



<b>National Imaging Associates, Inc.</b>	
<b>Clinical guidelines</b> <b>MEASUREABLE PROGRESSIVE</b> <b>IMPROVEMENT</b>	<b>Original Date:</b> November 2, 2015 <b>Page 1 of 13</b>
<b>Physical Medicine – Clinical Decision Making</b>	<b>Last Review Date:</b> June 2017
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### **Policy Statement**

Outcome measures and/or pre-determined treatment goals that are specific, measurable, and/or functional must be used with each patient. These goals and outcome measures must be clearly defined in the patient record to ascertain the amount or degree of change over time. The documentation must also provide evidence of lasting, sustainable, progress with treatment.

Initial Clinical Reviewers (ICRs) and Physician Clinical Reviewers (PCRs) must be able to apply criteria based on individual needs and based on an assessment of the local delivery system.

### **Purpose**

This policy will be used to provide minimal clinical thresholds using specific-measurable, and functional treatment goals and/or outcome measures in the determination of improved, lasting, and sustained outcomes. These thresholds will assist in medical necessity reviews of billed clinical services by network practitioners.

### **Scope**

Physical medicine practitioners, including chiropractors, physical therapists, occupational therapists, and speech language pathologists.

### **Definition**

#### **Treatment Goals**

Determined with the patient and clinician at the initial encounter for each episode of care. Unique for each patient's clinical presentation based on the evaluation/examination findings, outcome assessment tool results, and personal preferences.

#### **Episode of Care**

Consultation or treatment preceded and followed by at least 3 months without treatment for the same complaint

#### **Specific, Measurable, and Functional Goals**

Clearly defined goals of treatment that allow measurement of the amount and/or degree of meaningful change over time. These goals are often determined by the use of functional outcome assessment tools, as defined in Clinical Guideline, Plan of Care.

### **Outcome Measures**

Objective, measurable, assessments by the clinician to determine patient progress with treatment. The use of standardized tests and measures at the onset of care establishes the baseline status of the patient, providing a means to quantify change in the patient's functioning. Outcome measures, along with other standardized tests and measures used throughout the episode of care, as part of periodic reexamination, provide information about whether predicted outcomes are being realized. Outcomes measurement refers to the systematic collection and analysis of information that is used to evaluate the efficacy of an intervention. Systematic collection means that data are gathered at multiple time points using the same methods or instruments. Analysis refers to the process of condensing and examining the data to identify meaningful trends or changes. The World Health Organization defines an outcome measure as a “change in the health of an individual, group of people, or population that is attributable to an intervention or series of interventions.”

### **Lasting, Sustainable Progress**

Documentation must provide evidence to support that progress made by the patient has been maintained at a reasonable level over a reasonable period of time.

### **Minimally Clinically Important Change (MCIC)**

The smallest change in the outcome assessment score that the patient perceives as beneficial, i.e. clinically meaningful improvement.

### **Minimal Detectable Change-MDC**

The minimal detectable change is the smallest change in score than can be detected beyond random error and is dependent upon sample distribution.

### **Minimal Clinically Important Difference-MCID**

MCID is the smallest change in an outcome that a patient would identify as important.

### **Maximum Therapeutic Benefit-MTB**

Maximum Therapeutic Benefit (MTB) is determined following a sufficient course of care, where demonstrable improvement would be expected in a patient's health status and one or more of the following are present:

- The patient has returned to pre-clinical/pre-onset health status
- Meaningful improvement has occurred; however, there is no basis for further meaningful improvement
- Meaningful improvement has occurred and there is no basis for further in-office treatment
- The patient no longer demonstrates meaningful clinical improvement, as measured by standardized outcome assessment tools
- Meaningful improvement, as measured by standardized outcome assessment tools, has not been achieved
- There is insufficient information documented in the submitted patient record to reliably validate the response to treatment

It is the responsibility of the treating practitioner to maintain a patient record that includes periodic measures of treatment response by employing valid, reliable, and relevant outcome assessment tools. Further, it is the responsibility of the treating practitioner to include

sufficient clinical documentation, so that a peer reviewer can render a reasonable determination on baseline functional status and/or treatment response. Further, meaningful improvement can occur only when there is a potential for MCIC. When progress towards goals is such that outcome measures approximate normative data for asymptomatic populations or are indicative of mild deficits, which can typically be managed through home exercise or other self-care, then a determination of MTB is appropriate. Most individuals can expect to notice measurable improvement in pain and/or disability within 2 to 6 weeks after beginning treatment. If improvement has not occurred with 6 weeks of treatment, it is highly unlikely that continuing treatment will be helpful. When initial improvement did occur, many studies showed no additional lasting improvement beyond 6 to 12 weeks of treatment. Most flare-ups resolve quickly – within a few days to 3 weeks. The timelines for improvement may not be applicable to some types of post-surgical care. (Axen, 2005; Leboeuf, 2005; Kohlbeck, 2005; Hurwitz, 2006; Newell, 2007; Bove, 1998; Moraska, 2007; Borman, 2008; Thiel, 2008).

**Patient Acceptable Symptom State (PASS):**

Defined as the point at which the patient considers themselves well, recovered, and satisfied with treatment.

**Acceptable Thresholds of Measurable Improvement:**

Meaningful clinical change (Minimal Clinically Important Change-MCIC; Minimal Clinically Important Differences-MCID; Minimal Detectable Change-MDC) has been calculated for most common standardized outcome assessment tools. The application of valid and reliable outcome assessment tools in the management of neuromusculoskeletal disorders is generally considered as “best practice”.

In order to make a valid and reliable determination of meaningful progress toward goals (MCIC) and/or Maximum Therapeutic Benefit (MTB), it is essential that the record include a relevant standardized outcome assessment tool. Progress towards goals should be assessed at predetermined time periods, supported by anticipated meaningful clinical change based on treatment plan goals. Typically, recovery patterns for neuromusculoskeletal conditions involving the low back, neck, and headache disorders show that >50% of the overall improvement with care occurs within 4-6 weeks. When patients are categorized via predictive modeling, the percentage of those showing significant improvement within 6 weeks rises considerably. Studies have consistently shown that short term treatment response is predictive of long term outcomes. McGorry showed that exacerbations of LBP resolved within a few days (52%); within a week (16%); within two-three weeks (26%); even severe flare-ups usually resolved within nine days (McGorry, 2000). After a review of the scientific evidence, this organization has concluded all practitioner records must evaluate and document whether treatment is resulting in progressive and sustained improvement.

The practitioner records must demonstrate clear, specific and measurable improvement in the patient’s pain and function every two weeks, or at regular intervals as appropriate for the documented condition, as measured by one or more of the following examples of methods for each anatomic region. If no functional tool is available for the patient’s condition it is expected the practitioner will develop specific, measurable, and functional goals:

- 6-Minute Walk test (6MWT) for Older Adults
  - MDC (calculated from standard error of measurement (SEM)) = 58.21 m (190.98 ft) (Perera, 2006)
  - SEM Older people with limited mobility: 21 m (Perera, 2006)
  - Older people with stroke: 22 m (Perera, 2006)
- Activities of Daily Living Scale of the Knee Outcome Survey
  - 10-30% reduction in the global score
  - MDIC = 7.1% (Piva, 2009)
- Berg Balance Scale
  - MDC=6.5 points (Romero, 2011)
- Bournemouth – Back Questionnaire
- A change of 26 points in acute conditions and 18 points in subacute/chronic conditions. (Newell, 2010). It is recommended that the Bournemouth be used at baseline and for every 2-4 weeks or 6-12 visits thereafter within the treatment program to measure progress.
- Bournemouth – Neck Questionnaire
- A change of 13 points or 36% is considered clinically significant improvement. (Bolton, 2004). It is recommended that the Bournemouth be used at baseline and for every 2-4 weeks or 6-12 visits thereafter within the treatment program to measure progress.
- Dizziness Handicap Inventory
  - MDC = 17.18 points (Yorke, 2013)
- Dynamic Gait Index
  - MDC=2.9 points (Romero, 2011)
- Functional Gait Assessment
  - MCID=4 points
- Functional Rating Index
  - A 10% absolute change represents minimal clinically important change (Feise, 2010)
  - MCIC = 8.4%
  - It is recommended that for acute and subacute conditions the FRI be used at baseline and every 1 week or 3 visits thereafter. It is recommended that for chronic conditions the FRI be used at baseline and every 2 weeks or 6 visits thereafter. If the score does not improve by at least 10% (absolute change) in any two successive two-week periods, you should pursue a change in management.
- FOTO or Functional Status (FS) measure:
  - The MCII (Minimally Clinically Important Improvement) and MDC (Minimal Detectable Change) are stated on the assessment report. For significant, minimal improvement, the patient status should increase by the MDC value. FOTO summary report is available upon request.
- Gait Speed for Older Adults
  - Small meaningful change=.5m/sec (Perera, 2006)
  - Substantial meaningful change=.10m/sec (Perera, 2006)
  - Meaningful change for those with stroke undergoing rehab=.175 m/sec
- Headache Disability Inventory (HDI)
  - Authors of the index have determined that a decrease of 29 points or more is considered clinical significant (Jacobson, 1994).

- Keele STarT Back Screening Tool
  - No MDC or MCID established.
  - Low, Medium and High risk categories established for subscales and overall score
- LEFS
  - Minimal Detectable Change is 9 points.
  - Minimal Clinically Important Difference is 9 points. (Brinkley, 1999). It is recommended that the LEFS be used at baseline and for every 2-4 weeks or 6-12 visits thereafter within the treatment program to measure progress.
- Neck Disability Index
  - MDC=10 points. (Young, 2009). It is recommended that the Neck Disability Index be used at baseline and for every 2 weeks thereafter within the treatment program to measure progress. A score of 0%-20% represents a minimal disability. Usually no treatment is indicated, apart from advice on posture, physical fitness, and diet. Patients often do not score the Neck Disability items as zero, once they are in treatment. The practitioner should avoid the trap of "treating till zero", as this is not supportable based on current evidence.
- Numeric Pain Rating Scale
  - MCID=2 points. (Childs, 2005)
- Oswestry Disability Index
  - The Minimal Important Change is 10 points or a 30% improvement. (Smeets 2011). It is recommended that the Oswestry Disability Index be used at baseline and for every 2 weeks thereafter within the treatment program to measure progress. A score of 0%-20% represents a minimal disability. Usually no treatment is indicated, apart from advice on lifting, sitting posture, physical fitness, and diet. Patients often do not score the Oswestry items as zero, once they are in treatment. The practitioner should avoid the trap of "treating till zero", as this is not supportable based on current evidence.
- Pain Disability Index
  - A decrease of 8.5-9.5 points is considered clinically important
- Patient Specific Functional Scale
  - Minimum detectable change (90%CI) for average score = 2 points
  - Minimum detectable change (90%CI) for single activity score = 3 points (Stratford, 1995). It is recommended that the PSFS be used at baseline and for every 2-4 weeks or 6-12 visits thereafter within the treatment program to measure progress.
- Roland-Morris Disability Questionnaire
  - Minimal Detectable Change=7.6 points (Froud 2010) or a 30% improvement from baseline (Smeets, 2011). It is recommended that the RMDQ be used at baseline and for every 2-4 weeks or 6-12 visits thereafter within the treatment program to measure progress.
- Shoulder Pain and Disability Index
  - The smallest detectable change is 19.7 points and the minimal important change is 20 points (Thoomes-de Graff, 2017). It is recommended that the SPADI be used at baseline and for every 2-4 weeks or 6-12 visits thereafter within the treatment program to measure progress.

- Timed Up and Go (TUG)
- Cut-off score of 13.5 sec or longer is predictive of falls; however, the Timed Up and Go test has limited ability to predict falls in community dwelling elderly and should not be used in isolation to identify individuals at high risk of falls in this setting. (Barry, 2014).
- Tinetti (POMA)
  - MDC= 5 Points (Faber, 2006).
- VAS scores
  - Minimum of a 2 point change on a 0-10 pain scale

The records must compare baseline measures to updated measures and document progress toward measurable goals as defined in Clinical Guideline, Plan of Care.

**NOTE: Questionable Outcome tool: Global Rating of Change (GRoC)**

Further work is needed to determine the true value of the GRoC as an outcome measure and in turn as an anchor measure. Several key points have been identified:

1. There is fluctuant temporal stability of the GRoC from week to week.
2. There is poor correlation between the GRoC and functional measures.
3. The GRoC is only correlated to functional measures up to 3 weeks.

## REFERENCES

- Angst F, Goldhahn J, Drerup S, et al. Responsiveness of six outcome assessment instruments in total shoulder arthroplasty. *Arthritis Rheum.* 2008; 59:391-398.
- Axen I, Jones JJ, Rosenbaum A, et al. The nordic back pain subpopulation program: Validation and improvement of a predictive model for treatment outcome in patients with low back pain receiving chiropractic treatment. *J Manip Physiol Ther.* July/Aug 2005a; 28(6):381-385.
- Axen I, Rosenbaum A, Robech R, et al. The nordic back pain subpopulation program: Can patient reactions to the first chiropractic treatment predict early favorable treatment outcome in non-persistent low back pain? *J Manip Physiol Ther.* Mar/Apr 2005b; 28(3):153-158.
- Axen I, Rosenbaum A, Robech R, et al. The nordic back pain subpopulation program: Can patient reactions to the first chiropractic treatment predict early favorable treatment outcome in persistent low back pain? *J Man Physiol Ther.* September 2002; 25(7):450-454.
- Barry E, Galvin R, Keogh C, et al. Is the Timed Up and Go test a useful predictor of risk of falls in community dwelling older adults: a systematic review and meta-analysis. *BMC Geriatr.* 2014; 14:14.
- Beaton DE, Richards RR. Assessing the reliability and responsiveness of 5 shoulder questionnaires. *J Shoulder Elbow Surg.* 1998, 7:565-572.
- Beninato M, Fehandez A, Plummer LS. Minimal clinically important difference of the functional gait assessment in older adults. *J Geriatr Phys Ther.* 2014; 11:1594-1603.
- Binkley JM, Stratford PW, Lott SA, et al. The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. *Phys Ther.* April 1999; 79(4):371-383.
- Bolton JE. Sensitivity and specificity of outcome measures in patients with neck pain: detecting clinically significant improvement. *Spine.* November 1, 2004; 29(21):2410-2417.
- Bombardier C, Hayden J, Beaton DE. Minimal clinically important difference. Low back pain: outcome measures. *J Rheumatol.* 2001; 28:431-438.
- Borman P, et al. The efficacy of intermittent cervical traction in patients with chronic pain. *Clin Rheumatol.* 2008; 27:1249-1253.
- Bove G, Niels Nilsson. Spinal manipulation in the treatment of episodic tension-type headache. *JAMA.* 1998; 280(18):1576-1579.
- Brennan GP, et al. Identifying subgroups of patients with acute/subacute “nonspecific” low back pain. *Spine.* 2006; 31(6):623-631.

- Bronfort G, et al. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. *Spine*. 2001; 26(7):788-799.
- Cai C, Pua YH, Lim KC. A clinical prediction rule for classifying patients with low back pain who demonstrate short-term improvement with mechanical lumbar traction. *Eur Spine J*. 2009; 18(4):554-561. doi: 10.1007/s00586-009-0909-9.
- Childs JD, Fritz JM, Flynn TW, et al. A clinical prediction rule to identify patients with low back pain most likely to benefit from spinal manipulation: a validation study. *Ann of Intern Med*. 2004; 141(12):920-928.
- Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine*. 2005; 30(11):1331-1334.
- Cleland JA, et al. Development of a clinical prediction rule for guiding treatment of a subgroup of patients with neck pain: use of thoracic spine manipulation, exercise, and patient education. *Phys Ther*. 2007; 87:9-23.
- Cloke DJ, Lynn SE, Watson H, et al. A comparison of functional, patient-based scores in subacromial impingement. *J Shoulder Elbow Surg*. 2005; 14:380-384.
- Copay AG, Cher DJ. Is the Oswestry Disability Index a valid measure of response to sacroiliac joint treatment? *Qual Life Res*. February 2016; 25(2):283-92.
- Crowell MS, Wofford NH. Lumbopelvic manipulation in patients with patellofemoral pain syndrome. *J Man Manip Ther*. August 2012; 20(3):113-120.
- Currier LL, Froehlich PJ, Carow SD, et al. Development of a clinical prediction rule to identify patients with knee pain and clinical evidence of knee osteoarthritis who demonstrate a favorable short-term response to hip mobilization. *Phys Ther*. 2007; 87:1106-1119.
- Davidson M & Keating J. A comparison of five low back disability questionnaires: Reliability and responsiveness. *Phys Ther*. 2002; 82:8-24.
- Donahue D, Stokes EK. How much change is true change? The minimal detectable change of the Berg Balance Scale in elderly people. *J Rehab Med*. 2009; 41:343-346.
- Evans R, Bronfort G, Bittell S, et al. A pilot study for a randomized clinical trial assessing chiropractic care, medical care and self-care education for acute and subacute neck pain patients. *JMPT*. 2003; 26(7):403-411.
- Evans R, Bronfort G, Bittell S, et al. Two-year follow-up of a randomized clinical trial of spinal manipulation and two types of exercise for patients with chronic neck pain. *Spine*. 2002; 27(21):2383-2389
- Faber MJ, Bosscher RJ, van Wieringen PC. Clinimetric properties of the performance-oriented mobility assessment. *Phys Ther*. 2006; 86:944-954.

Fabre J, Ellis R, Kosma M, et al. Falls risk factors and a compendium of falls risk screening instruments. *J Geriatr Phys Ther.* 2010; 33:184-197.

Fairbank JC, Pynsent, PB. The Oswestry Disability Index. *Spine.* November 15, 2000; 25(22):2940-2953.

Farrar J, Berlin J, Strom B. Clinically important changes in acute pain outcome measures: a validation study. *J Pain Symptom Manage.* 2003; 25:406-411.

Farrar J, Portenoy R, Berlin J, et al. Defining clinically important difference in pain outcome measures. *Pain.* 2000; 88(3):287-294.

Feise RJ, Menke JM. Functional rating index: literature review. *Med Sci Monit,* February 2010; 16:RA25-36.

Flynn TW, Fritz J, Whitman J, et al. A clinical prediction rule for classifying patients with low back pain who demonstrate short-term improvement with spinal manipulation. *Spine.* 2002; 27(24):2835-2843.

Fritz JM, Childs JD, Flynn TW. Pragmatic application of a clinical prediction rule in primary care to identify patients with low back pain with a good prognosis following a brief spinal manipulation intervention. *BMC.* 2005; 6:29.

Fritz JM, Hebert J, Koppenhaver S, et al. Beyond minimally important change: defining a successful outcome of physical therapy for patients with low back pain. *Spine.* 2009; 34(25):2803-9.

Froud R, Eldridge S, Underwood M. Minimally important change on the Roland Morris disability questionnaire. *J Bone Joint Surg Br.* 2010; 92(B Suppl D):233.

Garrison C, Cook C. Clinimetrics corner: the Global Rating of Change score (GRoC) poorly correlates with functional measures and is not temporally stable. *J Man Manip Ther.* November 2012; 20(4):178-181.

Grotle M, Brox JI, Vollestad NK. Concurrent comparison of responsiveness in pain and functional status measurements used for patients with low back pain. *Spine.* 2004; 29:E492-501.

Haas M, Grouppe E, Aickin M, et al. Dose response for chiropractic care of chronic cervicogenic headache and associated neck pain: a randomized pilot study. *JMPT.* 2004; 27(9):547-553.

Haefeli M, Elfering A. Pain assessment. *Eur Spine J.* January 2006; 15 Suppl 1:S17-24.

Heald SL, Riddle DL, Lamb RL. The shoulder pain and disability index: the construct validity and responsiveness of a region-specific disability measure. *Phys Ther.* 1997, 77:1079-1089.

Hicks GE, et al. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil.* 2005; 86(9):1753-1762.

Hinton P, McLeod R, Broker B, et al. Outcome measures and their everyday use in chiropractic practice. *J Can Chiropr Assoc.* June 2010; 54(2):118-131.  
<http://www.ncbi.nlm.nih.gov/pubmed/16696738>.

Hurst H, Bolton J. Assessing the clinical significance of change scores recorded on subjective outcome measures. *J Manip Physiol Ther.* 2004; 27(1):26-35.

Hurwitz EL, et al. A randomized trial of chiropractic manipulation and mobilization for patients with neck pain: clinical outcomes from the UCLA neck-pain study. *Am J Public Health.* 2002; 92:1634-1641.

Hurwitz EL, Morgenstern H, Kominski GF, et al. A randomized trial of chiropractic and medical care for patients with low back pain: Eighteen month follow-up outcomes from the UCLA low back pain study. *Spine.* 2006; 31(6):611-621.

Irrgang JJ, Snyder-Mackler L, Wainner RS, et al. Development of a patient-reported measure of function of the knee. *J Bone Joint Surg Am.* 1998; 80(80):1132-45.

Iverson CA, Sutlive TG, Crowell MS, et al. Lumbopelvic manipulation for the treatment of patients with patellofemoral pain syndrome: development of a clinical prediction rule. *J Orthop Sports Phys Ther.* 2008; 38:297-312.

Jacobson GP, Newman CW. The development of the dizziness handicap inventory. *Arch Otolaryngol Head Neck Surg.* 1990; 116:424-427.

Jacobson, G.P., et al. Headache Disability Inventory (HDI). *Neurology.* 1994; 44(5):837-42.

Jordan K, Dunn KM, Lewis M, Croft P. A minimal clinically important difference was derived for the Roland-Morris disability questionnaire for low back pain. [Published online ahead of print November 4, 2005]. *J Clin Epidemiol.* January 2006; 59(1):45-52.

Kohlbeck FJ, Haldeman S, Hurwitz EL, et al. Supplemental care with medication-assisted manipulation versus manipulative therapy alone for patients with chronic low back pain. *JMPT.* 2005; 28(4):245-252.

Kvien TK, Heiberg T, Hagen KB. Minimally clinically important improvement/difference (MCII/MCID) and patient acceptable symptom state (PASS): What do these concepts mean? *Ann Rheum Dis.* 2007; 66:iii40-41.

Lauridsen HH, Hartvigsen J, Manniche C, et al. Responsiveness and minimal clinically important difference for pain and disability instruments in low back pain patients. *BMC Musculoskelet Disord.* October 25, 2006; 7:82.

Leboeuf-Yde C, Grønstedt A, Borge JA, et al. The Nordic Back Pain Subpopulation Program: can patient reactions to the first chiropractic treatment predict early favorable

treatment outcome in persistent low back pain? *J Manip Physiol Ther*. February 2005; 28(2):90-96.

Leshner JD, Sutlive TG, Miller GA, et al. Development of a clinical prediction rule for classifying patients with patellofemoral pain syndrome who respond to patellar taping. *J Orthopaedic Sports Phys Ther*. 2006; 36:854-866.

Liebenson C. *Rehabilitation of the Spine: A Practitioner's Manual*. 2<sup>nd</sup> ed. Baltimore, MD. Lippincott Williams & Wilkins 2007:146-182.

McGorry RW, Webster BS, Snook SH, et al. The relation between pain intensity, disability, and the episodic nature of chronic and recurrent low back pain. *Spine*, 2000; 25(7):834-841.

Menke MJ, Feise RJ. Functional Rating Index: literature review. *Med Sci Monit*. 2010; 16(2):RA25-36.

Moraska A, Chandler C. Changes in clinical parameters in patients with tension-type headache following massage therapy: A pilot study. *J Man Manip Ther*. 2008; 16:106-112.

Muller U, Duetz MS, Roeder C, et al. Condition-specific measures for low back pain: Part 1: validation. *Eur Spine J*. 2004; 13:301-313.

Newell D, Bolton JE. Responsiveness of the Bournemouth questionnaire in determining minimal clinically important change in subgroups of low back pain patients. *Spine (Phila Pa 1976)*. September 1, 2010; 35(19):1801-1806.

Newell D, Field J. Who will get better? Predicting clinical outcomes in chiropractic practice. *Clinical Chiropractic*. 2007; 10:179-186.

Ostelo RW, Deyo RA, Stratford P, et al. 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.

Perera S, Mody S, Woodman RC, et al. Meaningful change and responsiveness in common physical performance measures in older adults. *J Am Geriatr Soc*. 2006; 54:743-749.

Piva S, Gil A, Moore C, et al. Responsiveness of the activities of daily living scale of the knee outcome survey and numeric pain rating scale in patients with patellofemoral pain. *J Rehabil Med*. February 2009; 41(3):129-135.

Pool JJ, Ostelo RW, Hoving JL, et al. Minimal clinically important change of the Neck Disability Index and the Numerical Rating Scale for patients with neck pain. *Spine (Phila Pa 1976)*. December 15, 2007; 32(26):3047-3051.

Roland M, Fairbank J. The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. *Spine*. 2000; 25(24):3115-3124.

Romero S, Bishop M, Velozo C, et al. Minimum detectable change of the Berg Balance Scale and the Dynamic Gait Index in older persons at risk for falling, *J Geriatr Phy Ther.* 2011; 34:131-137.

Schmitt J, Abbott JH. Global ratings of change do not accurately reflect functional change over time in clinical practice. [Published online ahead of print January 8, 2015]. *J Orthop Sports Phys Ther.* February 2015; 45(2):106-111. doi: 10.2519/jospt.2015.5247.

Schmitt J, Di Fabio RP. Reliable change and minimum important difference (MID) proportions facilitated group responsiveness comparisons using individual threshold criteria. *J Clin Epidemiol.* 2004; 57:1008-1018.

Schoffermann J, Wasserman S. Successful treatment of low back pain and neck pain after a motor vehicle accident despite litigation. *Spine.* 1994; 19(9):1007-1010.

Shumway-Cook A, Woollacot, M. *Motor Control-Theory and Applications.* Baltimore, MD: Williams and Wilkins; 1995.

Smeets R1, Köke A, Lin CW, et al. Measures of function in low back pain/disorders: Low Back Pain Rating Scale (LBPRS), Oswestry Disability Index (ODI), Progressive Isoinertial Lifting Evaluation (PILE), Quebec Back Pain Disability Scale (QBPDS), and Roland-Morris Disability Questionnaire (RDQ). *Arthritis Care Res (Hoboken).* November 2011; 63 Suppl 11:S158-173.

Soer R, Reneman MF, Vroomen PC, et al. Responsiveness and minimal clinically important change of the Pain Disability Index in patients with chronic back pain. *Spine (Phila Pa 1976).* 2012; 37:711-715.

Stratford PW, Binkley J, Solomon P, et al. Defining the minimal level of detectable change for the Roland-Morris Questionnaire. *Phys Ther.* April 1996; 76(4):359-365; discussion 366-368.

Stratford P, Gill C, Westaway M, et al. Assessing disability and change on individual patients: a report of a patient specific measure. *Physiotherapy Canada.* 1995; 47:258-263.

Thiel HW, Bolton JE. Predictors of immediate and global responses to chiropractic manipulation of the cervical spine. *J Manipulative Physiol Ther.* 2008; 31(3):172-183.

Thoomes-de Graaf M, Scholten-Peeters W, Duijn E, et al. The responsiveness and interpretability of the shoulder pain and disability index. *J Orthop Sports Phys Ther.* April 2017; 47(4):278-286.

Tseng YL, Wang WT, Chen WY, et al. Predictors for the immediate responders to cervical manipulation in patients with neck pain. *Man Ther.* November 2006; 11(4):306-315.

Tuchin PJ, Pollard H, Bonello R. A randomized controlled trial of chiropractic spinal manipulative therapy for migraine. *JMPT.* 2000; 23(2):91-95.

Tveita EK, Ekenberg OM, Juel NG, et al. Responsiveness of the shoulder pain and disability index in patient's with adhesive capsulitis. *BMC Musculoskel Disord.* 2008; 9:161.

Vianin M. Psychometric properties and clinical usefulness of the Oswestry Disability Index. *J Chiropr Med.* 2008; 7(4):161-163.

Yorke A, Ward I, Vora S, et al. Measurement characteristics and clinical utility of the dizziness handicap inventory among individuals with vestibular disorders. *Archives of Physical Medicine and Rehabilitation.* 2013; 94(11):2313-2314.

Young BA, Walker MJ, Strunce JB, et al. Responsiveness of the Neck Disability Index in patients with mechanical neck disorders. *Spine J.* October 2009 ;9(10):802-808.

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