and standard deviations for all relevant outcomes at all time points used in the study. In addition, correlation or regression coefficients and odds ratios for alliance and outcomes were extracted. For each included study, descriptive data regarding participants, interventions, measures of alliance, and other outcome measures were extracted. If different data were reported by the 2 reviewers, data were rechecked by both reviewers. If disagreement continued, a third author would arbitrate. However, a third author was not necessary, as consensus was reached for all extracted data.

Studies meeting the eligibility criteria were assessed for methodological quality. The methodological quality of the studies was independently assessed by 2 authors using a checklist that comprised 7 criteria: use of a representative sample, having a defined sample, use of blinding, having a follow-up rate greater than 85%, appropriate choice of outcome measures, reporting outcome data at follow-up, and control for confounding via statistical adjustment. These criteria have been used in previous studies, (23,24) and their inclusion in checklists for rating methodological quality has been recommended by a recent systematic review of quality assessment tools for observational studies (25) and by the STROBE Statement. (26) However, this scale was not designed to provide a quality score per se; thus, there is no score allocated to each individual study. Similarly, if different data were reported by the 2 reviewers, data were rechecked by both reviewers. If disagreement continued, a third reviewer was used to arbitrate.

Data Synthesis and Analysis

Studies were grouped according to the study population and outcome measure. Within each study population, meta-analyses were intended to be performed if 2 or more studies used similar measures of alliance and similar

measures of outcome. Where there were not multiple studies with sufficient homogeneity, the correlation between alliance and outcome measure of the individual studies was reported.

Results

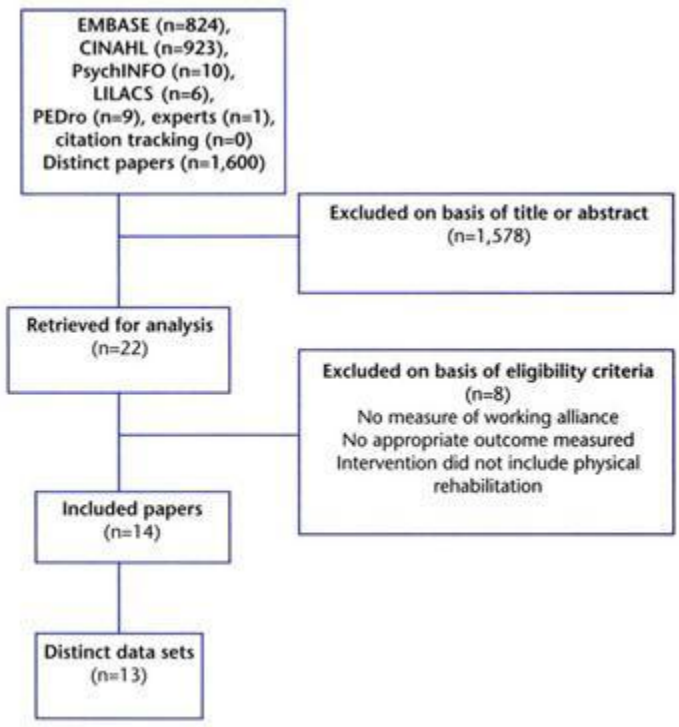


Figure.
Search strategy and exclusion process.

Included Studies

A total of 1,600 unique titles were identified using multiple databases (ie, EMBASE, CINAHL, MEDLINE, PsychINFO, LILACS and PEDro), citation tracking, and contact with experts in the field. Titles were merged in EndNote X, * and sources included books, theses, abstracts, conference proceedings, and journal articles from both refereed and nonrefereed journals. Following the exclusion process, a total of 14 publications (13 distinct data sets) met the inclusion criteria. (27-39) The 2 publications reporting on the same cohort (33,34) are treated as 1 study. The 13 studies were published between 1990 and 2009; 10 were from published sources, and 3 were from unpublished doctoral dissertations or master's theses. A detailed description of the

methodological quality of each study is presented in Table 1. Considering the possibility of missed articles in this search strategy, readers are encouraged to alert the corresponding author to any papers that have not been cited in this article for future updated reviews of this material.

Participants

The patient population's diagnoses varied among the studies, including brain injury (3/13), musculoskeletal conditions (6/13), cardiac conditions (1/13), and multiple pathologies such as systemic diseases, trauma and postoperative conditions, back pain, and neck and shoulder pain (3/13).

Interventions and Treatment Outcome

The length of treatment was reported in 7 of the 13 studies and varied from 4 to 16 weeks. In 9 of the 13 studies, the interventions were delivered by a single therapist, predominantly a registered physical therapist (8/9). The other 4 studies used multidisciplinary interventions administered by multiple therapists; the alliance was based on the relationship with the client's primary therapist, who was not specified. Various outcome measures were assessed in each study, and a detailed description of the measurement tool is provided in the descriptive summary for each study (Tab. 2).

Alliance Measurement Tools

In the 13 studies, multiple instruments were used to measure the alliance between therapist and patient. The short-form WAI was used most often in the included studies (6/13). Five studies (27,28,37-40) used alliance scales that are not commonly referred to in the literature. These scales either were created by the researchers for the specific study or were subscales within more general treatment questionnaires. In the sample of studies, patients were the most common raters of the alliance (12/13), followed by therapists (8/ 13) and observers (2/13).

Alliance Score Predictor of Outcome

Of the included studies, there was a wide range of patient diagnoses. Included studies were summarized in terms of diagnoses. Within the specific diagnostic groups, there was insufficient homogeneity between measurement of alliance and measurement of outcome to warrant pooling of data. The association between alliance and outcome, therefore, is

described as reported in the individual studies. A summary of the included studies, including study characteristics and correlations (if stated), is reported in Table 2. A further detailed description of each included trial is presented in Appendix 2.

Brain injury. Three of the 13 studies included patients who were participating in brain injury rehabilitation programs. The rehabilitation program was similar among trials and commonly referred to as the postacute brain injury rehabilitation program (PABIR). It consisted of a multidisciplinary team working with the patient on achieving goals of improved physical, cognitive, and social function. The results from these studies are inconsistent. Two studies conducted by Schonberger and colleagues (33-35) found significant positive associations between alliance and adherence, employment, physical training, depression, and therapeutic success. The study by Sherer et al (6) found a positive correlation between alliance and program attendance but not between alliance and disability, productivity, or depression (Tab. 2).

Musculoskeletal conditions. Six of the 13 studies included patients with a diagnosis that falls under the category of musculoskeletal pain conditions, including chronic low back pain (3/6), chronic neck pain (1/6), and multiple diagnoses of musculoskeletal conditions (2/6). Various outcomes were measured in all studies. Significant positive associations were found between the alliance and the patient's global perceived effect of treatment, (30,38,39) change in pain, (32,39) physical function, (30,31) patient satisfaction with treatment, (28) depression, (32) and general health status. (32)

Other conditions. Each of the remaining 4 studies investigated the alliance in mixed populations, comprising patients with a variety of different conditions. Among these studies, 2 included correlation data, which found that the alliance was significantly positively associated with physical function and depression in geriatric patients with various physical function deficits (27) and that a change in alliance was associated with a change in treatment adherence for patients with cardiac conditions. (29)

Discussion

Influence of Alliance on Treatment Outcome

The findings of this study suggest that the alliance between patient and therapist positively correlates with treatment outcome for people in physical rehabilitation settings, lending support to this study's hypothesis. The

outcomes included in this review are: (1) ability to perform activities of daily living, (2) pain, (3) specific physical function tasks, (4) depression, (5) global assessment of physical health, (6) treatment adherence, and (7) treatment satisfaction. Unfortunately, a meta-analysis was not possible, and we are unable to provide a more precise estimate of the magnitude of association between the alliance and relevant treatment outcomes.

The included studies recruited patients with a mix of diagnoses. Six of the 14 studies included patients with musculoskeletal pain conditions who were undergoing physical therapy or physical conditioning programs. These studies showed a consistent pattern of positive correlations between alliance and outcome. This positive correlation pattern also was seen for patients with other conditions, including cardiovascular disease, geriatric disability conditions, and general chronic pain conditions. However, this pattern was not consistent for patients diagnosed with brain injury, as one study (36) reported that as client ratings and therapist ratings of alliance improved, outcomes of physical function, productivity, and depression declined. The authors suggested that this paradoxical effect, in comparison with the other studies, may have been due, in part, to the difference in the time at which the alliance was measured. The study measured alliance in the first 2 weeks of treatment, whereas the other 2 brain injury studies measured alliance either after the treatment program (35) or at multiple points during the program (33) and then used a mean score for correlation analysis. In both studies that found positive correlations, there was a longer time in which the feelings of bonding and perceptions of tasks and goals of treatments could be formed.

Measurement of Alliance in Rehabilitation Settings

It is clear from this review that the alliance has not been systematically investigated in the physical rehabilitation setting, as evidenced by the lack of consensus regarding the methods of measurement. Although 6 of the 13 studies used the WM to measure alliance, overall 7 different tools were used across the 13 studies.

To date, 3 of these measures have been validated in psychotherapy settings, (13) and none have been validated for patients undergoing physical rehabilitation. Without appropriate clinimetric testing, it is difficult to assess whether each tool is measuring the same construct. However, because the tool used does not appear to influence the magnitude and direction of the

correlation in different musculoskeletal samples, we would suggest there is some indirect evidence that the tools may be equally valid.

Table 1.
Methodological Quality (Criteria Developed From Sanderson et al[25] and STROBE Guidelines[26])[a]

Study	Representative Sample	Defined Sample	Blinding		Follow-up Rate >85%	Methods of Assessment	Outcome Data Reported	Statistical Adjustment
			Alliance Rater	Outcome Rater				
Schonberger et al (2006)[15]	✓	✗	T_1	T_1	✓	✓	✓	?
Schonberger and colleagues (2006)[13,14]	✓	✗	P/T	T	?	✓	✓	✓
Sherer et al (2007)[16]	✓	✗	P/T	P	✓	✓	✓	✓
Ferreira et al (2009)[10]	✗	✓	P	P	✓	✓	✓	✓
Beattie et al (2005)[28]	✓	?	P	P	✗	✓	✓	✗
Zaproudina et al (2007)[18]	✗	✓	P	P	✓	✓	✓	✗
Zaproudina et al (2009)[19]	✗	✓	P/T	P	✓	✓	✓	✗
Higdon (1997)[31]	✗	✓	P/T	P/T	✗	✓	?	✗
Mirsky (2002)[32]	✗	✓	P	P	✗	✓	?	✗
Burns and Evon (2007)[29]	✓	✓	P	P/T	✓	✓	?	✗
Slujis et al (1993)[17]	✓	✗	P/O	P	?	?	?	✗
Ambady et al (2002)[27]	✗	✓	O	P	✓	✓	✓	✗
Walker (1990)[40,b]	?	✗	P/T	P	✗	✗	✗	✗
Control for bias • Representative sample: participants were selected as consecutive or random cases • Defined sample: description of participant source and inclusion and exclusion criteria • Blinded outcome assessment: assessor was unaware of prognostic factors at the time of outcome assessment • Follow-up >85%: outcome data were available for at least 85% of participants at one follow-up point								
Appropriate measurement of variables • Methods of assessment: appropriate choice of outcome measures • Outcome data reported: reporting of outcome data at follow-up								
Control for confounding • Statistical adjustment: multivariable analysis conducted, with adjustment for potentially confounding factors								

[a] P=patient, T=therapist, T_1=therapist rated retrospectively, O=observer, ✓=yes, ✗=no, ?=unclear.
[b] Quality ratings are based on available abstract, as the full dissertation was unavailable.

There were some similarities in the methodological approach of the studies. The timing of alliance assessment was relatively consistent among studies, with 7 of 13 studies measuring the alliance during the second to fifth treatment sessions. This finding may be due, in part, to recommendations by Horvath that the alliance measured between the first and fifth treatment sessions or within the first third of treatment shows a stronger alliance-outcome association. (7) Additionally, 12 of 13 studies included

patient ratings of the alliance, 8 chose therapist ratings, and 2 chose observer ratings.

This choice also may be due to conclusions from a previous metaanalysis that patients' ratings of the alliance had a stronger correlation with outcome than therapists' ratings in psychotherapy settings. (3) However, based on the available data, we are unable to determine whether this is the case in physical rehabilitation settings.

Recommendations

Clinicians. The results of this study suggest a positive alliance is associated with improved outcome. Although a few studies (27,41) have attempted to identify the factors that influence the alliance, there is no conclusive evidence as to which factors are most important. The limited data would suggest that providing positive feedback, answering the patient's questions, and providing clear instructions for home

practice are positively correlated with a good working alliance and satisfaction with treatment.

Researchers. The WAI was the most frequently used tool among the studies included in this review. There is some evidence that the WAI is appropriate for most research projects because it is well-triangulated measure with good validity data. (13) These clinimetric properties, however, are based on its use in different populations undergoing psychotherapy, and further clinimetric testing of this questionnaire is needed to support its use in the physical rehabilitation setting.

Conclusions

The alliance has been previously shown to play a key role in influencing adherence to treatment advice as well as improving treatment outcome in psychotherapy and general medicine. Our review indicates that there are also several studies investigating the alliance in a physical rehabilitation setting, the majority of which include patients with musculoskeletal pain conditions. Although a meta-analysis could not be conducted, the results indicate a consistent positive correlation between the alliance and treatment outcomes of pain, disability, physical and mental health, and satisfaction with treatment. The findings also indicate that instruments used to measure the alliance have been developed for assessment in the psychotherapy setting.

There is, therefore, an urgent need to develop a measure of the alliance construct that investigates the factors underlying the alliance in the physical rehabilitation setting before meaningful research regarding prediction of treatment outcome can be undertaken. Once appropriate measurement has been established, further prospective longitudinal studies in which the alliance is systematically measured are needed to obtain a more conclusive understanding of the relationship between the alliance and its effect on treatment outcome.

The Bottom Line

What do we already know about this topic?

Table 2.
Characteristics of Included Studies (Arranged by Patient Population)[a]

Study	Study Type	n	Intervention Description	Alliance	Session Rated	Outcome	Client Rated	Therapist Rated	Observer Rated
Brain injury									
Schonberger et al (2006)[15]	Cohort	98	14 weeks of multidisciplinary rehabilitation delivered by a physical therapist for patients with acquired brain injury	Prigatano Scales/WAI-SF	3–4	Adherence		r_s=.76*	
						Employment		r_s=.20*	
Schonberger and colleagues (2006)[33,34]	Cohort	86	14 weeks of multidisciplinary rehabilitation delivered by a team of therapists[b] for patients with acquired brain injury	WAI-SF	3–4	Therapeutic success	r=.63*	r=.49*	
						Depression	r=.60*		
Sherer et al (2007)[16]	Cohort	69	Multidisciplinary rehabilitation delivered by a team of therapists[b] for patients with acquired brain injury	CALPAS/Prigatano Scales	3–6	Disability	r=.09*	r=.31*	OR=1.07 (95% CI=1.0–1.15)
						Attendance	r=.47*	r=.82*	
						Productivity	r=−.06*	r=.38*	
						Depression	r=−.17*	r=−.46*	
Musculoskeletal pain									
Ferreira et al (2009)[30]	RCT	240	8 weeks of physical therapy for patients with chronic low back pain	WAI-LF	3	Function	b=0.17 (95% CI=0.07–0.28)*		
						Global assessment[c]	b=0.08 (95% CI=0.03–0.13)*		
Beattie et al (2005)[28]	CS	1,449	Physical therapy for patients with musculoskeletal pain conditions	MedRisk internal factors	4–5	Treatment satisfaction	r=.83*		
Higdon (1997)[31]	Cohort	53	Physical rehabilitation delivered by an occupational therapist for patients with musculoskeletal pain conditions	WAI-SF	N/S	Physical function	r=.09–.27*		
						Floor-bench lifts	β=0.20*		
Zaproudina et al (2007)[18]	RCT	105	5–10 sessions of physical therapy, traditional bone setting,[d] or massage therapy for patients with chronic neck pain	5-item questionnaire	2–3	Global assessment	r_2=.36–.47*		
Zaproudina et al (2009)[19]	RCT	131	5–10 sessions of physical therapy or traditional bone setting for patients with chronic back pain	5-item questionnaire	2–3	Global assessment	r_2=.30*		
						Pain	r_2=.30*		
Mirsky (2002)[32]	Cohort	11	4 weeks of multidisciplinary rehabilitation delivered by a team of therapists for patients with chronic low back pain	WAI-SF	Last				

The therapeutic alliance between a patient and a treatment provider is positively correlated with treatment adherence and outcome in both general medicine and psychotherapy settings.

What new information does this study offer?

This systematic review found that a positive therapeutic alliance also consistently correlated with improved pain, disability, and treatment satisfaction in physical rehabilitation. However, the retrieved studies used a variety of alliance measures that were developed for use in psychotherapy and have not been tested for reliability and validity in physical rehabilitation. Development of measures validated for physical therapy settings have the potential not only to increase our understanding of interventions but also to increase their effectiveness.

If you're a patient, what might these findings mean for you?

In order to maximize the benefits of physical therapy, a patient-centered approach is recommended as the basis for the development of a good working relationship between physical therapist and patient, with enhanced effectiveness of communication regarding specific tasks required to achieve treatment goals.

All authors provided concept/idea/research design. Ms Hall, Dr P.H. Ferreira, and Professor Maher provided writing. Ms Hall, Dr P.H. Ferreira, Professor Maher, and Dr M.L.

Ferreira provided data collection and analysis.

Professor Maher provided project management.

Dr Latimer provided facilities/ equipment. Dr P.H. Ferreira, Professor Maher, Dr Latimer, and Dr M.L. Ferreira provided consultation (including review of manuscript before submission).

Table 2.
Continued

Study	Study Type	n	Intervention Description	Alliance	Session Rated	Outcome	Client Rated	Therapist Rated	Observer Rated
Other									
Burns and Evon (2007)[29]	Cohort	79	12 weeks of outpatient cardiac rehabilitation delivered by a physical therapist for patients with cardiovascular disease	WAI-SF	N/S				
Sluijs et al (1993)[17]	Cohort	695	Physical therapy for patients with multiple pathologies[e]	Verbal behaviors	N/S	Adherence[f]			Mean=2.51 (SD=0.5)[g]
									Mean=2.45 (SD=0.47)[h]
Ambady et al (2002)[27]	Cohort	48	Physical therapy for geriatric patients with various physical conditions	Nonverbal cues	First or last	Activities of daily living			r=.60*
Walker (1990)[40]	Cohort	96	Multidisciplinary rehabilitation for patients with chronic pain	N/S	N/S				

[a] RCT=randomized controlled trial, CS=cross-sectional, WAI-SF=short-form Working Alliance Inventory containing 12 items from original 36 items, WAI-LF=long-form Working Alliance Inventory containing 36 items, CALPAS=California Psychotherapy Alliance Scale, N/S=not stated or unclear, r_1=Cramer correlation (description in Appendix 2), r_2=Spearman rho, MedRisk=MedRisk Instrument for Measuring Patient Satisfaction With Physical Therapy Care, OR=odds ratio, 95% CI=95% confidence interval. *P<.05. [b] Significance not reported. Note: more detailed descriptions of the tools used to measure alliance and the correlations between alliance and outcome are reported in Appendix 2.
[c] Team of therapists includes physical therapist, occupational therapist, speech therapist, and neuropsychologist.
[d] Global assessment refers to the patients' self-report of their assessment of health status.
[e] Traditional bone setting was delivered by an experienced Finnish traditional bone setter.
[f] Multiple pathologies include systemic disease, trauma and postoperative conditions, nonradiating back pain, and neck and shoulder pain.
itsup;f For analysis, the sample was divided into 2 groups based on adherence, and alliance scores were obtained in both groups.
[g] Mean alliance score for compliant group.
[h] Mean alliance score for noncompliant group.

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Appendix 1.
Search Strategies

PsychINFO
1. (therap$ adj5 alli$).mp.
2. (work$ adj5 alli$).mp.
3. trust.mp.
4. (emot$ adj5 Bond$).mp.
5. professional-patient relations.mp.
6. therapist-patient relations. ab,ti,tw.
7. interact.mp.
8. rehab$.mp.
9. Physiotherap$.mp.
10. physical therapy.mp.
11. 8 or 9 or 10
12. 1 or 2 or 3 or 4 or 5 or 6 or 7
13. 11 and 12
14. from 13 keep 1-10

MEDLINE and EMBASE
1. (therap$ adj5 alli$).mp.
2. (work$ adj5 alli$).mp.
3. trust.mp.
4. (emot$ adj5 Bond$).mp.
5. professional-patient relations.mp.

6. therapist-patient relations.ab,ti,tw.
7. interact.mp.
8. rehab$.mp.
9. Physiotherap$.mp.
10. physical therapy.mp.
11. 8 or 9 or 10
12. 1 or 2 or 3 or 4 or 5 or 6 or 7
13. 11 and 12

CINAHL
1. (therap$ adj5 alli$).mp.
2. (work$ adj5 alli$).mp.
3. trust.mp.
4. (emot$ adj5 Bond$).mp.
5. professional-patient relations.mp.
6. therapist-patient relations.ab,ti,tw.
7. interact.mp.
8. rehab$.mp.
9. Physiotherap$.mp.
10. physical therapy.mp.
11. 8 or 9 or 10
12. 1 or 2 or 3 or 4 or 5 or 6 or 7
13. 11 and 12

PEDro and LILACS search terms used:
1. bond
2. trust
3. alliance
4. in abstract

Appendix 2.
Detailed Description of Included Studies (a)

Study	Descriptive Summary of Findings
Schonberger et al (2006) (35)	Alliance was measured by the therapist retrospectively in December 2002. At this time, follow-up outcome data on the client's employment and physical activity status also were collected via telephone interview. Alliance was correlated with the follow-up employment and physical activity status, as well as with adherence, during the intervention. Both the physical therapist's and the neuropsychologist's ratings of the alliance were significantly related to adherence (Cramer correlations=.76 and .79, P<.001 for both) and employment status (Cramer correlations=.20 [P=.05] and .43 [P<.01]), but neither rating was significantly related to weekly physical training (Cramer correlations=.17 [P=.11] and .17 [P=.10]). (Note: Schonberger et al dichotomized the alliance data into "good or excellent" or "poor or fair" and stated that they used the Cramer

	statistic, which has been recommended for analysis when a variable has 2 categories. (42))
Schonberger and colleagues (2006) (33,34)	The client-rated WAI "bond" subscale score (mean score collected over 4 time points depression during a 14-week rehabilitation program) was highly correlated with change scores of pretreatment and posttreatment outcomes of (r=.60, P=.001) and therapeutic success (r=.63, P=.01), as measured with the European Brain Injury Questionnaire. (b) (Teasdale 1997). The therapist-rated WAI "bond" subscale score also was correlated with therapeutic success (r=.49, P=.05). Correlations with the other outcomes were not given, and efforts to contact authors for data were unsuccessful.
Sherer et al (2007) (36)	Multivariable linear regression models were used for each outcome with CALPAS-patient, CALPAS-family, and CALPAS therapist. None of the alliance measures were found to be a significant predictor of functional status at discharge. The patient-rated perception of alliance was negatively associated with program completion (OR=0.93, 95% CI=0.87-0.99, P=.02) and productivity status (OR=0.93, 95% CI=0.88-0.99, P=.02). Contrary to this, the stronger the family-rated alliance, the greater the likelihood of higher productivity status at discharge (OR=1.07, 95% CI-1.00-1.1 5, P=.05). Contact with the authors also provided Pearson r correlations (P values were not reported) with treatment outcomes for the client-rated CALPAS scores and therapist-rated Prigatano Alliance Scale scores. These results indicate the client-rated alliance was positively correlated with attendance (r=.47) but not with disability (r=-.09) or productivity at discharge (r=-.06), and there was a negative correlation with depression (r=-.1 7). The therapist-rated alliance scores showed a similar pattern, with a positive correlation with attendance (r=.82) and negative correlations with disability (r=-.31), productivity at discharge (r=-.38), and depression scores (r=-.46). The strength of each of these correlations is consistently greater when the alliance is rated by the therapist, possibly suggesting that perhaps the therapist may overrate the alliance or have an expectation bias that is not shared by the client. However, in this article, the

	therapists and clients used different scales to rate the alliance, which may account for the difference; the therapists used the Prigatano Alliance Scale, and the clients used the CALPAS scale, and these scales appear to measure slightly different aspects of the alliance. The Prigatano Alliance Scale uses items that are based more on attendance and adherence to treatment recommendations rather than the relationship between therapist and client, as seen in the CALPAS.
Ferreira et al (2009) (30)	Linear regression models were used to investigate the ability of the alliance to predict outcome and response to treatment. Results indicated that the alliance was a significant predictor of global perceived effect (b=0.08, CI=0.03 0.13, P=.001) and physical function (b=0.17, CI=0.07-0.28, P=.001).
Beattie et al (2005) (28)	Pearson r correlations were calculated to measure the association between the alliance and patient satisfaction with treatment. The MedRisk Instrument for Measuring Patient Satisfaction With Physical Therapy Care (28) was used, which includes 6 items related to the patient-therapist interaction as internal factors, 3 items related to administration (termed external factors), and 2 items that measure the outcome of patient satisfaction with treatment. The internal factor score was significantly correlated with patient satisfaction (r=.830, P<.01), as was the external factor score (r=.715, P<.01). With regard to the individual items, patient satisfaction correlated strongly with the therapist answering patient's questions (r=.803, P<.01), the therapist giving detailed instructions regarding home program (r=.768, P<.01), and the therapist respecting the patient (r=.761, P<.01).
Higdon (1997) (31)	Pearson r correlation and multiple regression were used to measure the association between the alliance and the change scores in various physical function tasks. Results indicate a positive correlation varying from r=.09 to r=.27. Alliance also was shown to be a significant predictor of floor-bench lifts (13=0.27).
Zaproudina et al (2007) (38)	Spearman rho correlations were calculated to measure the association of the alliance with global assessment of treatment. The alliance

	was evaluated by patients using a 5-item questionnaire measuring the therapist's ability to communicate and to interact with the patient during the treatment sessions. The alliance was significantly correlated with the global assessment scores (r=.36-.47, P<.001).
Zaproudina et al (2009) (39)	Spearman rho correlations were calculated to measure the association between the alliance and global assessment of treatment. The alliance was evaluated by patients using a 5-item questionnaire measuring the therapist's ability to communicate and to interact with the patient during the treatment sessions. Results indicate a statistically significant correlation between the alliance and global assessment of treatment (r=.28-.30, P<.01), as well as changes in pain (r=.30).
Mirsky (2002) (32)	The alliance was intended to be correlated with outcomes of depression, pain intensity, and general health status, as stated in the methods. However, the results were not reported in the article. Attempts to contact the author for the data were unsuccessful.
Burns and Evon (2007) (29)	The alliance and treatment outcome were measured 3 times: at the beginning of treatment, at the middle of treatment, and at the end of treatment. The authors used 3 subscales of the WAI. They used the "bond" subscale score as one measure of alliance and combined the goal and task subscale scores into one score as a second measure of alliance. For analysis, only change scores of the alliance and change scores of the outcomes were correlated and reported in the results. Therefore, the relationship between the actual alliance score and the change score of the outcomes is not known.
Ambady et al (2002) (27)	Pearson r correlations were calculated to measure the association of treatment outcome with 4 alliance variables. The alliance variables were rated by an observer from video footage of the first or last therapy sessions. Distancing (uninvolved behavior) on part of the physical therapist significantly predicted decreased the patient's capacity to perform activities of daily living at discharge (r=-.34, P<.01) and at 3-month follow-up (r=-.35, P<.01). Distancing and therapist's professionalism significantly predicted an increased level of depression at discharge (r=-.27 [P<.05] and r=-.35 [P<.01], respectively). Therapist's

	professionalism and nervousness predicted decreases in mobility at the 3-month follow-up (r=-.51 and r=-.52, P<.01). A further analysis of the specific nonverbal behaviors (including smile, frown, nod, head shake, shrug, forward lean, look at, and sit) as predictors of outcome revealed that facial expressiveness (including smiling, nodding, and frowning) was associated with improvements in activities of daily living at discharge (r=.60, P<.001) and at the 3-month follow-up (r=.58, P<.001).
Slujis et al (1993) (37)	The alliance was rated by an observer using an audiotaped physical therapy session. For analysis, the sample was divided into 2 groups based on adherence, and the alliance scores were reported in both groups. The difference between the alliance scores in both groups was not statistically significant (P=.111), and the authors concluded that there was no association with treatment adherence.
Walker (1990) (40)	The electronic search identified the abstract of this study, which is part of an unpublished doctoral dissertation. The abstract states that there several significant correlations between the client-rated working alliance score and both the client-rated and therapist-rated outcome measure scores. However, the abstract provides no information on the alliance tool, type of outcome, or correlation coefficient data. Attempts to contact the author for the full manuscript were unsuccessful.

(a) WAI=Working Alliance Inventory, CALPAS=California Psychotherapy Alliance Scale, OR=odds ratio, 95% CI=95% confidence interval.

(b) Teasdale TW, Christensen AL, Willmes K, et al. Subjective experience in brain-injured patients and their close relatives: a European Brain Injury Questionnaire study. Brain Inj. 1997;11:543-563.

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* Thomson Reuters, 2141 Palomar Airport Rd, Suite 350, Carlsbad, CA 92011.

A.M. Hall, BKIN, MPE, is a PhD candidate, The George Institute for International Health, Faculty of Medicine, The University of Sydney, PO Box M201, Missenden Road, Sydney, New South Wales, 2050 Australia. Address all correspondence to Ms Hall at: amandahall@george.org.au.

P.H. Ferreira, PhD, is Lecturer, Faculty of Health Sciences, The University of Sydney.

C.G. Maher, PT, PhD, is Director, Musculoskeletal Division, The George Institute for International Health and Professor, Faculty of Medicine, Sydney Medical School, The University of Sydney.

J. Latimer, PT, PhD, is Associate Professor, Faculty of Medicine, Sydney Medical School, The University of Sydney.

M.L. Ferreira, BPhty, MSc, PhD, is Postdoctoral Fellow, Faculty of Health Sciences, The University of Sydney.

Table 1.
Methodological Quality (Criteria Developed From Sanderson et al (25) and STROBE Guidelines (26)) (a)

Study	Representative Sample	Blinding Defined Sample	Alliance Rater
Schonberger et al (2006) (35)	[check]	X	[T.sub.1]
Schonberger and colleagues (2006) (33,34)	[check]	X	P/T
Sherer et al (20007) (36)	[check]	X	P/T
Ferreira et al (2009) (30)	X	[check]	P
Beattie et al (20005) (28)	[check]	?	P
Zaproudina et al (20007) (38)	X	[check]	P
Zaproudina et al (20009) (39)	X	[check]	P/T
Higdon (1997) (31)	X	[check]	P/T
Mirsky (20002) (32)	X	[check]	P
Burns and Evon (20007) (29)	[check]	[check]	P
Slujis et al (1993) (37)	[check]	X	P/O
Ambady et al (2002) (27)	X	[check]	O
Walker (1990) (40,b)	?	X	P/T

Study	Outcome Rater	Follow-up Rate >SS%	Methods of Assessment
Schonberger et al (2006) (35)	[T.sub.1]	[check]	[check]
Schonberger and colleagues (2006) (33,34)	T	?	[check]
Sherer et al (20007) (36)	P	[check]	[check]

Ferreira et al (2009) (30)	P	[check]	[check]
Beattie et al (20005) (28)	P	X	[check]
Zaproudina et al (20007) (38)	P	[check]	[check]
Zaproudina et al (20009) (39)	P	[check]	[check]
Higdon (1997) (31)	P/T	X	[check]
Mirsky (20002) (32)	P	X	[check]
Burns and Evon (20007) (29)	P/T	[check]	[check]
Slujis et al (1993) (37)	P	?	?
Ambady et al (2002) (27)	P	[check]	[check]
Walker (1990) (40,b)	P	X	X

Study	Outcome Data Reported	Statistical Adjustment
Schonberger et al (2006) (35)	[check]	?
Schonberger and colleagues (2006) (33,34)	[check]	[check]
Sherer et al (20007) (36)	[check]	[check]
Ferreira et al (2009) (30)	[check]	[check]
Beattie et al (20005) (28)	[check]	X
Zaproudina et al (20007) (38)	[check]	X
Zaproudina et al (20009) (39)	[check]	X
Higdon (1997) (31)	?	X
Mirsky (20002) (32)	?	X
Burns and Evon (20007) (29)	?	X
Slujis et al (1993) (37)	?	X
Ambady et al (2002) (27)	[check]	X
Walker (1990) (40,b)	X	X

Control for bias

* Representative sample: participants were selected as

consecutive or random cases

* Defined sample: description of participant source and inclusion and exclusion criteria

* Blinded outcome assessment: assessor was unaware of prognostic factors at the time of outcome assessment

* Follow-up >85% outcome data were available for at least 85% of participants at one follow-up point

Appropriate measurement of variables

* Methods of assessment: appropriate choice of outcome measures

* Outcome data reported: reporting of outcome data at follow-up

Control for confounding

Statistical adjustment: multivariable analysis conducted, with adjustment for potentially confounding factors

(a) P=patient, T=therapist, [T.sub.1] =therapist rated retrospectively, O=observer, [check]=yes, X=no, ?=unclear.

(b) Quality ratings are based on available abstract, as the full dissertation was unavailable.

Table 2.
Characteristics of Included Studies (Arranged by Patient Population) (a)

Study	Study Type	n
Brain injury		
Schonberger et al (2006) (35)	Cohort	98
Schonberger and colleagues (2006) (33,34)	Cohort	86
Sherer et al (2007) (36)	Cohort	69
Musculoskeletal pain		
Ferreira et al (2009) (30)	RCT	240
Beattie et al (2005) (28)	CS	1,449

Higdon (1997) (31)	Cohort	53
Zaproudina et al (2007) (38)	RCT	105
Zaproudina et al (2009) (39)	RCT	131
Mirsky (2002) (32)	Cohort	11
Other		
Burns and Evon (2007) (29)	Cohort	79
Sluijs et al (1993) (37)	Cohort	695
Ambady et al (2002) (27)	Cohort	48
Walker (1990) (40)	Cohort	96

Study	Intervention Description
Brain injury	
Schonberger et al (2006) (35)	14 weeks of multidisciplinary rehabilitation delivered by a physical therapist for patients with acquired brain injury
Schonberger and colleagues (2006) (33,34)	14 weeks of multidisciplinary rehabilitation delivered by a team of therapists (b) for patients with acquired brain injury
Sherer et al (2007) (36)	Multidisciplinary rehabilitation delivered by a team of therapists (b) for patients with acquired brain injury
Musculoskeletal pain	
Ferreira et al (2009) (30)	8 weeks of physical therapy for patients with chronic low back pain
Beattie et al (2005) (28)	Physical therapy for patients with musculoskeletal pain conditions
Higdon (1997) (31)	Physical rehabilitation delivered by an occupational therapist for patients with

	musculoskeletal pain conditions
Zaproudina et al (2007) (38)	5-10 sessions of physical therapy, traditional bone setting, (d) or massage therapy for patients with chronic neck pain
Zaproudina et al (2009) (39)	5-10 sessions of physical therapy or traditional bone setting for patients with chronic back pain
Mirsky (2002) (32)	4 weeks of multidisciplinary rehabilitation delivered by a team of therapists for patients with chronic low back pain
Other	
Burns and Evon (2007) (29)	12 weeks of outpatient cardiac rehabilitation delivered by a physical therapist for patients with cardiovascular disease
Sluijs et al (1993) (37)	Physical therapy for patients with multiple pathologies (e)
Ambady et al (2002) (27)	Physical therapy for geriatric patients with various physical conditions
Walker (1990) (40)	Multidisciplinary rehabilitation for patients with chronic pain

Study	Alliance	Session Rated
Brain injury		
Schonberger et al (2006) (35)	Prigatano Scales/WAI-SF	3-4
Schonberger and colleagues (2006) (33,34)	WAI-SF	3-4
Sherer et al (2007) (36)	CALPAS/Prigatano Scales	3-6
Musculoskeletal pain		
Ferreira et al	WAI-LF	3

(2009) (30)		
Beattie et al (2005) (28)	MedRisk internal factors	4-5
Higdon (1997) (31)	WAI-SF	N/S
Zaproudina et al (2007) (38)	5-item questionnaire	2-3
Zaproudina et al (2009) (39)	5-item questionnaire	2-3
Mirsky (2002) (32)	WAI-SF	Last
Other		
Burns and Evon (2007) (29)	WAI-SF	N/S
Sluijs et al (1993) (37)	Verbal behaviors	N/S
Ambady et al (2002) (27)	Nonverbal cues	First or last
Walker (1990) (40)	N/S	N/S

Study	Outcome	Client Rated
Brain injury		
Schonberger et al (2006) (35)	Adherence	
	Employment	
Schonberger and colleagues (2006) (33,34)	Therapeutic success	r=.63 *
	Depression	r=.60 *
Sherer et al (2007) (36)	Disability	r=.09 #
	Attendance	r=.47 #
	Productivity	r=-.06 #
	Depression	r=-.17 #
Musculoskeletal pain		
Ferreira et al (2009) (30)	Function	b=0.17 (95% CI=0.07-0.28) *
	Global assessment (c)	b=0.08 (95% CI = 0.03-0.13) *
Beattie et al	Treatment	r=.83 *

(2005) (28)	satisfaction	
Higdon (1997) (31)	Physical function	r=.09-.27 *
	Floor-bench lifts	[beta]=0.20 *
Zaproudina et al (2007) (38)	Global assessment	[r.sub.2]=.36-.47 *
Zaproudina et al (2009) (39)	Global assessment	[r.sub.2]=.30 *
	Pain	[r.sub.2]=.30 #
Mirsky (2002) (32)		
Other		
Burns and Evon (2007) (29)		
Sluijs et al (1993) (37)	Adherence (f)	
Ambady et al (2002) (27)	Activities of daily living	
Walker (1990) (40)		

Study	Therapist Rated	
Brain injury		
Schonberger et al (2006) (35)		[r.sub.1]=.76 *
		[r.sub.1]=.20 *
Schonberger and colleagues (2006) (33,34)		r=.49 *
Sherer et al (2007) (36)		r=.31 #
		r=.82 #
		r=.38 #
		r=-.46 #
Musculoskeletal pain		
Ferreira et al (2009) (30)		
Beattie et al (2005) (28)		
Higdon (1997) (31)		

Zaproudina et al (2007) (38)	
Zaproudina et al (2009) (39)	
Mirsky (2002) (32)	
Other	
Burns and Evon (2007) (29)	
Sluijs et al (1993) (37)	
Ambady et al (2002) (27)	
Walker (1990) (40)	

Study	Observer Rated
Brain injury	
Schonberger et al (2006) (35)	
Schonberger and colleagues (2006) (33,34)	
Sherer et al (2007) (36)	OR=1.07 (95% CI=1.0-1.15)
Musculoskeletal pain	
Ferreira et al (2009) (30)	
Beattie et al (2005) (28)	
Higdon (1997) (31)	
Zaproudina et al (2007) (38)	
Zaproudina et al (2009) (39)	
Mirsky (2002) (32)	
Other	
Burns and Evon	

(2007) (29)	
Sluijs et al (1993) (37)	Mean=2.51 (SD=0.5) (g) Mean=2.45 (SD=0.47) (h)
Ambady et al (2002) (27)	r=.60 *
Walker (1990) (40)	

(a) RCT=randomized controlled trial, CS=cross-sectional, WAI-SF=short-form Working Alliance Inventory containing 12 items from original 36 items, WAI-LF=long-form Working Alliance Inventory Instrument for containing 36 items, CALPAS=California Psychotherapy Alliance Scale, N/S=not stated or unclear, r, =Cramer correlation (description in Appendix 2), r2=Spearman rho, MedRisk=MedRisk the tools used to Measuring Patient Satisfaction With Physical Therapy Care, OR=odds ratio, 95% CI=950/% confidence interval. * P<.05. # Significance not reported. Note: more detailed descriptions of measure alliance and the correlations between alliance and outcome are reported in Appendix 2.

(b) Team of therapists includes physical therapist, occupational therapist, speech therapist, and neuropsychologist.

(c) Global assessment refers to the patients' self-report of their assessment of health status.

(d) Traditional bone setting was delivered by an experienced Finnish traditional bone setter.

(e) Multiple pathologies include systemic disease, trauma and postoperative conditions, nonradiating back pain, and neck and shoulder pain. itsup; (f) For analysis, the sample was divided into 2 groups based on adherence, and alliance scores were obtained in both groups.

(g) Mean alliance score for compliant group.

(h) Mean alliance score for noncompliant group.

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