

UPPER EXTREMITY OUTCOME MEASURES

Live Interactive Webinar
Presented By
Jodi Gootkin, PT, MEd, CEAS
jodiemail@comcast.net

1

Course Rationale

- The purpose of this course is to enhance clinical decision making when selecting outcome measures for musculoskeletal and neuromuscular pathologies of the upper extremity. The emphasis is comparative analysis of contemporary instruments to assess impairments and function of the shoulder, elbow, wrist and hand in adult and pediatric populations.

Copyright Jodi Gootkin

3

3

Goals and Objectives

1. Define psychometric properties of standardized health-related outcome measures.
2. List global and specific domains that can be assessed with outcome measures.
3. Distinguish between patient or proxy reported and performance-based measures.
4. Identify advantages of and barriers to patient reported outcomes assessed through computer adaptive testing.
5. Detail the clinical relevance of performance measures to quantify impairments and function of the shoulder, elbow, wrist and hand.
6. Compare and contrast patient reported outcome measures for the upper extremity.
7. Describe scoring procedures and values for specific upper extremity outcome measures.
8. Identify upper extremity outcome measures appropriate for the pediatric population.
9. Identify upper extremity outcome measures appropriate for individuals with neuromuscular disorders.
10. List tests and measures to assess readiness for return to sport following rehabilitation for upper extremity pathology.

Copyright Jodi Gootkin

4

4

Disclaimer

- Application of concepts presented in this webinar is at the discretion of the individual participant in accordance with federal, state, and professional regulations.
- No conflict of interest exists for the presenter or provider of this course.

Copyright Jodi Gootkin

5

5

Course Outline and Schedule



Topic	Time
Value of Tests and Measures	0:00-0:15
Psychometric Properties	0:16-0:30
Types of Instruments and Domains	0:31-0:40
Performance Measures	0:41-0:50
Interactive Discussion of Clinical Applications	0:51-1:00
Performance Measures	1:01-1:20
Activity Assessments	1:21-1:30
Patient Reported Measures	1:31-1:50
Interactive Discussion of Clinical Applications	1:51-2:00
Patient Reported Measures	2:00-2:30
Pediatric Specific Tools	2:31-2:40
Return to Sport Performance Testing	2:41-2:50
Interactive Discussion of Clinical Applications	2:51-3:00

6

Course Post Test

- Slides with “Consider This” icon in bottom right corner will be helpful in completing the post-test.



Copyright Jodi Gootkin

8

Value of Tests and Measures

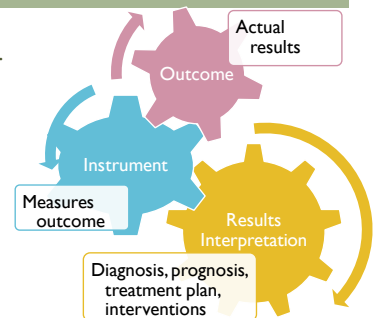
- Assist in establishing plan of care and quantifying progress.
- Serve as foundation to engage patient and caregivers.
- Standardize communication among health care professionals.
- Justify services and reimbursement.

Copyright Jodi Gootkin

9

Outcome Measures

- Objectively assess individual.
- Evaluate quality and determine relevance of research to support evidence-based practice.

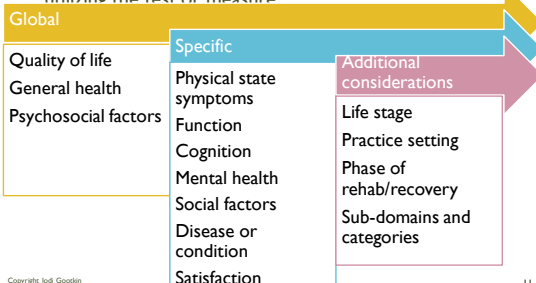


Copyright Jodi Gootkin

10

Instrument Domains

- Specific category of information to be gathered by utilizing the test or measure



Copyright Jodi Gootkin

11

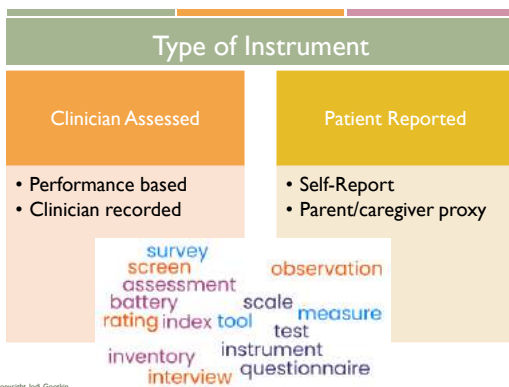
Functional Measurement

- What type of tool provides the most beneficial information to guide clinical decision making?
- Performance measured by clinician, patient reported or mixed?



Copyright Jodi Gootkin

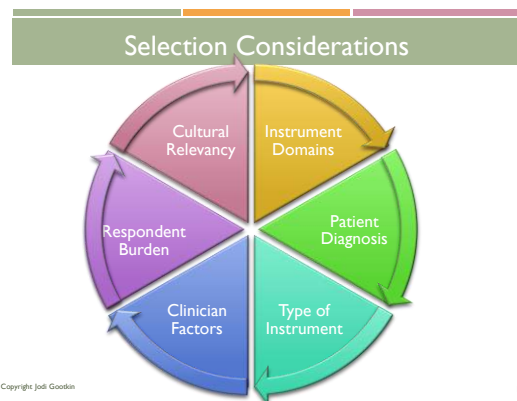
12



Copyright Jodi Gootkin

13

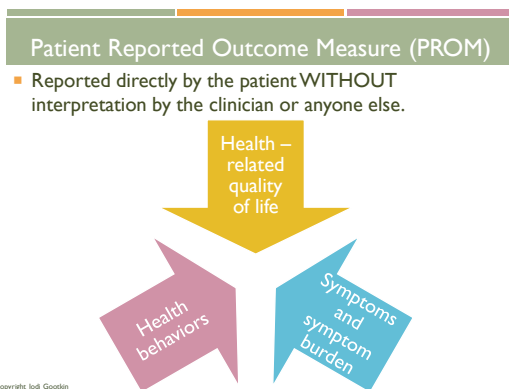
13



Copyright Jodi Gootkin

14

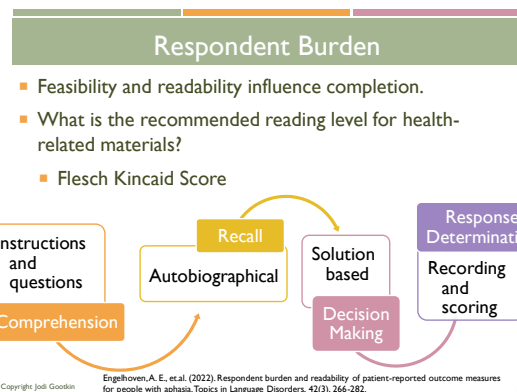
14



Copyright Jodi Gootkin

15

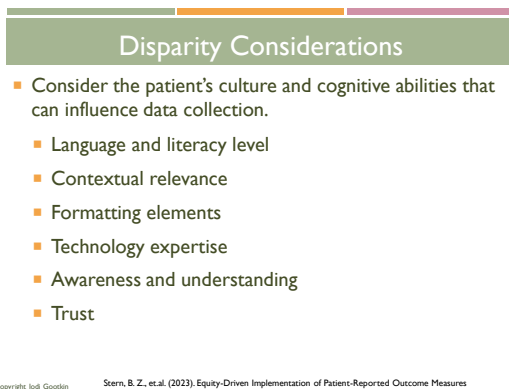
15



Copyright Jodi Gootkin

16

16

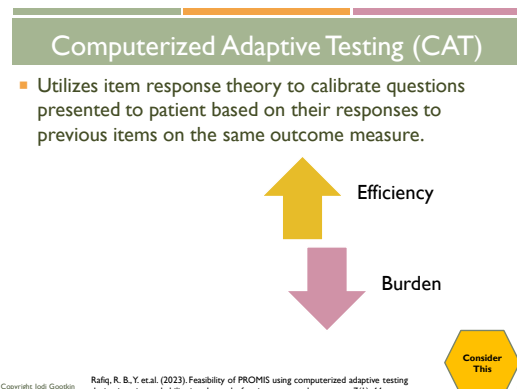


Copyright Jodi Gootkin

Stern, B. Z., et al. (2023). Equity-Driven Implementation of Patient-Reported Outcome Measures in Musculoskeletal Care: Advancing Value for All. *JGIM*, 105(9), 726-735.

17

17



Copyright Jodi Gootkin

Rafiq, R. B., Y. et al. (2023). Feasibility of PROMIS using computerized adaptive testing during inpatient rehabilitation. *Journal of patient-reported outcomes*, 7(1), 44.

18

18

Psychometrics

- Characteristics of measures utilized to determine their effectiveness and trustworthiness.

Copyright Jodi Gootkin

19

19

Psychometric Properties

Validity

Measures what is intended



Reliability

Consistent over time

Intra-rater	Inter-rater	Test-retest
• Same tester	• Different testers	• Patient over time

Copyright Jodi Gootkin

20

20

Sensitivity - Responsiveness



PASS Patient Acceptable Symptom State Patient satisfied

SCB Substantial Clinical Benefit Optimal improvement

MCID Minimal Clinically Important Difference Patient perceived meaningful change

MDC Minimal Detectable Change Smallest change not from error

SEM Standard Error Measurement Value attributed to error

Copyright Jodi Gootkin

21

21

Bench to Bedside



Facilitators

- Evidence and knowledge
- Colleague support
- Ease of application
- Technology

Obstacles

- Lack of time
- Knowledge of measures
- Technology
- Patient response

Smith, D., et al. (2022). Perception and utilization of standardized outcome measures in acute care physical therapy: an analysis of practice. *Journal of Acute Care Physical Therapy*, 13(4), 174-181.
Gauthier, M. L., et al. (2023). Missing The Forest For The Trees: A Lack Of Upper Extremity Physical Performance Testing In Sports Physical Therapy. *International Journal of Sports Physical Therapy*, 18(2), 419.

Copyright Jodi Gootkin

22

22

COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN)

- Provides standards for assessing methodological quality of studies that examine psychometric properties of health-related outcome measures.
- The goal of COSMIN is to enhance the selection of appropriate instruments to be consistently used in research and clinical practice.
- Conversely, de novo measures are new and not based on any existing measures.

Copyright Jodi Gootkin

COSMIN, <https://www.cosmin.nl/>

23

23

Categories of Measures

- Performance
 - Clinician Assessment
 - May include Patient Response Portions
- Activity
 - Clinician Administered
 - Patient Reported Outcome Measures
 - Patient Response Questionnaires
 - Pediatric Specific
 - Return to Sport

Copyright Jodi Gootkin

24

24

PERFORMANCE MEASURES

Clinician with Patient Report Section

- Constant-Murley Score (CMS)
- UCLA Shoulder Scale
- American Shoulder and Elbow Surgeons Shoulder (ASES)

Clinician

- Fugl-Meyer Assessment – Upper Extremity (FMA-UE)
- Perdue Pegboard Test (PPT)

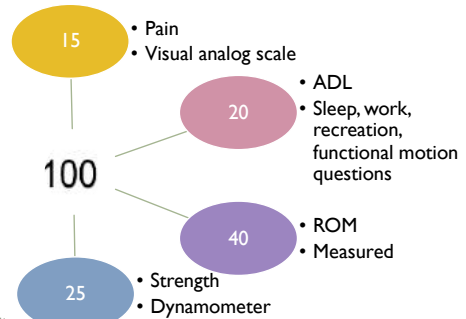
Objective, clinician administered tools indicated for assessing baseline, progress, and degree of disability.

25

Copyright Jodi Gootkin

25

Constant-Murley Score (CMS)



Copyright Jodi Gootkin

26

26

CMS Research

Cohort	Psychometrics
SLAP-II Surgical Management	3 months too early for outcome assessment
Reverse Shoulder Arthroplasty	MCID 3 6 12 months post-op 7 7 9 respectively
Calcific Rotator Cuff Tendonitis	MCID 10 points SCB 20 points

Slane, O., et al. (2021). Responsiveness of five shoulder outcome measures at follow-ups from 3 to 24 months. *BMC Musculoskeletal Disorders*, 22, 1-10.
Zhou, A., et al. (2023). Minimal Clinically Important Differences for Oxford, Constant, and University of California Los Angeles Shoulder Scores After Reverse Shoulder Arthroplasty to Allow Interpretation of Patient-Reported Outcome Measures and Future Statistical Power Analyses. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 39(6), 1405-1414.
Louwerens, J. K., et al. (2020). Quantifying the minimal and substantial clinical benefit of the Constant-Murley score and the Disabilities of the Arm, Shoulder and Hand score in patients with calcific tendinitis of the rotator cuff. *JSES International*, 4(3), 606-611.

Copyright Jodi Gootkin

27

University of California Los Angeles (UCLA) Shoulder Scale



Copyright Jodi Gootkin

28

28

UCLA Shoulder Scale Research

Cohort	Psychometric Property
Reverse Shoulder Arthroplasty	MCID 3 6 12 month post-op 4 3 3 points respectively
Arthroscopic Cuff Repair	MCID 10 anchor approach 3 distribution approach
Reverse Shoulder Arthroplasty	PASS total score thresholds 3 6 12 months post-op 17 21 26 points respectively

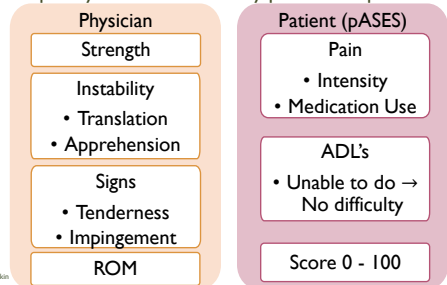
Zhou, A., et al. (2023). Minimal Clinically Important Differences for Oxford, Constant, and University of California Los Angeles Shoulder Scores After Reverse Shoulder Arthroplasty to Allow Interpretation of Patient-Reported Outcome Measures and Future Statistical Power Analyses. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 39(6), 1405-1414.
Yang, C., et al. (2024). Determining patient acceptable symptom states from patient reported outcome measures following reverse shoulder arthroplasty: Constant-murley, UCLA, Oxford Shoulder Scores. *Journal of Orthopaedics*, 54, 143-147.
Makadam, A. A., et al. (2024). Estimating the minimal clinically important difference of shoulder functional scores after arthroscopic rotator cuff repair: a prospective study. *Archives of Orthopaedic and Trauma Surgery*, 1-9.

Copyright Jodi Gootkin

29

American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES)

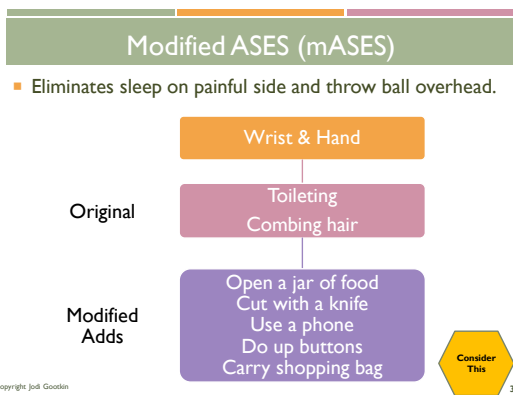
- Contemporary version utilizes only patient component.



Copyright Jodi Gootkin

30

30



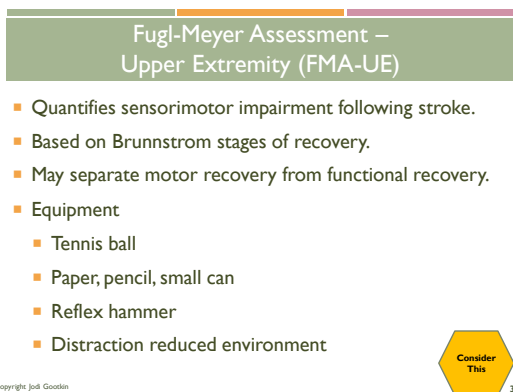
31

pASES Research

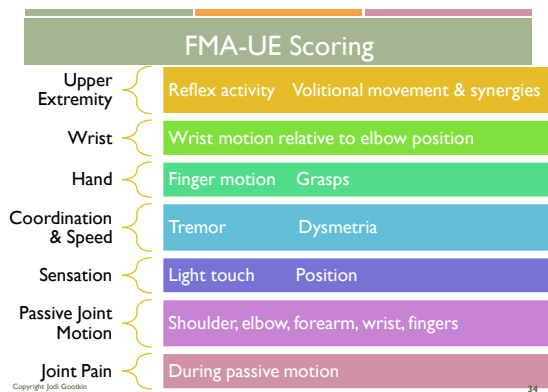
Cohort	Psychometrics	
Rotator Cuff Repair	Non-operative MCID	12 – 17
	Operative	27
	Maximum Possible Improvement	>50% of value
	MCID	19
Superior Capsule Reconstruction	Substantial Clinical Benefit	28
	Patient Acceptable Symptom State	81

Agel, J., et al. (2023). American Shoulder and Elbow Surgeons score: what does it tell us about patients selecting operative treatment of a rotator cuff injury? JSES International, 7(5), 751-755.
Yeom, J., et al. (2022). Patient acceptable symptom state, minimal clinically important difference, and substantial clinical benefit after arthroscopic superior capsular reconstruction. The American Journal of Sports Medicine, 50(12), 3108-3117.

32



33



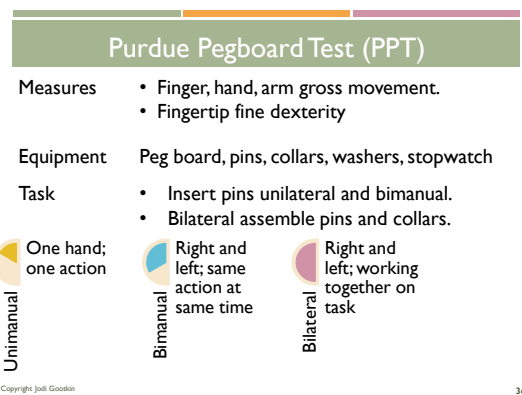
34

FMA-UE Research

Cohort	Psychometrics
Moderate to severe hemiparesis during acute to subacute phase	MDC 7 MCID 13
Chronic moderate to severe impairment	Valid with appropriate item difficulty Hook grasp may be misfit item

Huynh, B. P., et al. (2023). Sensitivity to Change and Responsiveness of the Upper Extremity Fugl-Meyer Assessment in Individuals With Moderate to Severe Acute Stroke. Neurorehabilitation and Neural Repair, 37(8), 545-553.
Hijikata, N., et al. (2020). Item difficulty of Fugl-Meyer assessment for upper extremity in persons with chronic stroke with moderate-to-severe upper limb impairment. Frontiers in neurology, 11, 577855.

35



36

Perdue Pegboard Test Scoring

- Pin Placement – number in 30 seconds
 - Right Hand
 - Left Hand
 - Both Hands
- Assembly
 - Pin + Washer + Collar + Washer = 32 points
- Age-referenced Norms

Copyright Jodi Gootkin

37

37

Perdue Pegboard Research

Cohort	Psychometrics
Ischemic Stroke	Valid to distinguish dexterity impairment in individuals with hand injuries. Post stroke, bimanual tasks elicited greater activation of bilateral sensorimotor cortices and contralesion hemisphere.

Copyright Jodi Gootkin

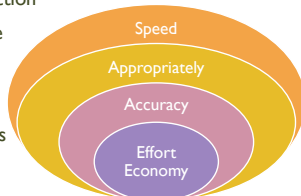
Chen, S., et al. (2024). Cortical activity in patients with high-functioning ischemic stroke during the Purdue Pegboard Test: insights into bimanual coordinated fine motor skills with functional near-infrared spectroscopy. *Neural Regeneration Research*, 19(5), 1098-1104.

38

38

Hand Function Tool Selection

- Consider information to be gathered.
 - Dexterity vs. Hand Function
 - Efficiency vs. Grasp Type
 - Completion vs. Quality
 - Functional Activities
 - Environmental Demands



Yong, J., et al. (2022). Performance-based outcome measures of dexterity and hand function in person with hands and wrist injuries: A scoping review of measured constructs. *Journal of Hand Therapy*, 35(2), 200-214.
Hahn, A., et al. (2022). Aid for Decision Making in Occupation Choice (ADOC) as a Tool to Address Activities and Participation: A Scoping Review. *Malaysian Journal of Medicine & Health Sciences*, 18.

Copyright Jodi Gootkin

39

39

ACTIVITY ASSESSMENTS

- Canadian Occupational Performance Measure (COPM)
- Activity Measure For Post-acute Care (AM-PAC)

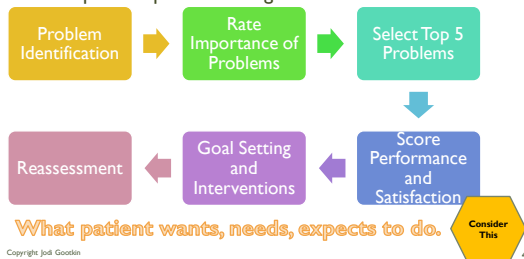
Clinician administered tools to gather information on functional activities.

COPYRIGHT JODI GOOTKIN

40

Canadian Occupational Performance Measure (COPM)

- Personalized semi-structured interviewing identifies occupational performance goals.



Copyright Jodi Gootkin

41

41

COPM Problem Identification

- Young children may not be capable of self-evaluating.

Self-care	Productivity	Leisure
- Personal care - Functional mobility - Community management	- Work - Household - Play/school	- Quiet recreation - Active recreation - Socialization

Copyright Jodi Gootkin

Verkerk, G., et al. (2023). Instructions for administering the Canadian occupational performance measure with children themselves. *Physical & Occupational Therapy in Pediatrics*, 43(1), 58-73.
Law, M., et al. (2014). *Canadian Occupational Performance Measure* (5th ed.). CAOT Publications.

42

42

COPM Scoring

- Individualized scoring and not norm referenced.
- Responsiveness values vary by individual, problems, and context.
- Mean score may indicate negative change which may not actually indicate a change in abilities.
 - Patient insight and awareness may alter scoring.

Copyright Jodi Gootkin

43

43

COPM Research

Cohort	Psychometrics
Dupuytren Disease	107 performance problems Greater responsiveness than QuickDASH
Cancer Survivors	100 performance problems Chronic cognitive, emotional, psychosocial impacts

Lauritzen, A., et al. (2023). Responsiveness of the patient-specific Canadian occupational performance measure and a fixed-items activity limitations measure in patients with dupuytren disease. *Journal of Patient-Reported Outcomes*, 7(1), 1-8.
Winters, C.A., et al. (2024). Does the Canadian Occupational Performance Measure (COPM) capture the complex experiences of cancer survivors? A mixed methods approach. *Occupational Therapy in Health Care*, 38(2), 347-363.

Copyright Jodi Gootkin

44

44

Activity Measure for Post-Acute Care (AM-PAC)

- Assess patient across care settings utilizing form versions.
- Items correlate to PROMIS Upper Extremity



Copyright Jodi Gootkin

Thackeray, A., et al. (2021). Linking AM-PAC mobility and daily activity to the PROMIS physical function metric. *Physical Therapy*, 101(8), pzab084.

45

45

PATIENT REPORTED OUTCOME MEASURES

- Disabilities of the Arm, Shoulder, and Hand (DASH)
- Shoulder Pain and Disability Index (SPADI)
- Wheelchair Users Shoulder Pain Index (WUSPI)
- Simple Shoulder Test (SST)
- Penn Shoulder Score
- Western Ontario Rotator Cuff Index (WORC)
- Michigan Hand Outcomes Questionnaire (MHQ)

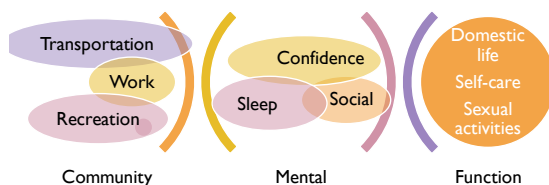
Patient's subjective assessment of their functional abilities.

COPYRIGHT JODI GOOTKIN

46

Disabilities of the Arm, Shoulder, and Hand (DASH)

- Entire upper limb disability and symptoms.
 - Pain, sensation, weakness, stiffness
- Optional work and sports specific sections.



Copyright Jodi Gootkin

47

47

DASH Scoring

- Mathematical calculation with resultant score higher value indicating greater disability.
- Normative value for healthy population is 10.
- MCID ranges from 4 to 15.
- QuickDASH utilizes a shortened question list to avoid redundancy in domains assessed.

Copyright Jodi Gootkin

48

48

DASH Research

Cohort	Psychometrics
Lateral Elbow Tendinopathy	SEM 4 MCID 9
Ulnar Nerve Entrapment	Larger effect size than biomechanical measures and progressively increases >3 months post surgery
Orthopedic and Neurologic Wrist and Hand Disorders	Responsive for carpal tunnel, hand rheumatoid arthritis and trauma.

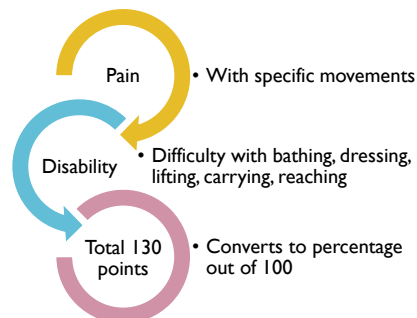
Chaloumas, D., et al. (2023). Determining minimal important differences for patient-reported outcome measures in shoulder, lateral elbow, patellar and Achilles tendinopathies using distribution-based methods. *BMC Musculoskeletal Disorders*, 24(1), 1-8.
Dabagh, A., et al. (2022). Psychometric Properties of the Patient-Reported Outcome Measures for People With Ulnar Nerve Entrapment at the Elbow: A Systematic Review. *Physical Therapy*, 102(10), pzac103.
Zelbari, C., et al. (2023). Patient-reported outcome measures used for hand and wrist disorders: An overview of systematic reviews. *Journal of Hand Therapy*.

Copyright Jodi Gootkin

49

49

Shoulder Pain and Disability Index (SPADI)



Copyright Jodi Gootkin

50

50

SPADI Research

Cohort	Psychometrics
Adhesive Capsulitis	For pain and disability subscales SEM 2 MDC 6

Copyright Jodi Gootkin

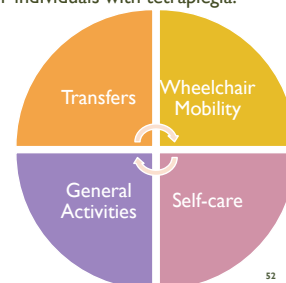
Venturini, D., et al. (2023). Reliability and validity of the Shoulder Pain and Disability Index in a sample of patients with frozen shoulder. *BMC Musculoskeletal Disorders*, 24(1), 1-9.

51

51

Wheelchair Users Shoulder Pain Index (WUSPI)

- Measures pain interference.
- VAS may be challenging for individuals with tetraplegia.



Copyright Jodi Gootkin

52

52

WUSPI Research

Cohort	Psychometrics
Female Wheelchair Basketball Players	Strongly associated with point tenderness in bicipital groove, positive speed test, and limited shoulder abduction ROM.

Copyright Jodi Gootkin

Tsumoda, K., et al. (2021). Associations between wheelchair user's shoulder pain index and tendinitis in the long head of the biceps tendon among female wheelchair basketball players from the Japanese national team. *Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*, 24, 29-34.

53

53

Simple Shoulder Test (SST)

- Dichotomous response scale for questions regarding function, pain, strength and range of motion

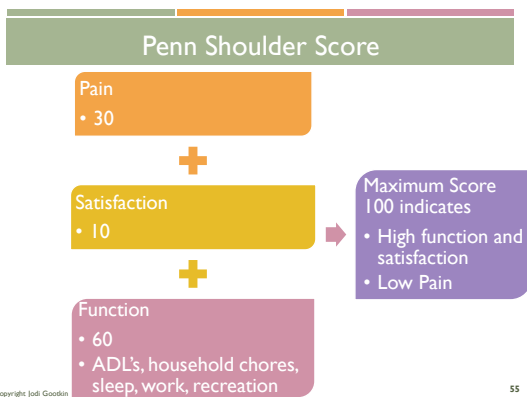


Copyright Jodi Gootkin



54

54



Copyright Jodi Gootkin

55

55

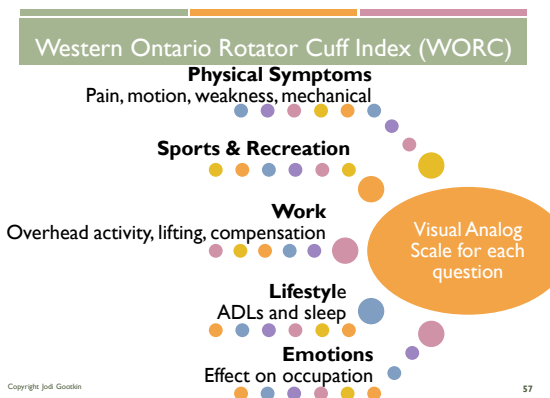
Penn Shoulder Score Research	
Cohort	Psychometrics
Systematic Review	MDC 12 points on total score
	Unclear cross-cultural appropriateness

Copyright Jodi Gootkin

Evans, N.A., et al. (2023). A systematic review of the measurement properties of the Pennsylvania Shoulder Score. Journal of Hand Therapy.

56

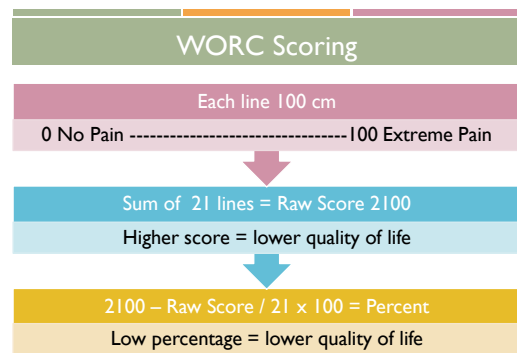
56



Copyright Jodi Gootkin

57

57



Copyright Jodi Gootkin

58

58

WORC Research	
Cohort	Psychometrics
Healthy Shoulders Normative Data	BMI, tobacco, history shoulder pathology yielded worse scores.
	Subscale scores may be more valuable clinically.

Copyright Jodi Gootkin

Kemp, S.E., et al. (2020). Normative values of the Western Ontario Rotator Cuff (WORC) Index for the general population in the USA. Journal of ISAKOS, 5(3), 264-268.

59

59

Michigan Hand Outcomes Questionnaire (MHQ)		
- Strength - Motion - Sensation	- Individual gross/fine motor - Bilateral dressing, grooming	- Ability - Intensity - Volume
Overall Hand Function	ADL	Work Performance
- Frequency - Intensity - Sleep - ADLs - Emotional impact	- Emotional impact - Socialization	- Function - Motion - Strength - Pain - Sensation
Pain	Esthetics	Patient Satisfaction

Copyright Jodi Gootkin

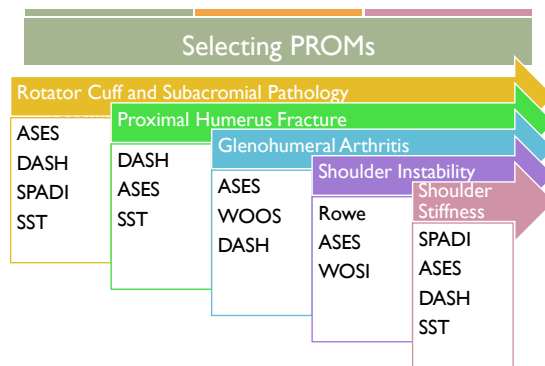
60

60

MHQ Research	
Cohort	Psychometrics
Ulnar Nerve Entrapment	Excellent discrimination on patient satisfaction,
Orthopedic and Neurologic Wrist and Hand Disorders	Good content validity and responsiveness for carpal tunnel syndrome and trauma.

Dabbagh, A., et al. (2022). Psychometric Properties of the Patient-Reported Outcome Measures for People With Ulnar Nerve Entrapment at the Elbow: A Systematic Review. *Physical Therapy*, 102(10), pasc103
Ziebart, C., et al. (2023). Patient-reported outcome measures used for hand and wrist disorders: An overview of systematic reviews. *Journal of Hand Therapy*.

61



Padua, R., et al. (2021). Choosing patient-reported outcome measures for shoulder pathology. *EFORT Open Reviews*, 6(9), 779-787.

62

PEDIATRIC SPECIFIC TOOLS

- Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH)
- Pediatric Adolescent Shoulder Survey (PASS)
- Performance of Upper Limb Tool (PUL)

Combination of performance, clinical and patient reported measures suggested.

Consider This

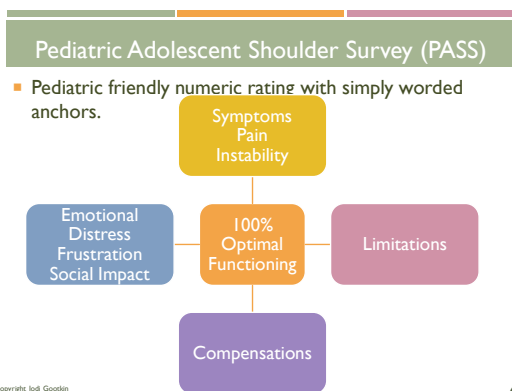
COPYRIGHT JODI GOOTKIN

63

QuickDASH	
- Omits adult-specific questions. - Proxy completion may be necessary for children particularly under 8 years old. - High score = Maximum disability	
Cohort	Psychometrics
Pediatric Upper Limb Fractures	Not validated for patients under 18 years old.

Alberghina, F., et al. (2022). Review of pediatric functional outcomes measures used to evaluate surgical management in pediatric patients with an upper extremity fracture. *Journal of Pediatric Orthopaedics B*, 31(3), 260-269.

64



Copyright Jodi Gootkin

65

PASS Research	
Cohort	Psychometrics
Shoulder Instability Surgery	MDC 13 points
	MCID at least 17 points
	SCB total score at least 85

Walls-Lang, K., et al. (2023). Assessment of Thresholds for Clinically Relevant Change in the Pediatric Adolescent Shoulder Survey After Shoulder Instability Surgery: Factors Associated With Meaningful Improvement in Outcomes. *Orthopaedic Journal of Sports Medicine*, 11(9), 23259671231196943.

66

Performance of Upper Limb Tool (PUL)

- Developed for patients with Duchenne Muscular Dystrophy; broader applications emerging.
- Clinician assessed performance scale.
 - 0 (unable), 1 (independently with modifications), and 2 (completed without compensation).



Copyright Jodi Gootkin

67

67

PUL Research

Cohort	Psychometrics
Neuromuscular Dystrophies	Functional evolution over time. MCID at least 4 point change between subsequent evaluations.
Limb-girdle Muscular Dystrophy	Identifies preserved function in presence of strength deficits.

Gandolla, M., et al. (2020). Test-retest reliability of the Performance of Upper Limb (PUL) module for muscular dystrophy patients. *PLoS One*, 15(9), e0239064.
Diehl, E., et al. (2022). The Performance of Upper Limb (PUL) module in limb-girdle muscular dystrophy. *Acta Myologica*, 41(4), 207.

Copyright Jodi Gootkin

68

68

RETURN TO SPORT PERFORMANCE TESTING

- Single Arm Seated Shot Put Test (SSPT)
- Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)

Incorporate subjective and objective measures.

Barber, P., et al. (2023). Objective and subjective measures to guide upper extremity return to sport testing: A modified Delphi survey. *Physical Therapy in Sport*.

Copyright Jodi Gootkin

69

69

Single Arm Seated Shot Put Test (SSPT)

- Long sitting across two armless chairs or on floor with back against wall.
- Hold weighted ball in one hand at shoulder height with elbow flexion and wrist extension.
- Push ball up and forward away from the body as far as possible.
- Measure distance thrown to where ball first touches ground.
- Average three trials.

DeGout, M., et al. (2021). Intra- and inter-session reliability and agreement of the unilateral seated shot-put test outcome measures in healthy male athletes. *BMC Sports Science, Medicine and Rehabilitation*, 13, 1-7.

Copyright Jodi Gootkin

Consider This

70

70

Single Arm SSPT Research

Cohort	Psychometrics
Healthy Overhead Sport Athletes	Floor position Excellent reliability SEM 8 – 11 cm Chair position Moderate to excellent reliability SEM 15 – 19 cm

Tagliarini, G. O., et al. (2023). Performance, Test-retest Reliability, and Measurement Error of the Upper Limb Seated Shot Put Test According to Different Positions of Execution. *International Journal of Sports Physical Therapy*, 18(3), 698.

Copyright Jodi Gootkin

71

71

Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)

- Only assesses bilateral performance.
- Standard or modified push-up position on floor.
- Hands separated on tape marks.
- Alternate touching of opposite hand.
- Count number of cross-body touches.
- Average 3 trials of 15 seconds.

Consider This

72

72

CKCUET Research

Cohort	Psychometrics
Healthy Males	Strong correlation to serratus anterior strength.
Female Athletes	MDC 4 SEM 7
Team Handball Players	Gender differences in performance. Does not differentiate presence of pain with activity.

Weon, Y.S., et al. (2021). Relationship between the Closed Kinetic Chain Upper Extremity Stability Test and strength of serratus anterior and triceps brachii muscles. *Physical Therapy Korea*, 28(3), 208-214.
Kardos, S., et al. (2023). Upper extremity physical performance tests in female overhead athletes: a test-retest reliability study. *Journal of Orthopaedic Surgery and Research*, 18(1), 489.
Torabi, T.P., et al. (2024). The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) Performance in Elite Team Handball Players Playing with Shoulder Pain, Previous Pain, or No Pain. *International journal of sports physical therapy*, 19(2), 189.

Copyright Jodi Gootkin

73

73

Conclusion

- A wide variety of performance and patient reported measures are available to support collaboration with the patient to identify and monitor progress toward meaningful goals.

Copyright Jodi Gootkin

74

74

1. Which administration method of patient reported outcome measures tailors questions to best assess the individual?

- A. Short form paper based
- B. Interview method
- C. Caregiver proxy completion
- D. Computer adaptive testing

Copyright Jodi Gootkin

75

75

2. The Minimal Clinically Important Difference (MCID) of an outcome measure is an example of what psychometric property?

- A. Responsiveness
- B. Reliability
- C. Construct validity
- D. Structural validity

Copyright Jodi Gootkin

76

76

3. What tool provides standards for assessing methodological quality of studies examining health-related outcome measures?

- A. PROMIS
- B. COSMIN
- C. CPG
- D. De Novo

Copyright Jodi Gootkin

77

77

4. Which of the following is NOT an activity assessed with the Modified American Shoulder and Elbow Surgeons (mASES) Society Standardized Shoulder Assessment?

- A. Open a jar of food
- B. Use a phone
- C. Carry shopping bag
- D. Throw ball overhead

Copyright Jodi Gootkin

78

78

5. The Fugl-Meyer Upper Extremity Assessment is specific for individuals with what condition?

- A. Rotator Cuff Pathology
- B. Spinal Cord Injury
- C. Post-Stroke
- D. Hand Trauma

Copyright Jodi Gootkin

79

79

6. The _____ defines occupational performance as an activity the client "wants to do, needs to do, or is expected to do".

- A. ODI
- B. COPM
- C. SPADI
- D. PROMIS

Copyright Jodi Gootkin

80

80

7. The Simple Shoulder Test (SST) questionnaire utilizes what type of scale?

- A. Likert
- B. Dichotomous
- C. Multiple Rating
- D. Graphic

Copyright Jodi Gootkin

81

81

8. What type of outcome measures should be utilized with the pediatric population?

- A. Primarily performance and clinical measures
- B. Only objective clinical assessments
- C. Patient reported measures completed by the parent
- D. Combination of performance, clinical, and patient reported

Copyright Jodi Gootkin

82

82

9. In what direction should the weighted ball be thrown when performing the single arm seated shot-put test?

- A. Directly overhead
- B. Toward the arm that is not being tested
- C. Up and forward away from the body
- D. Ipsilaterally away from the body

Copyright Jodi Gootkin

83

83

10. What is a limitation of the Closed Kinetic Chain Upper Extremity Stability Test?

- A. Inability to assess unilateral performance
- B. Need for isokinetic equipment
- C. Lower extremity support position cannot be modified
- D. Difficulty quantifying performance

Copyright Jodi Gootkin

84

84

Upper Extremity Outcome Measures

References

- Abbot, S., Proudman, S., Sim, Y. P., & Williams, N. (2022). Psychometric properties of patient-reported outcomes measures used to assess upper limb pathology: a systematic review. *ANZ Journal of Surgery*, 92(12), 3170-3175.
- Agel, J., et.al. (2023). American Shoulder and Elbow Surgeons score: what does it tell us about patients selecting operative treatment of a rotator cuff injury?. *JSES international*, 7(5), 751-755.
- Alben, M. G., Gordon, D., Gambhir, N., Kim, M. T., Romeo, P. V., Rokito, A. S., ... & Virk, M. S. (2023). Minimal clinically important difference (MCID) and substantial clinical benefit (SCB) of upper extremity PROMIS scores following arthroscopic rotator cuff repairs. *Knee Surgery, Sports Traumatology, Arthroscopy*, 31(7), 2602-2614.
- Alberghina, F., Andreacchio, A., Pavone, V., Mansour, M., Dimeglio, A., & Canavese, F. (2021). Review of pediatric functional outcomes measures used to evaluate surgical management in pediatric patients with an upper extremity fracture. *Journal of Pediatric Orthopaedics B*, 31(3), 260-269.
- Aldon-Villegas, R., Ridao-Fernández, C., Torres-Enamorado, D., & Chamorro-Moriana, G. (2021). How to assess shoulder functionality: a systematic review of existing validated outcome measures. *Diagnostics*, 11(5), 845.
- American Occupational Therapy Association. (2021). Improve your documentation and quality of care with AOTA's updated Occupational Profile template. *American Journal of Occupational Therapy*, 75, 7502420010. <https://doi.org/10.5014/ajot.2021.752001>
- Arcidiacone, S., Panuccio, F., Tusoni, F., & Galeoto, G. (2022). A systematic review of the measurement properties of the Michigan Hand Outcomes Questionnaire (MHQ). *Hand Surgery and Rehabilitation*.
- Azad, C. L., Beres, L. K., Wu, A. W., & Giladi, A. M. (2023). Patient interpretations vary for questions in the Patient-Reported Outcomes Measurement Information System Upper Extremity. *Journal of Hand Surgery (European Volume)*, 17531934231162738.
- Barber, P., Pontillo, M., Bellm, E., & Davies, G. (2023). Objective and subjective measures to guide upper extremity return to sport testing: A modified Delphi survey. *Physical Therapy in Sport*.
- Bejer, A., Płocki, J., Probachta, M., Kotela, I., & Kotela, A. (2023). A Comparison Study of the Western Ontario Rotator Cuff Index, and the Constant–Murley Score with Objective Assessment of External Rotator Muscle Strength and Pain in Patients after Arthroscopic Rotator Cuff Repair. *International Journal of Environmental Research and Public Health*, 20(13), 6316.
- Bernhardsson, S., Larsson, A., Bergenheim, A., Ho-Henriksson, C. M., Ekhammar, A., Lange, E., ... & Bornhöft, L. (2023). Digital physiotherapy assessment vs conventional face-to-face physiotherapy assessment of patients with musculoskeletal disorders: A systematic review. *Plos one*, 18(3), e0283013.
- Bonanno, M., De Luca, R., Torregrossa, W., Tonin, P., & Calabrò, R. S. (2022, June). Moving toward appropriate motor assessment tools in people affected by severe acquired brain injury: a scoping review with clinical advices. In *Healthcare* (Vol. 10, No. 6, p. 1115). MDPI.
- Bonden, H., Jahnsen, R. B., & Klevberg, G. L. (2024). Self-care and hand function in preschool children with unilateral or bilateral cerebral palsy: A cross-sectional study. *Child: Care, Health and Development*, 50(1), e13208.

- Bradet-Levesque, I., Audet, J., Roy, J. S., & Flamand, V. H. (2021). Measuring functional outcome in Dupuytren's disease: A systematic review of patient-reported outcome measures. *Journal of Hand Therapy*.
- Carroll, T. J., Dondapati, A., Minto, J., Hoffman, S., Hammert, W. C., & Mahmood, B. (2023). An Analysis of Patient-Reported Outcomes Measurement Information System (PROMIS) in Non-operative Posterolateral Elbow Dislocations. *Cureus*, 15(8).
- Challoumas, D., Zouvani, A., Creavin, K., Murray, E., Crosbie, G., Ng, N., & Millar, N. L. (2023). Determining minimal important differences for patient-reported outcome measures in shoulder, lateral elbow, patellar and Achilles tendinopathies using distribution-based methods. *BMC Musculoskeletal Disorders*, 24(1), 1-8.
- Chanthana, P., Atthakomol, P., Manosroi, W., Wongpakaran, T., Kraissarin, J., & Sananpanich, K. (2023). Comparison of patient preferences and responsiveness among common patient-reported outcome measures for hand/wrist injuries or disorders. *Journal of Orthopaedics and Traumatology*, 24(1), 2.
- Chen, S., Mao, M., Zhu, G., Chen, Y., Qiu, Y., Ye, B., & Xu, D. (2024). Cortical activity in patients with high-functioning ischemic stroke during the Purdue Pegboard Test: insights into bimanual coordinated fine motor skills with functional near-infrared spectroscopy. *Neural Regeneration Research*, 19(5), 1098-1104.
- COSMIN - Improving the selection of outcome measurement instruments. (n.d.). COSMIN; Amsterdam Public Health. Retrieved August 20, 2023, from <https://www.cosmin.nl/>
- Dabbagh, A., Saeidi, S., & MacDermid, J. C. (2022). Psychometric Properties of the Patient-Reported Outcome Measures for People With Ulnar Nerve Entrapment at the Elbow: A Systematic Review. *Physical Therapy*, 102(10), pzac103.
- Davoli, G. B. D. Q., Cardoso, J., Silva, G. C., Moreira, R. D. F. C., & Mattiello-Sverzut, A. C. (2021). Instruments to assess upper-limb function in children and adolescents with neuromuscular diseases: a systematic review. *Developmental Medicine & Child Neurology*, 63(9), 1030-1037.
- Degot, M., Blache, Y., Vigne, G., Franger, G., Neyton, L., & Rogowski, I. (2021). Intra-and intersession reliability and agreement of the unilateral seated shot-put test outcome measures in healthy male athletes. *BMC Sports Science, Medicine and Rehabilitation*, 13, 1-7.
- Diella, E., LoMauro, A., Delle Fave, M., Cima, R., & D'Angelo, M. G. (2022). The Performance of Upper Limb (PUL) module in limb-girdle muscular dystrophy. *Acta Myologica*, 41(4), 207.
- Edelstein, J., Walker, R., Middleton, A., Reistetter, T., Gary, K. W., & Reynolds, S. (2022). Higher frequency of acute occupational therapy services is associated with reduced hospital readmissions. *The American Journal of Occupational Therapy*, 76(1), 7601180090.
- Engelhoven, A. E., Bislick, L., Gray, S., & Pompon, R. H. (2022). Respondent burden and readability of patient-reported outcome measures for people with aphasia. *Topics in Language Disorders*, 42(3), 266-282.
- Evans, N. A., Mehta, S., Holtschneider, S., Kemper, N., Meisterheim, E., Subr, M., & Talbot, E. (2023). A systematic review of the measurement properties of the Pennsylvania Shoulder Score. *Journal of Hand Therapy*.
- Feldhacker, D. R., Lucas Molitor, W., Jensen, L., Lohman, H., & Lampe, A. M. (2022). Occupational therapy and the IMPACT Act: Part 2. A systematic review of evidence for functional status, medication reconciliation, and skin integrity interventions. *The American Journal of Occupational Therapy*, 76(1).

- Foster, B. K., Callahan, C., & Dwyer, C. L. (2023). Readability of Online Hand and Upper Extremity Patient Resources. *Cureus*, 15(3).
- Furtado, R., Bobos, P., Ziebart, C., Vincent, J., & MacDermid, J. (2022). Patient-reported outcome measures used for shoulder disorders: An overview of systematic reviews. *Journal of Hand Therapy*, 35(2), 174-185.
- Gandolla, M., Antonietti, A., Longatelli, V., Biffi, E., Diella, E., Delle Fave, M., ... & Pedrocchi, A. (2020). Test-retest reliability of the Performance of Upper Limb (PUL) module for muscular dystrophy patients. *PLoS One*, 15(9), e0239064.
- Gauthier, M. L., Unverzagt, C. A., Mendonça, L. D. M., & Seitz, A. L. (2023). Missing The Forest For The Trees: A Lack Of Upper Extremity Physical Performance Testing In Sports Physical Therapy. *International Journal of Sports Physical Therapy*, 18(2), 419.
- Glenwright, B. G., Simmich, J., Cottrell, M., O'Leary, S. P., Sullivan, C., Pole, J. D., & Russell, T. (2023). Facilitators and barriers to implementing electronic patient-reported outcome and experience measures in a health care setting: a systematic review. *Journal of patient-reported outcomes*, 7(1), 13.
- Greif, D. N., Distefano, D., Zhang, L., Ramirez, G. A., Kenney, R. J., Mannava, S., & Voloshin, I. (2022, December). Correlation of patient-reported outcome measurement information system-upper extremity with American Shoulder and Elbow Surgeons scores in shoulder arthroplasty. In *Seminars in Arthroplasty: JSES* (Vol. 32, No. 4, pp. 766-774). WB Saunders.
- Griffith, R., Fretes, N., Bolia, I. K., Murray, I. R., Meyer, J., Weber, A. E., ... & Petrigliano, F. A. (2021). Return-to-sport criteria after upper extremity surgery in athletes—A scoping review, part 1: Rotator cuff and shoulder stabilization procedures. *Orthopaedic journal of sports medicine*, 9(8), 23259671211021827.
- Halim, A., Azam, M., Tomori, K., Nawawi, M., Fazwi, R., Zohdi, M., ... & Che Daud, A. Z. (2022). Aid for Decision Making in Occupation Choice (ADOC) as a Tool to Address Activities and Participation: A Scoping Review. *Malaysian Journal of Medicine & Health Sciences*, 18.
- Haratian, A., Deadwiler, B., Dobitsch, A., Bolia, I. K., Thompson, A. A., Hasan, L. K., ... & Gamradt, S. C. (2023). Return to Sport Criteria Following Upper Extremity Surgery in Athletes—A Scoping Review Part 4: Shoulder Arthroplasty Procedures. *Journal of ISAKOS*.
- Hijikata, N., Kawakami, M., Ishii, R., Tsuzuki, K., Nakamura, T., Okuyama, K., & Liu, M. (2020). Item difficulty of Fugl-Meyer assessment for upper extremity in persons with chronic stroke with moderate-to-severe upper limb impairment. *Frontiers in neurology*, 11, 577855.
- Huynh, B. P., DiCarlo, J. A., Vora, I., Ranford, J., Gochyyev, P., Lin, D. J., & Kimberley, T. J. (2023). Sensitivity to Change and Responsiveness of the Upper Extremity Fugl-Meyer Assessment in Individuals With Moderate to Severe Acute Stroke. *Neurorehabilitation and Neural Repair*, 37(8), 545-553.
- Hwang, Y., Kwon, J. Y., Cho, J., & Choi, J. (2023). Individualized Goal Setting for Pediatric Intensive Care Unit-Based Rehabilitation Using the Canadian Occupational Performance Measure. *Children*, 10(6), 985.
- Jamal, K., Penisson, A., Rostagno, S., & Duclos, C. (2022). Where Are We on Proprioception Assessment Tests Among Poststroke Individuals? A Systematic Review of Psychometric Properties. *Journal of Neurologic Physical Therapy*, 46(4), 231-239.

- Kalle, J. P., Saris, T. F., Sierevelt, I. N., Eygendaal, D., & van Bergen, C. J. (2022). Quality of patient-and proxy-reported outcomes for children with impairment of the upper extremity: a systematic review using the COSMIN methodology. *Journal of Patient-Reported Outcomes*, 6(1), 1-17.
- Kardor, S., Gorji, Z., Ghotbi, N., Attarbashi-Moghadam, B., Shadmehr, A., & Gorji, M. (2023). Upper extremity physical performance tests in female overhead athletes: a test–retest reliability study. *Journal of Orthopaedic Surgery and Research*, 18(1), 1-10.
- Kemp, S. E., Urband, C. E., Haase, L. R., Obermeier, M. C., Sikka, R. S., & Tompkins, M. (2020). Normative values of the Western Ontario Rotator Cuff (WORC) Index for the general population in the USA. *Journal of ISAKOS*, 5(5), 264-268.
- Khanna, D., Khadka, J., Mpundu-Kaambwa, C., Lay, K., Russo, R., & Ratcliffe, J. (2022). Are we agreed? Self-versus proxy-reporting of paediatric health-related quality of life (HRQoL) using generic preference-based measures: a systematic review and meta-analysis. *Pharmacoeconomics*, 40(11), 1043-1067.
- Kobayashi, E., Himuro, N., Mitani, Y., Tsunashima, T., Nomura, K., & Chiba, S. (2023). Feasibility and informativeness of the Canadian occupational performance measure for identifying priorities in patients with Parkinson's disease. *Physiotherapy theory and practice*, 39(3), 607-614.
- Lauritzson, A., Eckerdal, D., & Atroshi, I. (2023). Responsiveness of the patient-specific Canadian occupational performance measure and a fixed-items activity limitations measure in patients with dupuytren disease. *Journal of Patient-Reported Outcomes*, 7(1), 1-8.
- Lavoie-Gagne, O., Huddleston, H. P., Fu, M. C., Mehta, N., Nwachukwu, B., Forlenza, E. M., ... & Forsythe, B. (2022). PROMIS Upper Extremity underperforms psychometrically relative to American Shoulder and Elbow Surgeons score in patients undergoing primary rotator cuff repair. *Journal of Shoulder and Elbow Surgery*, 31(4), 718-725.
- Law, M., Baptiste, S., Carswell, A., McColl, M. A., Polatajko, H., & Pollock, N. (2014). *Canadian Occupational Performance Measure* (5th ed.). CAOT Publications.
- Lee, D., Paulson, A., Sanghavi, K., & Giladi, A. M. (2022). Responsiveness of the Brief Michigan Hand Outcomes Questionnaire and Patient-Reported Outcomes Measurement Information System Pain Interference in the Context of Patient Mental Health. *The Journal of Hand Surgery*.
- Mara, C. A., Carle, A. C., Goldschneider, K. R., Kashikar-Zuck, S., Sherry, D. D., Dampier, C., & Morgan, E. M. (2023). Development and evaluation of the patient-reported outcomes measurement information system (PROMIS) pediatric pain quality item bank and short form. *Pain*, 164(3), 555-562.
- Martín-Martín, J., Pajares-Hachero, B., Alba-Conejo, E., Ribelles, N., Cuesta-Vargas, A. I., & Roldán-Jiménez, C. (2023). Validation of the Upper Limb Functional Index on Breast Cancer Survivor. *International Journal of Environmental Research and Public Health*, 20(6), 4997.
- Mukadam, A. A., Nayak, S., Willems, J., & Pandey, V. (2024). Estimating the minimal clinically important difference of shoulder functional scores after arthroscopic rotator cuff repair: a prospective study. *Archives of Orthopaedic and Trauma Surgery*, 1-9.
- Naye, F., Décary, S., Houle, C., LeBlanc, A., Cook, C., Dugas, M., ... & Tousignant-Laflamme, Y. (2023). Six Externally Validated Prognostic Models Have Potential Clinical Value to Predict Patient Health Outcomes in the Rehabilitation of Musculoskeletal Conditions: A Systematic Review. *Physical Therapy*, 103(5), pzad021.

- Nyiring, M. R. K., Olsen, B. S., Amundsen, A., & Rasmussen, J. V. (2021). Minimal clinically important differences (MCID) for the Western Ontario Osteoarthritis of the Shoulder Index (WOOS) and the Oxford Shoulder Score (OSS). *Patient Related Outcome Measures*, 299-306.
- Ohno, K., Saito, K., Matsumoto, H., Tomori, K., & Sawada, T. (2021). The clinical utility of a decision-aid to facilitate the use of the hand in real-life activities of patients with distal radius fractures: A case study. *Journal of Hand Therapy*, 34(3), 341-347.
- Ohno, K., Tomori, K., Sawada, T., & Kobayashi, R. (2021). Examining minimal important change of the Canadian Occupational Performance Measure for subacute rehabilitation hospital inpatients. *Journal of Patient-Reported Outcomes*, 5(1), 1-10.
- Pathak, A., Wilson, R., Sharma, S., Pryymachenko, Y., Ribeiro, D. C., Chua, J., & Abbott, J. H. (2022). Measurement properties of the patient-specific functional scale and its current uses: an updated systematic review of 57 studies using COSMIN guidelines. *Journal of orthopaedic & sports physical therapy*, 52(5), 262-275.
- Poutanen, J., Savolainen, S., Shulga, A., Arokoski, J., & Hiekkala, S. (2023). ICF-linking and psychometric properties of upper extremity mobility outcome measures in spinal cord injury—a scoping review. *The Journal of Spinal Cord Medicine*, 1-13.
- Rafiq, R. B., Yount, S., Jerousek, S., Roth, E. J., Cella, D., Albert, M. V., & Heinemann, A. W. (2023). Feasibility of PROMIS using computerized adaptive testing during inpatient rehabilitation. *Journal of patient-reported outcomes*, 7(1), 44.
- Ravinskaya, M., Verbeek, J. H., Langendam, M. W., Madan, I., Verstappen, S. M., Kunz, R., ... & Hoving, J. L. (2022). Preferred methods of measuring work participation: an international survey among Trialists and Cochrane systematic reviewers. *Journal of occupational rehabilitation*, 32(4), 620-628.
- Riemann, B. L., Wilk, K. E., & Davies, G. J. (2023). Reliability of Upper Extremity Functional Performance Tests for Overhead Sports Activities. *International Journal of Sports Physical Therapy*, 18(3), 687-697.
- Safford, D. W., Shah, K. M., Turner, J. A., & McClure, P. W. (2023). Measurement Properties of the Timed Functional Arm and Shoulder Test in Patients With Shoulder Problems. *Physical Therapy*, 103(2), pzac144.
- Schoen, S. A., Miller, L. J., & Mulligan, S. (2021). Validity of the occupational performance scale of the Sensory Processing Three Dimensions measure. *The American Journal of Occupational Therapy*, 75(2).
- Shafiee, E., Farzad, M., & Karbalaee, M. (2021). A systematic review of self-reported outcome measures assessing disability following hand and upper extremity conditions in Persian population. *Archives of Bone and Joint Surgery*, 9(2), 141.
- Sigirtmac, I. C., & Oksuz, C. (2022). Determination of the optimal cutoff values and validity of the Purdue Pegboard Test. *British Journal of Occupational Therapy*, 85(1), 62-67.
- Smith, D., Furtado, M., & Brusola, G. (2022). Perception and utilization of standardized outcome measures in acute care physical therapy: an analysis of practice. *Journal of Acute Care Physical Therapy*, 13(4), 174-181.
- Sousa, R. L., Moraes, V. Y. D., Zobiole, A. F., Nakachima, L. R., & Belloti, J. C. (2023). Diagnostic criteria and outcome measures in randomized clinical trials on carpal tunnel syndrome: a systematic review. *Sao Paulo Medical Journal*, 141, e2022086.

- Stern, B. Z., Franklin, P. D., Shapiro, L. M., Chaudhary, S. B., Kamal, R. N., & Poeran, J. (2023). Equity-Driven Implementation of Patient-Reported Outcome Measures in Musculoskeletal Care: Advancing Value for All. *JBJS*, 105(9), 726-735.
- Tagliarini, G. O., de S Junior, J. R., Glauber, M., Barbosa, P., & Secchi, L. L. (2023). Performance, Test-retest Reliability, and Measurement Error of the Upper Limb Seated Shot Put Test According to Different Positions of Execution. *International Journal of Sports Physical Therapy*, 18(3), 698-706.
- Tang, X., Schalet, B. D., Peipert, J. D., & Cella, D. (2023). Does scoring method impact estimation of significant individual changes assessed by patient-reported outcome measures? Comparing Classical Test Theory versus Item Response Theory. *Value in Health*.
- Teoh, W. W., Scholes, C., & Clitherow, H. (2022). Agreement between the American Shoulder and Elbow Surgeons Society Standardized Shoulder Assessment score (ASES) and the Oxford Shoulder Score (OSS) in patients presenting with shoulder pathology: A cohort analysis of the Clinical Quality Registry for Outcomes in Shoulder and Elbow Pathology (CROSEP) registry. *Shoulder & Elbow*, 14(6), 682-691.
- Thackeray, A., Hanmer, J., Yu, L., McCracken, P., & Marcus, R. (2021). Linking AM-PAC mobility and daily activity to the PROMIS physical function metric. *Physical Therapy*, 101(8), pzab084.
- Torabi, T. P., Bencke, J., & van den Tillaar, R. (2024). The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) Performance in Elite Team Handball Players Playing with Shoulder Pain, Previous Pain, or No Pain. *International journal of sports physical therapy*, 19(2), 189.
- Trofa, D. P., Desai, S. S., Li, X., & Makhni, E. C. (2022). The current utilization of patient-reported outcome measurement information system in shoulder, elbow, and sports medicine. *Journal of the American Academy of Orthopaedic Surgeons*, 30(12), 554-562.
- Tsunoda, K., Mutsuzaki, H., Kanae, K., Tachibana, K., Shimizu, Y., & Wadano, Y. (2021). Associations between wheelchair user's shoulder pain index and tendinitis in the long head of the biceps tendon among female wheelchair basketball players from the Japanese national team. *Asia-Pacific journal of sports medicine, arthroscopy, rehabilitation and technology*, 24, 29-34.
- Venturin, D., Giannotta, G., Pellicciari, L., Rossi, A., Pennella, D., Goffredo, M., & Poser, A. (2023). Reliability and validity of the Shoulder Pain and Disability Index in a sample of patients with frozen shoulder. *BMC Musculoskeletal Disorders*, 24(1), 1-9.
- Verkerk, G., van der Molen-Meulmeester, L., van Hartingsveldt, M., & Alsem, M. (2023). Instructions for administering the Canadian occupational performance measure with children themselves. *Physical & Occupational Therapy In Pediatrics*, 43(1), 58-73.
- Vincent, J. I., MacDermid, J. C., King, G. J., & Grewal, R. (2021). The Patient-Rated Elbow Evaluation and the American Shoulder and Elbow Surgeons—Elbow form capture aspects of functioning that are important to patients with elbow injuries. *Journal of Hand Therapy*, 34(3), 415-422.
- Vora, I., Kline, D. K., McCauley, C. A., Link, A., Asiello, J. D., Gaudino, S. G., ... & Kimberley, T. J. (2023). Psychometric properties of light touch-pressure somatosensory measures in adults with neurological disorders: A systematic review. *Clinical Rehabilitation*, 02692155231152417.
- Wallis-Lang, K., Bastrom, T. P., Boutelle, K. E., Wagle, A., Pennock, A. T., & Edmonds, E. W. (2023). Assessment of Thresholds for Clinically Relevant Change in the Pediatric/Adolescent Shoulder Survey After Shoulder Instability Surgery: Factors Associated With Meaningful Improvement in Outcomes. *Orthopaedic Journal of Sports Medicine*, 11(9), 23259671231196943.

- Weon, Y. S., Ahn, S. H., Kim, J. H., Gwak, G. T., & Kwon, O. Y. (2021). Relationship between the Closed Kinetic Chain Upper Extremity Stability Test and strength of serratus anterior and triceps brachii muscles. *Physical Therapy Korea*, 28(3), 208-214.
- Witavaara, B., & Florin, J. (2022). Content and psychometric evaluations of questionnaires for assessing physical function in people with arm–shoulder–hand disorders. A systematic review of the literature. *Disability and Rehabilitation*, 44(24), 7575-7586.
- Winters, C. A., et.al. (2024). Does the Canadian Occupational Performance Measure (COPM) capture the complex experiences of cancer survivors? A mixed methods approach. *Occupational Therapy In Health Care*, 38(2), 347-363.
- Yang, C., Yang, A. Z., Xu, S., Yew, A., & Lie, D. T. T. (2024). Determining patient acceptable symptom states from patient reported outcome measures following reverse shoulder arthroplasty: Constant-murley, UCLA, Oxford Shoulder Scores. *Journal of Orthopaedics*, 54, 143-147.
- Yeom, J. W., Kim, D. M., Lee, J. B., Ben, H., Alahmadi, B. M., Park, J. H., ... & Jeon, I. H. (2022). Patient acceptable symptom state, minimal clinically important difference, and substantial clinical benefit after arthroscopic superior capsular reconstruction. *The American Journal of Sports Medicine*, 50(12), 3308-3317.
- Yong, J., MacDermid, J. C., Packham, T., Bobos, P., Richardson, J., & Moll, S. (2022). Performance-based outcome measures of dexterity and hand function in person with hands and wrist injuries: A scoping review of measured constructs. *Journal of Hand Therapy*, 35(2), 200-214.
- Zhou, A., Xu, S., Yew, K. S. A., & Lie, D. T. T. (2023). Minimal Clinically Important Differences for Oxford, Constant, and University of California Los Angeles Shoulder Scores After Reverse Shoulder Arthroplasty to Allow Interpretation of Patient-Reported Outcome Measures and Future Statistical Power Analyses. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 39(6), 1405-1414.
- Zhu, T. Y., Plummer, O. R., Hunt, A., & Joeris, A. (2023). Efficiency and accuracy of computerized adaptive testing for the Oswestry disability Index and Neck disability Index. *JBJS Open Access*, 8(1).
- Ziebart, C., Bobos, P., Furtado, R., Dabbagh, A., & MacDermid, J. (2023). Patient-reported outcome measures used for hand and wrist disorders: An overview of systematic reviews. *Journal of Hand Therapy*.