Reviewer ID: Franny Fan, Carlos L. Cano Herrera, William Miller

Last updated: February 28th, 2024

**Research Summary – Capabilities of Upper Extremities Questionnaire (CUE-Q) – Upper Limb**

| Author Year Research Design Setting (country) | Demographics and Injury Characteristics of Sample | Validity | Reliability | Responsiveness Interpretability |
|---|---|---|---|---|
| Kalsi-Ryan et al. 2019<br><br>Post-hoc analysis of datasets for the GRASSP cross-sectional and longitudinal studies to calculate the psychometric properties of the GRASSP V2<br><br>Five clinics in Canada (Toronto Rehabilitation Institute, ON; GF Strong, BC; Hamilton Health Sciences-2 sites, ON; St. Michael's Hospital, ON; | **Cross sectional study:**<br>Chronic and traumatic tetraplegia (n = 72).<br>Mean age: 39.7 ± 10.7 yr.<br>Gender: NR.<br>Level of injury: C6=38.<br>Mean time since injury: NR.<br>AIS scale: A=28, B=18, C=14, D=12.<br><br>**Longitudinal study:**<br>Traumatic cervical SCI (n = 127).<br>Mean age: 49.3 ± 23.8 yr.<br>Gender: NR.<br>Level of injury: C1-C2=18, C3=20, C4=41, C5=29, C6=11, C7=3, C8=2, T1=3.<br>Mean time since injury: NR. | **Concurrent validity:**<br>Pearson correlation coefficient with CUE-Q and:<br>- GRASSP V2 Sensibility: 0.79<br>- GRASSP V2 Strength: 0.76<br>- GRASSP V2 Prehension: 0.83<br>All associations were positive and of moderate strength with $P < 0.001$. | | |

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| and Toronto Western Hospital, ON), two clinics in USA (Rehab Institute of Chicago, IL and Thomas Jefferson University, PA), and five in Europe (Klinik Hohe Warte Bayreuth, D; Unfallklinik Murnau, D; University Hospital Balgrist, CH; Universitätsklinik Heidelberg, D; and Swiss Paraplegic Center, CH) | AIS scale: A=29, B=17, C=26, D=55. | | | |
| Mulcahey et al. 2017 | N=47 children with tetraplegia<br>28 Male, 19 Female | Correlation between GRASSP and CUE-Q r=0.40-0.84 | | |

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| Psychometric study to validate the GRASSP in pediatric SCI populations and establish the lower age of test administration<br><br>US, Pennsylvania, Maryland, Illinois, Michigan, California, Texas | AIS: 14A, 4B, 10C, 8D, 11 Unknown<br>Age groups:<br>- 5, 3-5 years<br>- 15, 6-12 years<br>- 12, 13-15 years<br>- 15, 16-17 years | | | |
| Oleson and Marino 2014<br><br>Longitudinal, with convenience sample<br>Studying the revised CUE-Questionnaire (CUE-Q; 5pt | N = 46, 42 male<br>Median age 44±21 yrs<br>AIS-A = 14, B = 5, C = 8, D = 19<br>Right motor lvl:<br>C1-C4 = 11, C5 = 25, C6 = 7, C7-C8 = 3<br>Left motor lvl:<br>C1-C4 = 9, C5 = 27, C6 = 5, C7-C8 = 5 | Spearman Correlations of:<br>CUE-Q total score at:<br>Admission:<br>With (Upper extremity motor score – ISNCSCI) UEMS: r=0.89<br>With FIM-Self Care: r=0.73 Discharge:<br>With UEMS: r=0.70<br>With FIM-Self Care: r=0.80 | | **Responsiveness:**<br>Effect size (for change btwn admission and discharge): 0.92<br><br>**Floor/Ceiling Effect:**<br>Possible floor effect on one patient who had:<br>“low admission scores on all measures, but despite minimal change in UEMS and |

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| instead of 7pt scale)<br><br>"Data were obtained at admission and discharge from acute inpatient rehabilitation" | 28 Caucasian, 18 African-American<br>Etiology: fall = 18, MVA = 17, sports = 8 | CUE-Q score change btwn admission and discharge:<br>With UEMS: r=0.07<br>With FIM-Self Care: r=0.51 | | FIMsc reported less difficulty with CUE-Q items at discharge"<br><br>Possible ceiling effect on one patient, whose: "admission CUE-Q scores were high relative to UEMS and FIMsc scores, but at discharge the scores were more congruent" |
| Kalsi-Ryan et al. 2012<br><br>Cross-sectional multi-center study to study the psychometric variables of GRASSP<br><br>Seven centers: 3 European (University Hospital | N=72<br>Mean age = 39.7±10.7y (16-65y)<br>Mean YPI = 7.6 ±6.1y<br><br>Chronic tetraplegia ranging from 6 months to 20 years post-injury.<br><br>52.5% C6-C7 motor levels<br>66% C4-C6 sensory levels | Spearman correlation coefficients were used to establish the association between the Graded Redefined Assessment of Strength Sensibility and Prehension (GRASSP) subtests and the CUE questionnaire:<br>- Sensation total (R+L) = 0.77<br>- Strength total (R+L) = 0.76 | | **Interpretability:**<br>Mean CUE score: 78.8 (SD=29, range 4-124, median 78) |

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| Balgrist, Trauma Centre Murnau, and Hohe Worte, Bayreuth), and 4 North American (Toronto Rehabilitation Institute, Rehabilitation Institute of Chicag, GF Strong and Magee Rehabilitation Hospital, and Thomas Jefferson University Hospital). | 39% Complete tetraplegia<br>61% Incomplete tetraplegia | - Prehension performance total (R+L) = 0.83<br>All values: P<.0001 | | |
| Marino et al. 1998<br><br>Cross-sectional survey | N = 154 patients<br>Avg. age = 37 years, injured for avg. of 8 years.<br><br>99% of subjects had neurological | Different motor levels for each side of the body had significantly different CUE scores (P<.001) except for the motor levels adjacent with each other. | **Internal consistency:** Cronbach's alpha = 0.96<br><br>**Test-retest, Inter-rater, Intra-rater:** Test-retest reliability and agreement were | **Floor/Ceiling Effect:** One item had a borderline floor effect, item hand 5 on the left. This item asks about difficulty manipulating small objects and is difficult |

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<tr><td>Regional Spinal Cord Injury Center</td><td>examinations within 2 years of completing study.<br><br>AIS-A/B/C/D: 93/12/24/25</td><td>Correlations of the CUE to other instruments measuring the same construct:<br>- Functional Independence Measure: r = 0.738, ρ = 0.798, P<.05<br>- Upper Extremity Motor score: r = 0.782, ρ = 0.798, P<.05</td><td>assessed using a weighted k coefficient for individual items and intraclass correlation coefficient (ICC) for the total scale score.<br><br>Individual items: κ>0.60 for all but three: reaching forward with right arm (κ=0.58), manipulating objects with the right hand (κ=0.55), and lifting a 5-pound object overhead (κ=0.57)<br><br>ICC for total score = 0.94</td><td>with impaired hand function. No further explanation of “borderline” or actual values were given.<br><br>Interpretability:<br>SEM = 12.2<br>MDC (calculated from data in this article) = 33.8</td></tr>
<tr><td></td><td colspan="4">Interpretability:
<table>
<tr><th>Item</th><th colspan="2">Mean (SD)</th></tr>
<tr><th></th><th>Right</th><th>Left</th></tr>
<tr><td>Arm Function</td><td></td><td></td></tr>
<tr><td>Reach 1</td><td>4.5 (2.0)</td><td>5.4 (2.1)</td></tr>
<tr><td>Reach 2</td><td>4.6 (2.4)</td><td>4.5 (2.5)</td></tr>
</table></td></tr>
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<tr><td></td><td>
<table>
<tr><td>Reach 3</td><td>3.2 (2.5)</td><td>3.2 (2.5)</td></tr>
<tr><td>Pull/push 1</td><td>5.9 (1.9)</td><td>5.7 (2.1)</td></tr>
<tr><td>Pull/push 2</td><td>5.1 (2.2)</td><td>5.0 (2.2)</td></tr>
<tr><td>Pull/push 3</td><td>5.8 (2.1)</td><td>5.5 (2.3)</td></tr>
<tr><td>Pull/push 4</td><td>4.9 (2.3)</td><td>4.6 (2.3)</td></tr>
<tr><td>Wrist 1</td><td>5.0 (2.5)</td><td>4.8 (2.5)</td></tr>
<tr><td>Wrist 2</td><td>5.2 (2.3)</td><td>5.2 (2.3)</td></tr>
<tr><td>Hand Function</td><td></td><td></td></tr>
<tr><td>Hand 1</td><td>3.0 (2.3)</td><td>3.0 (2.3)</td></tr>
<tr><td>Hand 2</td><td>3.8 (2.5)</td><td>3.7 (2.4)</td></tr>
<tr><td>Hand 3</td><td>3.9 (2.5)</td><td>3.8 (2.5)</td></tr>
<tr><td>Hand 4</td><td>2.8 (2.3)</td><td>2.7 (2.3)</td></tr>
<tr><td>Hand 5</td><td>2.4 (2.0)</td><td>2.2 (2.0)</td></tr>
<tr><td>Hand 6</td><td>3.6 (2.6)</td><td>3.5 (2.6)</td></tr>
<tr><td></td><td colspan="2">Bilateral</td></tr>
<tr><td>Reach down</td><td></td><td></td></tr>
<tr><td>Bilateral 1</td><td colspan="2">4.7 (2.4)</td></tr>
<tr><td>Bilateral 2</td><td colspan="2">3.8 (2.6)</td></tr>
</table>
</td><td></td><td></td><td></td></tr>
</table>

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**Research Summary – Capabilities of Upper Extremities Questionnaire (CUE-Q) – Upper Limb- Cross-cultural Validation Studies**

| Author Year Research Design Setting (country) | Demographics and Injury Characteristics of Sample | Validity | Reliability | Responsiveness Interpretability |
|---|---|---|---|---|
| Aikat & Prasad 2023<br><br>Psychometric study to translate and cross-cultural adapt the CUE-Q into Hindi language (CUE-H) and assess its psychometric properties<br><br>Indian Spinal Injuries Centre, New Delhi, India | **Phase 1 - Translation and cross-cultural adaptation:** N = 10 male participants with tetraplegia<br><br>**Phase 2 – Content validation**<br><br>**Phase 3 – Psychometric testing:** N = 15 participants with tetraplegia | **Content validity:** In the quantitative phase, all items were retained as they had a CVR value of 1.0, except for 3 items (Question number 3, 6, and 8) which had a CVR value of 0.8. The mean of the CVR values of the retained items of the scale results in the CVI. The overall CVI of CUE-H was 0.95 (Excellent). | **Internal consistency:** Cronbach's alpha for the overall scale was 0.99 (Good), which may indicate item redundancy.<br><br>**Test-retest reliability:** The ICC for the single measure of the scale was found to be 0.99 (Range 0.95–0.99) and for the average measure was found to be 0.99 (Excellent) [Range 0.97–0.99]. | **Comprehensibility:** The respondents reported that the directions on the CUE-H were easy to understand demonstrating no difficulty with comprehension. The questions were relevant to their upper limb and the choice of words was also acceptable to them. |