Musculoskeletal Continuing Education Followed by Outcome Assessment in Nonoperative Clinical Practice: Looking for the Internal Evidence

Wayne Rath, PT, Dip MDT	Director of Treatment and Continuing Education Services, Duffy-Rath Physical Therapy, PC. (315) 243 3308 wayne@duffyrath.com
Jean Duffy Rath, PT, Dip MDT	President, CEO, Director of Prevention Services, Duffy-Rath Physical Therapy, PC.
Silas Halperin, PhD	Professor Emeritus, Syracuse University, Department of Psychology.

This research was performed as a component of the Duffy-Rath continuing education program for physical therapists, there was no grant or sponsorship.

Background and purpose: To investigate the utility of an outcome assessment requirement for certification of completion for a continuing education (CE) series for assessment and treatment of activity-related musculoskeletal disorders; is there evidence of effectiveness and efficiency in attendee's clinical practice.

Design: Multi-center, consecutive case series investigation required to complete a CE certification process involving the Duffy-Rath approach.

Setting: Private practice and hospital-based outpatient physical therapy for non-surgical, activity-related musculoskeletal disorders.

Participants: Seven licensed physical therapy clinicians provided outcome data for 166 patients with activity-related musculoskeletal disorders (MSD); 96 spine, 20 shoulder, 34 lower limb, 6 combination spine and limb that met selection criteria.

Intervention: An activity and patient self-efficacy focused assessment and treatment system consisting of six treatment strategies matched to the patient's signs, symptoms and ability/inability to rapidly improve and achieve functional (activity) goals.

Measurements: Outcomes were determined by change in pain (NRS: 0 -10) and disability (VAS: 0-100) rating at the first and last treatment sessions. Patients with improvement in pain and function scores were categorized as excellent (E), good (G), and fair (F) based on secondary criteria: 1) self-rating of improvement since the first visit (0-100%), 2) achievement of activity goals set at the initial evaluation, and 3) degree of control over the most relevant examination signs and symptoms established at the initial visit. Patients were given a poor (P) outcome when there was no improvement in pain and disability ratings. Outcomes were verified by a non-treating clinician following standardized guidelines.

Results: There was a significant overall reduction in pain (Ẋ 3.6: 95%CI 3.2-4.0;P<0.01) and disability (Ẋ 27.2: 95%CI:23.6-30.7;P<0.01). The majority of patients (N=158; 95.2 %) reported improvement during the course of treatment. The mean improvement in pain and disability was consistent with the outcome label, with the greatest improvement in the excellent and good groups, the least in the fair group and no improvement in the poor group. Clinical improvement was achieved with a modest number of mean visits (E-6.6, G-7.3, F-9.0) and weeks on program (E-4.1, G-4.4, F-5.0). Patients with a poor outcome (N=8) were identified efficiently having the smallest number of mean visits (4.9) and weeks (3.1).

Limitations: The study design prohibits any conclusions as to why the patients responded, the efficacy of the treatment methodology or change in outcomes as a direct result of attending the continuing education series. There were 7 subjects (4 %) given a treatment outcome (E=1, G=2, F=2, P=2) that were missing disability rating data, but pain ratings changed accordingly and secondary criteria were met when applicable. There were no patients with elbow, wrist or hand disorders included in the study. There is no follow-up data to indicate whether or not clinical improvements were sustained after discharge.

Discussion and conclusions: This study presents data demonstrating utility of an outcome assessment tool provided to CE participants to apply in their practice setting. The results identify evidence of effective and efficient clinical management of patients with activity-related musculoskeletal disorders; i.e. the internal evidence. There is good utilization of the physical therapy services as only a modest amount of treatment was required to achieve improvement, and those patients that failed to respond were identified quickly. A goal for the CE series is to help clinicians assess and optimize their effectiveness and efficiency when treating activity-related musculoskeletal disorders (MSD) in their clinical setting. The results indicate this was achieved for this group of therapists. Further investigation is warranted to determine if completing the Duffy-Rath continuing education series and certification is a relevant and reliable factor to achieving these improvements; this should include long-term follow-up after discharge.

1. Introduction:

Continuing education (CE) is a primary method of influencing the current knowledge and treatment methods of practicing clinicians, and has evolved into a mandatory requirement to maintain physical therapy license (Gardner 1981; Finley 1988; Tassone 1997; Landers 2005). These workshops and short-term courses often center about new evidence-based methods of diagnosis and treatment, and/or popular approaches developed by prominent clinicians (i.e., 'schools of thought'). One of the main intents of CE is to improve the delivery of Physical Therapy service to patients. There has been limited study of this in physical therapy with evidence both for and against an improvement in patient response to care after attending a CE program (Mays 1987; Brenan 2006; Cleland 2009). This needs further and ongoing investigation, and should include analysis of entire caseloads of patients to capture the larger view of the impact, effectiveness and efficiency of practices and performance of individual clinicians.

This paper presents the results of a consecutive case-series investigation that was a requirement for CE certification as a tool for 'internal evidence' and to encourage participants to objectively

inspect their practice. The CE program is the treatment component of the "Duffy-Rath System©" (DRS), developed by Wayne Rath, PT and Jean Duffy Rath, PT. Theirs is a systematic approach to both treatment and prevention of spine pain and cumulative trauma disorders and disability. The course series at the time of data collection consisted of 5 two-day workshops: 1) Clinical assessment of the spine and proximal limbs, 2) Treatment of lower back pain disorders and disability, 3) Treatment of neck and upper back pain disorders and disability, 4) Treatment of repetitive strain/cumulative trauma disorders of the limbs, and 5) Manual therapy and problem-solving techniques for the spine. Currently, the same subject matter is covered in a six-part series that includes a combination of distance learning and 5 one-day workshops.

Therapists who have attended all the workshops can test their knowledge and skills by going through a certification process. The course participants must first pass a 3-part written examination based up the "Assessment Center" model (Deusinger 1986). After successful completion they proceed to a practical component that is performed in their own clinical setting. This practical component includes patient chart review, manual therapy practical examinations (total of 109 techniques) and a consecutive case series investigation (i.e. the outcome assessment component). The process is designed to be a constructive learning experience that stimulates the therapist to look objectively at their clinical performance.

2. Methods:

Seven licensed Physical Therapists submitted outcome data collected from a consecutive series of patients treated in their clinical setting. The study population included patients referred to Physical Therapy for treatment of a musculoskeletal disorder (MSD). Excluded from the study were patients who did not have an activity-related MSD (e.g. CVA, systemic inflammatory disease etc.), those MSDs referred for post-operative treatment or patients with insufficient data to assign an outcome. The outcome assessment project was retroactively approved by the review boards of the two participating hospitals prior to submission for publication.

A DRS procedural manual and a standardized data collection format were provided to each therapist to guide and perform the outcome assessment process (Rath 1993; 1996; 1998). Data collected at the first visit was compared to that at the last visit to determine the response to treatment. Outcome measurement tools were the patient's numeric rating of pain (0 = no pain, 10 = worst pain possible) and perceived disability (0 = completely able, 100 = totally disabled) using the Duffy-Rath Questionnaire (Ventre 2005). The outcome label (i.e. excellent, good, fair or poor) was based on these ratings and the following secondary criteria (**see Table 1**): 1) the patient's rating of improvement during the course of treatment (0 = no improvement since the first visit and 100 = completely recovered, 2) change in relevant (those that reproduced the symptoms) examination signs (full control, partial control, no control), and 3) achievement of activity/function goals (full, partial, not achieved). The treating therapist assigned the outcome and then submitted this for verification by a non-treating therapist. This process had been used in an outcome prediction study presented at the International Society for the Study of the Lumbar Spine with good correlation to scores on all subscales of the Dallas Pain Questionnaire (Trief 1996).

Table 1: Outcome Criteria

The efficiency of the treatment was measured by the number of weeks and visits required to achieve the outcome. Patient satisfaction was measured and categorized (excellent, good, fair, poor) by scoring the patients ratings on a voluntary 5-question questionnaire (**Table 2**) offered at the last visit. The independent variables evaluated for association with outcome and efficiency of treatment are: 1) musculoskeletal region of the disorder, 2) treating therapist, 3) clinical setting (hospital vs. private practice), 4) case-type (payment method), 5) activity-level at initial evaluation (active, idle or restricted) and 8) the duration of the disorder (acute< 1 week, subacute 1-7 weeks, early chronic 8-25 weeks, late chronic ≥ 26 weeks).

Table 2: Satisfaction Survey and Outcome Criteria

The DRS classifies the patient into 4 groups according to the behavior of their signs and symptoms in response to a structured assessment process; 1) rapid responder, 2) slow (cumulative) responder, 3) adverse responder and 4) non-organic/non-mechanical responder. This leads the therapist to employ one of six treatment strategies to control the patients signs and symptoms and achieve the functional/activity goals of treatment; 1) posture-ergonomic, 2) reduction, 3) remodeling, 4) stabilization, 5) anti-inflammatory, and 6) functional treatment strategies (**Table 3**).

Table 3: DR Response Groups and Treatment Strategies

Once the consecutive case-series was completed (≥ 20 patients that met the inclusion criteria) the data was then forwarded to the administrative office for review and analysis. Research questions for this paper were divided into three groups; primary interest, confirmatory interest and exploratory interest. The primary interest was overall treatment effectiveness and efficiency compared to the body region of the disorder, and patient satisfaction outcomes. The confirmatory interest was the effect of the duration of the disorder, case-type and activity-level of the patient at the first visit. The exploratory interests were the effect of the individual clinician, response group and practice setting.

3. Results:

There were 274 consecutive patients seen by 7 physical therapists, of these 90 were not applicable for the study (S/P surgery, inflammatory disease and/or a medical condition) and 18 had insufficient information to determine outcome. This left a study population of 166 patients with 65 (39.2 %) achieving an excellent outcome, 54 (32.5 %) a good outcome, 39 (23.5 %) a fair outcome, and 8 (4.8 %) a poor outcome.

The mean pain rating decreased from 5.4 to 1.8 yielding a mean change of 3.6. The mean disability rating decreased from 46.5 to 19.4 yielding a mean change of 27.2. The degree of mean change was consistent with the category of outcome; i.e. the excellent group had the largest change and the fair group had the smallest positive change, and the poor group had a slight negative change (**see Table 4**). There were no final disability ratings for seven subjects reducing the sample size, but this had no substantial effect on the results. Pain ratings changed appropriately and secondary criteria for outcome category were met.

Table 4: Pain and Disability Ratings per Outcome Category

Clinical outcomes were generally similar when body regions were collapsed into spine, upper (shoulder) and lower limb. In those patients that improved with treatment, patients with multiple disorders had the largest percentage of fair outcomes (56.3%) followed by shoulder (25 %), spine (21.9%) and lower limb (11.8%). In those patients that did not improve the spine and multiple disorders had the greatest percentage (6.3%) followed by lower limb (2.9%) and there were no poor outcomes for the shoulder (**see Table 5).** The most significant change in pain and disability ratings occurred with treatment of neck, back, shoulder, hip and knee patients (**see Table 6**).

Table 5: Outcome categories per Body Region

Table 6: Pain and Disability Ratings per Body Region

The next question of primary interest was the efficiency of the treatment response. The mean number of visits was 6.6 (SE Mean 0.49; SD 3.97) and weeks 4.1 (SE Mean 0.35; SD 2.78). The mean visits were 6.6 (SD 4.0) for excellent, 7.3 (SD 5.0) for good, 9.0 (SD 5.0) for fair and 4.9 (SD 1.6) for poor outcomes. The mean weeks were 4.1 (SD 2.8) for excellent, 4.5 (SD 3.0) for good, 5.0 (SD 2.7) for fair and 3.1 (SD1.5) for poor outcomes. (**see Figure 1)**

Figure 1: Box plots and histograms of visits and weeks per outcome category

The satisfaction survey was completed by 134 patients (80.7 %) with 132 (98.5 %) rating their experience as good (50; 37.3 %) or excellent (82; 61.2 %) and 2 (1.5 %) with a fair rating. There were no patients that rated their experience as poor (i.e. dissatisfied). The patients with an unknown satisfaction outcome had a higher proportion of fair/poor treatment outcomes when compared to those with in the good/excellent satisfaction category (**see table 8**).

Table 7: Satisfaction outcomes per Treatment Outcome & Efficiency

The confirmatory interest of the study was to investigate the effect of case-type, initial activity-level and duration of the disorder on effectiveness and efficiency (**See table 8)**. There were a higher percentage of poor outcomes in the workers compensation (12.9 %) and motor vehicle accident (11.1%) case-types, but this was not statistically significant. However the relationship of activity-level to outcome was marginally significant (chi square 16.8, 9df, p=0.052). Acute and subacute disorders had the greatest number of excellent outcomes, but this was not statistically significant. The efficiency of treatment was fairly uniform across these variables with a tendency towards more mean visits and weeks, and greater variance with motor vehicle cases, restricted activity-level and late chronic disorders.

Table 8: Confirmatory Interests of the Study

The exploratory interests of the study were the effect of the individual practitioner, response group category and practice setting on the effectiveness and efficiency of treatment (**see Table 9**). Treatment outcome was affected by all three of these variables. One therapist had a poor response in 14.3 % (n=4) of their series, representing 50 % of the poor outcomes for the entire study population. The adverse (n=3; 20.0%) and non-organic/non-mechanical (n=1; 33.3%) groups had

half of the study's poor responses. The hospital setting had 80 % (n=7) of the poor outcomes. Efficiency was uniform with a tendency towards more visits and weeks with particular clinicians and the private practice (PP) setting with one PP therapist having the greatest average visits, but no poor outcomes.

Table 9: The Exploratory Interests of the Study

4. Discussion:

The results indicate utility of the outcome assessment tool. The outcome categories correlated well to the measured change in patient pain and disability rating. The excellent group essentially eliminated their pain and perceived disability, and the good group had a major improvement. The fair group met criteria for a minimally significant change with a 2 point change in pain and a 15 % change in disability (Ostelo 2008). The poor or non-responding group had a slight negative change in these ratings. Ninety-five percent of the patients improved with treatment. This meets a standard identified throughout the course series to target with clinical application of the system.

Efficiency of care was also demonstrated. This is an important concern in the DRS and was demonstrated in two ways; 1) those patients that responded did so in a reasonable number of visits and weeks on program (E-6.6 visits, 4.1 weeks; G-7.3 visits, 4.4 weeks; F-9.0 visits, 5.0 weeks), and 2) those that did not respond were seen for the least number of visits and weeks (P-4.9 visits, 3.1 weeks). This is an important result to demonstrate with any musculoskeletal healthcare service; i.e. that the greater the amount of service provided the greater the likelihood of improvement.

The strength of these findings might have benefited from use of a disability questionnaire with stronger validity. However, self-rated disability was only one component of the assessment and was not as strongly weighted in determining the outcome category as were the actual achievement of the patient's activity goals and their overall rating of recovery. The improvements in the NPS (0-10) scores were significant and are a recognized goal standard (von Korff 2000, Wainner 2003; Nordin 2008). The mean overall improvement was 3.6, the excellent group improved 4.6, the good group 4.2 and the fair group 2.0. According to Abbott (2014) 1.3 is a small change, whereas 2.7 is a large change – all were well beyond minimal requirements for important clinical change.

Our expectation for the confirmatory interests of the study was a negative correlation between case-type (WC and MVA), activity-level (idle and restricted) and duration (chronic) with effectiveness. Activity level had support for this hypothesis ($p = .052$) but duration and case-type did not have significance. The active patients had a good/excellent outcome in 82 % of the group verses only 52 % when idle or restricted. The importance of staying active in the management of activity-related spinal disorders has had unequivocal evidence support for over 20 years (Spitzer 1987; Abenhaim 2000; Nordin 2001; Haldeman 2008). The exploratory interests yielded no significant association between the practitioner, response group or practice setting with effectiveness or efficiency, with the strongest association found between visits and treatment setting (Cramer V-squared = 0.137).

The results of the study cannot be generalized due to its design and available data, thus we are uncertain as to what actually influenced the response of these patients or whether attending the workshops made a difference. However we can say that the system enabled the clinicians to further the standardization of their clinical approach and take a more objective look at their performance. We have always found this useful for self-assessment, utilization review and striving to improve the effectiveness and efficiency of treatment in the clinical practice setting. Outcome assessment with entire caseloads is a tool to identify strengths and weaknesses of individual practitioners, and to optimize clinical care.

The DRS workshops stress the importance of seeking, and remaining concurrent with emerging evidence. Guidelines for the design, implementation, reporting and analysis of clinical trials should be functionally understood by all practicing clinicians (Altman 2001; Sackett 2002; Malmivaara 2006; van Tulder 2007), but randomized controlled trials (RCT) are often not practical, too time consuming and expensive for a busy clinical practice. Additionally, just because a well-designed RCT demonstrates statistical significance and efficacy of an intervention does not mean that approach or procedure is appropriate and/or will be effective with the patient sitting before you (Scalzitti 2001). The factors affecting outcome are multiple and overlapping, and require experience and adaptability to successfully manage the largest segment of patients possible. Daily, objective assessment of patient response is critical to optimizing clinical practice results. It is often said that; "practice makes perfect", but that is only if you are practicing correctly – clinicians need an objective system to evaluate this with evidence-based targets.

In the workshops we refer to evidence published in peer reviewed journals, particularly RCT investigations as 'external evidence' (EE). This EE should guide and prioritize the selection of assessment and treatment procedures utilized in a clinician's daily practice, but each individual patient's response determines whether or not the evidence applies to them. EE must always be tempered by good clinical reasoning and practical skills (Jull 2009).

The research scientist and practicing clinician are and always will be interdependent (Rath 1998; Smith 2009) but with differing goals; the scientist to accumulate evidence for or against a theoretical proposition and the clinician to do whatever it takes to help each individual patient optimally. Daily clinical practice is the breeding ground for new ideas, methods and strategies for patient management and will always be a step or two ahead of the external evidence. Outcome assessment in clinical practice is a tool to identify and prioritize approaches and procedures that warrant scientific investigation. We refer to this putative evidence obtained by outcome assessment in one's clinical practice as the 'internal evidence' (IE) and this is measured one patient at a time. Patients are unlikely to be concerned about the rigorousness of the science that supports the treatment when they are satisfied with their results and experience. Patient satisfaction alone is now recognized as an extremely important measure of treatment outcome (Cherkin 2009).

5. Conclusion: This paper presents the results of requiring therapists to objectively assess the response of their patients to a systematic treatment approach they learned in a series of continuing education workshops; i.e. the Duffy-Rath System©. The design of the study does not allow specific conclusions as to the efficacy of the approach. However it does provide evidence that the outcome assessment tool has utility, and the therapists who participated provided highly effective and efficient care. This might be due solely to closer attention to patient management details dictated

by participation in the assessment process. Regardless of the reason for the outcomes, the results meet standards for excellent musculoskeletal care that were influenced by the CE process. The next step is to determine if the information and techniques obtained with the CE are associated with better clinical outcomes.

Conflict of interest statement

Wayne Rath, PT, Dip MDT and Jean Duffy Rath, PT, Dip MDT. are the sole owners of Duffy-Rath Physical Therapy, PC, Duffy-Rath Workshops and Seminars and the intellectual property rights associated with the Duffy-Rath System©, Tools to Fight Back® and the BackAbility® program.

Acknowledgements
Christian Appel, PT, Nancy Buerman, PT, Mark Brown, PT, Pat Heil, PT, Troy Marsh, PT, Kenna Sikvalend, PT, Farley Wagner, PT

References

Abbott JH. Minimum important differences for the patient-specific functional scale, 4 region-specific outcome measures, and the numeric pain rating scale. JOSPT. 2014; 44(8): 560-4.

Abenhaim L, Rossignol M, Valat JP, et al. The role of activity in the therapeutic management of back pain: report of the international Paris task force on back pain. Spine 2000; 25 (4S): 1S – 33S.

Altman DG, Schulz KF, Moher D, et al. The revised CONSORT statement for reporting randomized trials: explanation and elaboration. Ann Intern Med 2001; 134:663–94.

Brenan GP, Fritz JM, Hunter SJ. Impact of continuing education interventions on clinical outcomes of patients with neck pain who received physical therapy. Physical Therapy 2006; 86 (9): 1251-62.

Cherkin D, Kovacs FM, Coft P, et. al. The ninth international forum for primary care research on low back pain. Spine 2009; 34 (3): 304-7.

Cleland JA, Fritz JM, Brenan GP, Magel J. Does continuing education improve physical therapists' effectiveness in treatment neck pain?: a randomized clinical trial. Physical Therapy 2009; 89 (1): 38-47.

Deusinger SS, Sindelar B, Stritter FT. Assessment Center: A model for professional development and evaluation. Physical Therapy 1986; 66 (7): 1119 – 23.

Finley C. Mandatory continuing education – a survey of current activity: a special communication. Physical Therapy 1988; 68 (3): 374-77.

Gardner DL, Seymour RJ, Lacefield WE. Relicensure: mandatory continuing education or periodic reexamination? Physical Therapy 1981; 61 (7): 1029-34.

Haldeman S, Carroll L, Cassidy JD. The Empowerment of People With Neck Pain: Introduction: The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders Spine 2008; 33(4S): S8-S13.

Jull G, Moore A. Editorial: The primacy of clinical reasoning and clinical practical skills. Manual Therapy 2009; 14 (4): 353-4.

Landers MR, McWhorter JW, Krum LL, Glovinsky D. Mandatory continuing education in physical therapy: survey of physical therapists in states with and states without mandate. Physical Therapy 2005; 85 (9): 861-1262.

Malmivaara A, Koes BW, Bouter LM, van Tulder MW. Applicability and Clinical Relevance of Results in Randomized Controlled Trials The Cochrane Review on Exercise Therapy for Low Back Pain as an Example. Spine 2006; 31 (13): 1405–09.

Mays MJ. Assessing the change of practice by physical therapists after a continuing education program. Physical Therapy 1987; 64 (1): 50-54.

Nordin M 2000 International society of the study of the lumbar spine presidential address: backs to work: some reflections. Spine 2001; 26 (8): 851-856.

Nordin M, Carragee EJ, Hogg-Johnson Sheilah, et. al. Assessment of Neck Pain and Its Associated Disorders: Results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders Spine 2008; 33(4S): S101-22.

Ostelo RWJG, Deyo RA, Stratford P, Waddell G, Croft P, Von Korff M, Bouter LM, de Vet HC. Interpreting Change Scores for Pain and Functional Status in Low Back Pain: Towards International Consensus Regarding Minimal Important Change Spine: 2008; 33(1): 90-94.

Rath W. Clinical practice: it is both art and science. The McKenzie Journal 1998; 6(1): 5.

Rath W, Rath JD. Outcome assessment in clinical Practice. Presented at the NJ-APTA Annual Conference, Cherry Hill, March 22-24, 1996.

Rath W, Rath JD. Outcome assessment in clinical practice. The McKenzie Journal 1998; 6(2): 17-20.

Sackett DL, Haynes RB. Evidence base of clinical diagnosis: the architecture of diagnostic research. BMJ 2002; 324 (7336): 539-41.

Scalzitti DA. Evidence-based guidelines: application to clinical practice. Physical Therapy 2001; 81 (10): 1622-28.

Smith DR, Rivett DA. Bibliometrics, impact factors and manual therapy: balancing the science and the art. Manual Therapy 2009; 14 (4): 456-59.

Spitzer WO, LeBlanc FE, Dupuis M, et al: Scientific Approach to the Assessment and Management of Activity-related Spinal Disorders. Spine 1987; 12 (7S): S5-59.

Tassone MR, Speechley M. Geographical challenges for physical therapy continuing education: preferences and influences. Physical Theray 1997; 77 (3): 285-95.

Trief PM, Donelson R, Grant Wm, Rath W. Predicting outcome using functional status measures. Paper presented at the Annual meeting of the International Society for the Study of the Lumbar Spine, Burlington, VT, 1996.

van Tulder M, Malmivvaara A, Hayden J, Koes B. Statistical significance versus clinical importance. Spine 2007; 32 (16): 1785-90.

Ventre J, Schenk RJ Validity of the Duffy-Rath Questionnaire Orthopaedic Practice 2005; 17 (1): 22 – 26.

von Korff M, Jensen MP, Karoly P. Assessing global pain severity by self-report in clinical and health services research. Spine 2000; 25 (24):3140–51.

Wainner RS, Fritz JM, Irrgang JJ, Boninger ML, Delitto A, Allison S. Reliability and Diagnostic Accuracy of the Clinical Examination and Patient Self-Report Measures for Cervical Radiculopathy Spine 2003; 28(1): 52-62.

Weinstein J Where is the wisdom in healthcare? The "Wizard of Oz": heart, brain, and courage. Spine 2010; 35 (1):1-3.

Tables:

Table 1: These are the criteria used to assign the treatment outcome category. There are 4 categories of response to treatment (excellent, good, fair or poor) and two categories for which no response is identified (unknown or not applicable). Each participant was given an outcome assessment procedural manual to follow and data collection tables to complete.

Excellent (E)	The patient has achieved full control over RSSx*, is fully active (i.e., if they were idle, they have returned to work, and function goals have been achieved), rates 90 % recovery or greater, all VAS ratings of pain and disability are less than 2.
Good (G)	The patient has achieved full control over RSSx*, is fully active (i.e., if they were idle, they have returned to work, but this may be to restricted duty, and function goals have been achieved), rates 70 % recovery or greater, all VAS ratings of pain and disability are less than 5 (unless the response group was non-organic. In this case the VAS ratings had to improve, but do not need to be all less than 5).
Fair (F)	There has been measured improvement in some or all of the criteria, but not enough to be placed into the good category.
Poor (P)	The patient demonstrated no improvement in any subjective, objective or functional measurements.
Unknown (U)	The patient dropped-out so the outcome to treatment is not known and/or there is not enough data to identify a category.
Not Applicable (NA)	The intent of physical therapy was not to treat (consultation only, evaluation only, FCE, hospital discharge protocol etc.).

* RSSx = relevant signs and symptoms identified at the initial evaluation session.

Table 2: Patients completed a 5-question satisfaction survey utilizing a 5-point rating scale with following outcome criteria: 1-strongly disagrees, 2-disagree, 3-no opinion, 4-agree, 5-strongly agree. The questionnaire was voluntary and offered at the final visit.

Criteria for Satisfaction Outcome	**5 Questions Used in Satisfaction Survey** (1 = strongly disagree, 5 = strongly agree)
Excellent – all questions are answered with the highest possible rating of satisfaction (all are 5).	**1.** The therapist understood my goals for physical therapy and worked with me to achieve these goals.
Good – all questions answers are answered with a positive response, but not all are the highest possible rating (all are 4 – 5, but not all 5).	**2.** The therapist spent enough time with me and explained my treatment to me fully and in terms that I could understand.
Fair – there is a mixture of positive and negative responses.	**3.** The treatment I received was effective in meeting my goals.
Poor – all responses are negative (all 1 – 2).	**4.** I am very satisfied with the care I received here in physical therapy.
Unknown – the survey was not completed, or the patient indicates no opinion for the questions.	**5.** I would recommend this treatment to others with the same or similar problems.

Table 3: In the DRS there are 6 treatment strategies based upon the response group category assigned after a structured assessment process. The response group is assigned based upon the ability to control the patient's most relevant symptoms, signs and activity-related difficulties.

Response Group Classification	**Treatment Strategy**
Adverse Responder	Anti-inflammatory
Rapid Responder	Posture-ergonomic or reduction *
Slow (Cumulative) Responder	Remodeling or Stabilization **
Non-organic/Non-mechanical Responder	Function

* P-ergo strategy there are no relevant signs; reduction strategy there is a relevant loss of joint motion that can be quickly eliminated and controlled.
** Stabilization strategy only for those patients with a clinically relevant structural or functional instability.

Table 4: The change in numeric pain ratings (0 – 10) and self-rated disability (0-100) per outcome category are presented. The degree of improvement in pain and disability corresponded well to the outcome category assigned.

Outcome	**Initial Pain Rating**				**Final Pain Rating**			
Category	*Mean*	*SE Mean*	*St Dev*	*Median*	*Mean*	*SE Mean*	*St Dev*	*Median*
Excellent	4.969	0.292	2.352	5.000	0.331	0.0713	0.5747	0.000
Good	5.880	0.315	2.313	5.000	1.657	0.179	1.313	2.000
Fair	5.692	0.373	2.330	5.000	3.667	0.326	2.034	3.500
Poor	4.750	0.796	2.252	4.500	6.000	0.964	2.726	6.500
	Change in Pain Rating							
	Mean	*SE Mean*	*StDev*	*Median*	*95 % CI*	*DF*	*T-test*	
Excellent	4.638	0.288	2.321	4.000	4.1 – 5.2	64	16.1	
Good	4.222	0.326	2.396	4.000	3.6 – 4.9	53	13.0	
Fair	2.026	0.298	1.860	2.000	1.4 – 2.6	38	6.8	
Poor	- 1.250	0.491	1.389	-1.000	-2.4 – 0.1	7	- 2.5	
	Initial Disability Rating				**Final Disability Rating**			
	Mean	*SE Mean*	*St Dev*	*Median*	*Mean*	*SE Mean*	*St Dev*	*Median*
Excellent	40.03	3.07	24.59	38.50	5.80	0.943	7.544	1.650

Good	46.89	3.16	22.99	50.00	15.63	1.67	12.05	15.0
Fair	56.39	4.30	26.50	59.50	41.81	4.23	25.72	37.00
Poor	55.71	9.74	25.77	51.0	58.20	11.0	27.1	54.5
	Change in Disability Rating							
	Mean	*SE Mean*	*StDev*	*Median*	*95 % CI*	*DF*	*T-test*	
Excellent	34.23	2.88	23.05	30.00	28.5 – 40.0	63	11.9	
Good	30.59	2.69	19.41	30.00	25.2 – 36.0	51	11.4	
Fair	14.81	3.13	19.06	10.00	8.5 – 21.2	37	4.7	
Poor	- 1.67	0.919	2.251	-0.500	- 4.0 – 0.6	6	- 1.8	

Table 5: The count and percentage of outcome category per body region is presented.

Outcome	**Spine**				**U-Limb**	**Lower Limb**					**Comb.**
Category	LB	MB	Nk	Total	Shoulder	Hip	Knee	Ft/Ank	Leg	Total	
Excellent	27 (40.9%)	1 (33.3%)	10 (37.0%)	38 (39.6%)	11 (55.0%)	3 (37.5%)	5 (33.3%)	3 (50.0%)	1 (20.0%)	12 (35.3%)	4 (25.0%)
Good	22 (33.3%)	0 (0.0%)	9 (33.3%)	31 (32.3%)	4 (20.0%)	4 (50.0%)	8 (53.3%)	2 (33.3%)	3 (60.0%)	17 (50.0%)	2 (12.5%)
Fair	12 (18.2%)	2 (66.7%)	7 (25.9%)	21 (21.9%)	5 (25.0%)	1 (12.5%)	1 (6.7%)	1 (16.7%)	1 (20.0%)	4 (11.8%)	9 (56.3%)
Poor	5 (3.6%)	0 (0.0%)	1 (3.7%)	6 (6.3%)	0 (0.0%)	0 (0.0%)	1 (6.7%)	0 (0.0%)	0 (0.0%)	1 (2.9%)	1 (6.3%)
Totals:	66	3	27	96	20	8	15	6	5	34	16

Table 6: Change in pain and disability ratings per body region identify that the most significant changes occurred with low back, neck, shoulder, hip and knee patients. .

Mean Change in Pain Ratings					**Mean Change in Disability Ratings**				
	# (N=166)	Mean	SE Mean	t – test		# (N=159)	Mean	SE Mean	t – test
Neck	27	3.63	0.56	6.47*	Neck	27	22.93	4.49	5.10*
Low Back	66	3.93	0.36	11.04*	Low Back	63	31.17	2.84	10.98*
Mid Back	3	2.17	1.17	1.85	Mid Back	3	1.33	6.98	1.29
Low Back + Neck	6	2.50	1.06	2.36	Low Back + Neck	6	13.83	6.21	2.23
Neck + Shoulder	4	4.25	1.65	2.58	Neck + Shoulder	4	23.3	14.8	1.57
Spine + Leg	5	1.60	0.51	3.14	Spine + Leg	5	10.20	7.90	1.29
Shoulder	20	3.85	0.53	7.21*	Shoulder	19	27.89	4.01	6.96*
Hip	8	3.25	0.56	5.81*	Hip	8	33.75	8.82	3.83*
Knee	15	2.83	0.59	4.78*	Knee	14	32.25	6.11	5.28*
Foot/ankle	6	4.42	0.82	5.38*	Foot/ankle	5	31.4	13.1	2.40
Upper + Lower Limb	1	9.5	*	*	Upper + Lower Limb	0	-	-	-
Multi-leg	5	2.6	0.678	3.83	Multi-leg	5	19.4	9.96	1.95
* $P < 0.01$									

Table 7: Satisfaction outcomes were universally good for those patients that completed the survey (n=134; 80.7%). Those with an unknown satisfaction outcome represented 75 % of the patients with a poor treatment outcome.

Satisfaction	**Treatment Outcome**				**Number of Visits**				**Number of Weeks**			
Outcome	E (65)	G (54)	F (39)	P (8)	1-3	4-6	7-10	≥ 11	1-2	3-6	7-12	≥ 13
Excellent (82)	47	25	10	0	17	34	20	11	23	44	13	2
Good (50)	10	24	15	1	8	11	13	18	10	28	11	1
Fair (2)	0	0	1	1	0	0	1	1	0	1	1	0
Poor (0)	0	0	0	0	0	0	0	0	0	0	0	0
Unknown (32)	8	5	13	6	2	18	9	3	7	22	3	0

Table 8: The effectiveness and efficiency of treatment was evaluated by case-type (payment method), and the activity-level and the duration of the musculoskeletal disorder at the initial visit (i.e. confirmatory interests of the study).

	Excellent	Good	Fair	Poor	Mean Visits	Standard Deviation	Mean Weeks	Standard Deviation
Case-type:								
Medicare (44)	15 (34.1%)	20 (45.5%)	8 (18.2%)	1 (2.3%)	8.7	4.6	4.7	3.0
Private (82)	37(45.1%)	26 (31.7%)	17 (20.7%)	2 (2.4%)	5.8	3.1	4.0	2.7
Workers Comp (31)	11 (35.5%)	6 (19.4%)	10 (32.3%)	4 (12.9%)	8.3	4.9	4.6	2.8
Motor Vehicle Accident (9)	2 (22.2%)	2 (22.2%)	4 (44.4%)	1 (11.1%)	11.6	6.5	5.3	3.0
Total (166):	65	54	39	8	-	-	-	-
Activity-level:								
Active (56)	25 (44.6%)	21 (37.5%)	8 (14.3%)	2 (3.6%)	5.9	3.1	4.1	2.8
Idle (31)	11 (35.5%)	5 (16.1%)	12 (38.7%)	3 (9.7%)	7.6	4.5	4.6	2.4
Restricted (21)	5 (23.8%)	6 (28.6%)	8 (38.1%)	2 (9.5%)	9.3	5.7	4.8	3.4
Unknown (58)	24 (41.4%)	22 (37.9%)	11 (19.0%)	1 (1.7%)	7.9	4.7	4.4	2.7
Total (108):	65	54	39	8	-	-	-	-
Duration:								
Acute (< 7 days) (17)	9 (52.9%)	5 (29.4%)	3 (17.7%)	0	6.6	3.6	3.7	2.6
Subacute (1-7 wks) (69)	31(44.9%)	24 (34.8%)	10 (14.5%)	4 (5.8%)	6.8	4.4	3.8	2.2
Early Chronic (>7 < 26 wks) (42)	14 (33.3%)	14 (33.3%)	12 (28.6%)	2 (4.8%)	7.3	3.9	4.5	2.5
Late Chronic (≥ 26 wks) (38)	11 (29.0%)	11 (29.0%)	14 (36.8%)	2 (5.3%)	8.6	5.2	5.4	3.8
Total:	65	54	39	8	-	-	-	-

Table 9: The effectiveness and efficiency of treatment was evaluated by individual therapist, the response group conclusion and the practice setting (i.e. the exploratory interests of the study).

	Excellent (65)	Good (54)	Fair (39)	Poor (8)	Mean Visits	Standard Deviation	Mean Weeks	Standard Deviation
Practitioner:								
PT-01	12 (48.0)	10 (40.0)	3 (12.0)	0	5.2	2.6	4.2	3.3
PT-02	11(39.3)	9 (32.1)	4 (14.3)	4 (14.3)	6.7	3.0	4.1	2.4
PT-03	11 (45.8)	10 (41.7)	3 (12.5)	0	7.4	4.0	3.8	1.9
PT-04	9 (39.1)	6 (26.1)	7 (30.4)	1 (4.4)	7.6	3.8	4.2	2.4
PT-05	7 (30.4)	8 (34.8)	6 (26.1)	2 (8.7)	6.3	3.1	3.7	1.9
PT-06	7 (26.9)	5 (19.2)	14 (53.9)	0	11.0	6.5	6.3	3.7
PT-07	8 (47.1)	6 (35.3)	2 (53.9)	1 (5.9)	6.9	4.8	4.2	2.9
Response Group:								
Adverse	3 (20.0)	3 (20.0)	6 (40.0)	3 (20.0)	8.1	4.2	4.3	2.5
Rapid	43 (63.2)	15 (22.1)	10 (14.7)	0	6.1	3.7	3.7	2.0
Static	19 (23.8)	35 (43.8)	22 (27.5)	4 (5.0)	8.3	4.8	4.9	3.3
Non-mechanical	0	1 (33.3)	1 (33.3)	1 (33.3)	7.3	4.9	5.0	1.7
Practice Setting:								
Hospital	50 (40.7)	43 (35.0)	23 (18.7)	7 (5.7)	6.6	3.4	4.0	2.4
Private-practice	15 (34.9)	11 (25.6)	16 (37.2)	1 (2.3)	9.4	6.2	5.5	3.5