Revised Upper Limb Module for SMA

(RULM)

20 May

2025

Introduction to manual update

This manual clarifies the procedures and scoring set in the original version without changing previous standard administration procedures or scoring criteria. Points of clarification include the addition of tested function and scoring construct for each item.

The **Revised Upper Limb Module** (**RULM**) has been devised to assess motor performance in the upper limbs for individuals with Spinal Muscular Atrophy (SMA)[1.] This revised RULM manual is a result of a working group comprised of physiotherapists (PTs) and occupational therapists (OTs) with specific clinical experience in SMA and trainers within SMA trials (Appendix 1). Based upon experience over the past 10 years of administration and training, the working group led the effort to revise this manual to provide further clarification and refinement of item description and scoring details based on lessons learned from clinical use and therapeutic trials. Additionally, the items used in the kit have been formalized to ensure future standardization. This updated version (2025) supports the original 2014 manual without changes in scoring criteria. We are confident testing conducted using the original 2014 manual is valid and comparable to testing utilizing this updated version.

Conceptual Framework of the RULM

The purpose of an upper limb scale for use in SMA is to assess change that occurs in motor performance of the upper limb over time. Motor performance in SMA is defined as a demonstrated ability to perform a skill under certain test conditions. Motor performance will be impacted by muscle strength, contractures and maturational development (puberty). Therefore, performance potentially changes with disease progression and/or intervention (including surgery) and is based on the observed response on the day of assessment. The scale aims to incorporate performance of shoulder, elbow, wrist and hand function. Specific domains have yet to be established precisely but domains may relate to functional workspace. I.e. high-level shoulder dimension, mid-level elbow dimension, distal wrist and hand dimension. These domains are likely inter-related versus independent of each other. The RULM is intended to capture motor performance related to activities of daily living not typically included in measures of gross motor function. Further work is being conducted to assess the use of the RULM in other conditions and this manual specifically refers to the RULM for SMA

Notes on Testing Procedure
1.Intended population
The RULM is intended to be used in assessing upper extremity function in ambulant and non-ambulant individuals with SMA from childhood to adulthood. It has been validated in children as young as 30 months of age.

The RULM is intended for clinical use (natural history of treated and untreated patients) and for use in clinical trials to capture performance of activities of daily living not typically included in measures of gross motor function.

Consideration for patients unable to understand task requirements due to developmental age or cognition should be noted. Items scored on the RULM can be assessed by observation when cooperation or the ability to follow commands is limited however the validity of scoring for longitudinal comparison should be taken into consideration for determinants of efficacy in these instances.

2. Motor Scale Evaluators

RULM assessments should be performed by individuals who have experience in the handling of children and adults with SMA, such as physical or occupational therapists. Any use of this scale for research purposes should be predicated by the understanding of the scale's starting positions, operational definitions and scoring criteria. The reliability and validity of the RULM have been documented[1], however if the scale is utilized for clinical research, evaluators are encouraged to undergo training to establish reliability prior to beginning data collection.

3. Scoring System

The RULM was initially developed as an add-on module to complement the Hammersmith Functional Motor Scale Expanded (HFMSE) and is therefore designed with a 3-point scoring system. Variables on which the scoring is based vary among the different items with regard to target and finish position or compensation utilized to complete the task. Scoring construct for each item has been added to this manual for further clarification.

Score 0 =
- **Unable to perform task, does not initiate movement**
- **Uses two hands to compete unimanual task**

Score 1 =
- **Able to partially perform the task**
- **Performs the movement incompletely or with compensation**
- **If 2 targets are available, only the lower target is reached**

Score 2 =
- **Able to perform entire task**
- **Performs the movement completely or without compensation**
- **If 2 targets are available, the higher target is reached**

Specific scoring criteria per item is outlined in detail in this manual. In general, a score of 0 means the patient did **not** meet the criteria for a score of 1 or 2. For a score 2, items that allow up to 30˚ of trunk lean as a natural component of the task are noted in scoring details.

4. Positional Definitions

All items are performed with patient sitting in a wheelchair or in an appropriately sized chair with backrest, feet supported and with an adjustable height table or surface.

Seating

- For individuals in a power wheelchair unable to transfer easily, ensure their chair is out of tilt and positioned in 90/90 upright sitting: seat positioned as parallel as possible to the ground with the backrest in an upright position if tolerated. Wheelchair lateral supports and lap belts are ok to use if needed for safety and should remain consistent across subsequent assessments.
- Preferably arm rests removed from all seating options. Please see notes for administering specific items if armrests cannot be removed
- Preferably trunk supports such as a wheelchair chest harness, shoulder belts or Thoracic Lumbar Sacral Orthosis (TLSOs) should not be worn during testing. If not possible to test without trunk support then specify what is used or worn indicating type, and remain consistent across subsequent assessments.

Examination surface
- Ensure a standardized start position (defined below)
- Examination surface should be horizontal and a firm surface
- If patient is seated in wheelchair: adjust the table or surface so that it is placed at armrest level with elbow flexed to 90 degrees and humerus resting at side
- If patient is seated on chair: adjust the table to the patient's height at umbilicus level
- If it is not possible to assume these specified start positions the patient should be placed in the sitting position they spend most of the day in with height set individually at a comfortable working position. Ensure this is documented and remain consistent across subsequent assessments
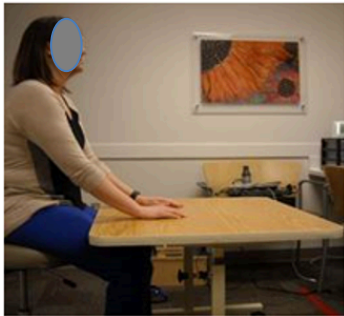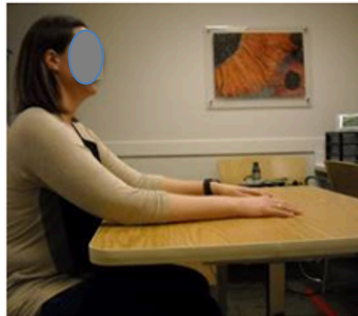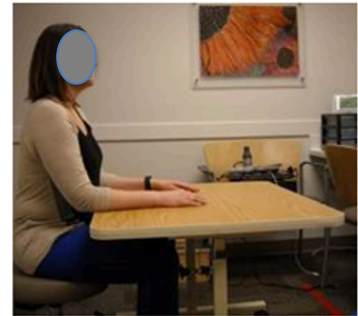
Too low   Too High   Correct

Upper limb positioning
- No upper extremity splints or assistive devices are allowed during the test
- Elbows and forearms can be supported on armrests or table according to specified start position
- RULM takes minimal contractures into account by allowing target finish positions in maximum available passive ROM. Relevant contractures are: elbow flexors, forearm pronators, wrist deviation

Standardized Start Positions:
Arms by sides in full available elbow extension: (seat without armrests or armrests removed) Entry Item A when assessing score 4, 5 and 6 and Item O.

Hands resting in lap with elbows unsupported off of armrest (items B, N, P-T)

Forearms and/or hands resting on table – manipulation items (Item A when assessing score 0, 1, 2,3 and Items C, D, G-M)

Elbow flexed to 90 degrees and humerus resting at side with arm adducted. Target items without weights (E,F) Forearm may slide onto table from armrest if needed.

Note: In all items testing action unilaterally, the contralateral hand should not interfere or assist in the functional movement or contribute to stabilization during movement. It is preferred that the contralateral hand remain resting in the lap for items B, N, P-T and resting at side with elbow flexed to 90 degrees for items E,F as defined in start positions above.

General administration instructions
- Ideally the same evaluator should perform evaluations at subsequent assessments
- Items should be performed in the order provided in this manual
- Using clinical judgement based upon the entry item as a guide, you may choose to attempt a score of 2 without first attempting a score 1 to ease the burden of testing and improve efficiency. If criteria for a score 2 are not met, attempt for a score 1 should then be conducted. If unsure of the patient's capability, you may choose to administer the attempt for a score 1 and if achieved then attempt score 2
- All items should be attempted and scored. If unable for any reason you should document why an item was not attempted
- Ideally each item should be tested and scored individually for both right and left sides unless it is a bimanual activity
- Evaluator may place patient's hands in start position for items starting with hands on examination surface if he/she is unable to do so independently
- It is acceptable for the evaluator to demonstrate the task and suggest alternative strategies within scoring options to ensure patient understanding of each task
- Up to three good attempts are allowed per task
- The patient should wear loose clothing, T-shirt etc. as not to restrict movement. Consider rolling or pulling long sleeves up to reduce friction on surface
- Make note of contractures and mark within each scoring option if these limit function and therefore scoring Limited by Contracture (LBC). If unable to place patient in standardized start position due to contractures a score 0 + LBC should be documented
- Short 5-10 minute rest breaks are allowed but aim to complete the assessment in a reasonable amount of time in one session and on same day.
- Anticipated time to complete the test may range from 15 – 30 minutes, depending on functional level and cooperation of the patient.

Documentation of positioning and contractures on Scoresheet

Describe testing environment and seating positions to keep consistency

REVISED UPPER LIMB MODULE FOR SMA

Date of assessment: ☐☐ / ☐☐☐ / ☐☐☐☐ (D D / M M / Y Y Y Y)
Start Time: (HH:MM): _____:_____ 24-hour clock

Preferred arm: ☐ Right ☐ Left ☐ Ambidextrous
TLSO worn: ☐ Yes* ☐ No *If Yes, specify type:

Patient Name / ID:

Right elbow contracture ☐ Yes ☐ No
Left elbow contracture ☐ Yes ☐ No
Spinal surgery ☐ Yes ☐ No

Assessor Name:
Assessor Signature:

→ **TLSO** if worn during the assessment

Comments:

→ Weelchair/chair, table/examination surface

A. ENTRY ITEM	0	1	2	3	4	5	6
	No useful function of hands.	Can demonstrate use of hands to hold pencil or pick up a token or drive a powered chair, use phone key pad	Can raise 1 or 2 hands to mouth but cannot raise a cup with a 200g weight inside to mouth level	Can raise standardized plastic cup with 200g weight inside to mouth level using both arms/hands if necessary.	Can raise both arms simultaneously to shoulder height with or without compensation. Wrists and elbows at shoulder height. Elbow flexed or in extension	Can partially abduct and raise both arms simultaneously above head (by flexing the elbow shortening circumference of the movement /using accessory muscles)	Can fully abduct both arms simultaneously , elbows in maximum available extension in a full circle

Record contractures that may limit upper extremity function and if they limit scoring

REVISED UPPER LIMB MODULE FOR SMA

Date of assessment: ☐☐ / ☐☐☐ / ☐☐☐☐ (D D / M M / Y Y Y Y)
Start Time: (HH:MM): _____:_____ 24-hour clock

Preferred arm: ☐ Right ☐ Left ☐ Ambidextrous
TLSO worn: ☐ Yes* ☐ No *If Yes, specify type:

Patient Name / ID:

Right elbow contracture ☐ Yes ☐ No
Left elbow contracture ☐ Yes ☐ No
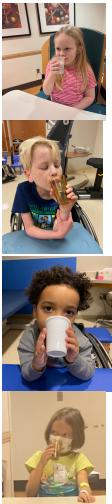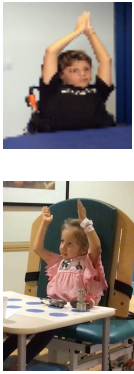Spinal surgery ☐ Yes ☐ No

Assessor Name:
Assessor Signature:
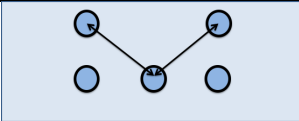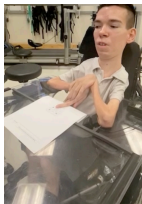
→ Mark if **significant** elbow contractures are present

Comments:

A. ENTRY ITEM	0	1	2	3	4	5	6
	No useful function of hands.	Can demonstrate use of hands to hold pencil or pick up a token or drive a powered chair, use phone key pad	Can raise 1 or 2 hands to mouth but cannot raise a cup with a 200g weight inside to mouth level	Can raise standardized plastic cup with 200g weight inside to mouth level using both arms/hands if necessary.	Can raise both arms simultaneously to shoulder height with or without compensation. Wrists and elbows at shoulder height. Elbow flexed or in extension	Can partially abduct and raise both arms simultaneously above head (by flexing the elbow shortening circumference of the movement /using accessory muscles)	Can fully abduct both arms simultaneously , elbows in maximum available extension in a full circle

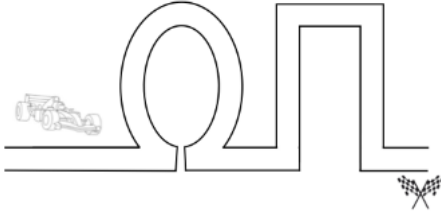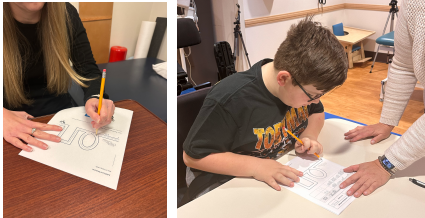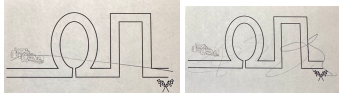|	Description	0	1	2	SCORE R	L
B	Bring hands from lap to table	Unable to bring 1 hand to table	Brings one hand completely to table (independent of opposite hand)	Brings two hands completely to table either simultaneously or one at a time	LBC	LBC
C	Complete the path bringing the car to the finish line without stopping or taking pencil off of paper?	With pencil in hand unable to hold it or make a mark on paper. Does not complete whole path Moves paper instead of hand. Moves pencil grip through movement rather than hand.	Able to complete the path but needs to stop or raises pencil from paper due to muscle weakness. Patient pivots on table or pencil to readjust hand and/or finger	Able to complete the path without stopping or raising hand from paper .to readjust hand/finger position. Hand and pencil move together	LBC	LBC

Mark the LBC box if:
- Start/finish position not achievable due to contractures:
  - Mark 0 and LBC
- Score limited to 0 or 1 due to contractures
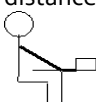 - Mark score and LBC

5. Standardized Equipment
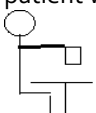
Item	Description	Image
Adjustable table top or surface	Can be a table or adjustable plinth/examination table with firm surface. Table edge facing patient should be a straight edge (preferably not a curved or cut out table edge)	
Tablecloth marked with circles[1]	White non friction surface. Circles and lines will be drawn with black permanent marker or printed according to dimensions specified in Appendix 2 of RULM manual	
HB pencil		
2 Coins/Tokens	$\varnothing$ 24mm	
2 Plastic cups (vending cup) one placed inside the other	The RULM was standardized with European standard cups. Capacity: 200 ml/8 oz *Upper $\varnothing$ 7 cm/2.7in* *Lower $\varnothing$ 4,5 cm/1.7 in* *Height: 8 cm/ 3,1*	
Selection of Calibration metric weights:	200 g 500 g 1 kg	
500 gr gym sand weight[5]	Make sure it can be fastened in a ring shape	
Plastic round container with lid that has lip [6]	Top $\varnothing$: 10cm/4 in Bottom $\varnothing$: 7,5 cm/3 in h: 5cm/2 in	
Push light button with temporary and permanent lighting settings (pressure dependent light)	$\varnothing$ 6,7 cm/2.6 in h: 1,5 cm/0.6 in	
Plain A4 paper	Size A4: 21cm/8.3 in X 29,7cm/11.7 in Paper weight: 80 gsm	

A. Entry item	
Equipment	200g weight and plastic cup (score 3). Token and a pencil if necessary (score 1)
Start position	Ambulant: use a chair with backrest and no armrests. Non-ambulant: use a wheelchair (armrests removed) or other supportive chair no armrests and position the seat and back rest as upright as possible. Score 0-3 Sitting, hands on table, table positioned as referenced in Notes on Testing Procedure Section. Score 4-6 Sitting, arms in full available extension by sides. If arm rests cannot be removed or if patient is unable to transfer to a chair without armrests, ensure start position is arms resting at sides on outside of armrests in as much adduction as possible. Order of assessment for entry item may be based upon clinical judgement.
Finish position	Score 2: All four fingertips should be at mouth level. Elbows may rest on table. Score 3: Cup with 200g with upper rim at mouth level. Can use 1 or 2 hands on cup or contralateral forearm. Elbows may rest on table. Score 4: Both elbows and wrists to reach shoulder height. Elbows flexed or extended. Score 5: Both hands above head simultaneously through partial abduction. Some degree of shoulder flexion allowed. Score 6: Both arms above head simultaneously in full abduction and available elbow extension.
Instruction	For score 0&1: ***"Can you show me how you write or pick up a coin?"*** For score 2/3: ***"Raise your hands/cup to your mouth"*** For score 4-6: ***"Raise your hands/ arms from your sides simultaneously as high as you can"*** Demonstration: For the more able individuals, demonstrate abduction of both arms simultaneously with elbows in extension. For scores 2 and 3, you may cue the patient to perform with hands to mouth rather than flexing head down to hands.
Tested function and scoring construct	Reachable workspace. Score is based upon functional use of extremities for day to day tasks.
Scoring details	Trunk forward flexion allowed up to 30° **Score 2 and 3**. They should not do this by bringing their mouth to their hands. If they need to use significant head and trunk flexion (>30°) in order to complete the task then they cannot score 2 or 3 for this item. Any hand hold on cup is permitted. **Score 4 and 5**. The motion should primarily be shoulder abduction versus motion in the scapular plane. Elbow flexion allowed.

A.ENTRY ITEM	0	1	2	3	4	5	6
	No useful function of hands.	Can demonstrate use of hands to hold pencil or pick up a token or drive a powered chair, use phone key pad	Can raise 1 or 2 hands to mouth but cannot raise a cup with a 200g weight inside to mouth level	Can raise standardized plastic cup with 200g weight inside to mouth level using both arms/hands if necessary.	Can raise both arms simultaneously to shoulder height with or without compensation. Wrists and elbows at shoulder height. Elbow flexed or in extension	Can partially abduct and raise both arms simultaneously above head (by flexing the elbow shortening circumference of the movement /using accessory muscles)	Can fully abduct both arms simultaneously, elbows in maximum available extension in a full circle
			Head and trunk flexion <30°				

B. BRING HANDS FROM LAP TO TABLE	
Equipment	Table
Start position	Start with hands resting on lap. Preferably elbows not supported on armrests Table positioned as referenced in Notes on Testing Procedure Section and approximately forearm distance from abdomen to allow hand movement from lap
Finish position	Entire hand/hands completely over the edge of examination surface to wrist crease
Instruction:	*"Bring your hands from lap onto table"*
Tested function and scoring construct	Bring hands independently (not together or assisted with opposite hand) from lap onto table. Achieving hand onto table or surface
Scoring details	**Score 2:** Task must be completed without use of table edge **Score 1:** Task may be completed with hand(s) crawling onto table with multiple movements to achieve finish position (to wrist crease). Functional movement of the trunk is allowed up to 30˚ forward flexion or lateral flexion. **Score 0**: Brings only fingers onto table (not to level of wrist crease), climbs fingers on chest. Uses two hands clasped together or assists with opposite hand

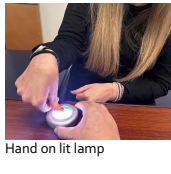|	0	1	2
	Unable to bring 1 hand onto table 	Brings one hand completely to table (independent of opposite hand) **Finish position (score right hand)**	Brings two hands completely to table either simultaneously or one at a time
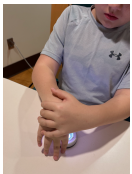
C. TRACING A PATH	
Equipment	- Standard HB pencil. - Standard path provided in scoresheet (Appendix 3)
Start position	Sitting, start with forearms and/or hand(s) on table. Table positioned as referenced in Notes on Testing Procedure Section. The paper may be positioned by the patient or evaluator in a position desired by patient (i.e., straight or turned) however the paper then must remain stationary for the duration of the task. The paper can be stabilized by the patient or evaluator while the task is being completed. The patient can either pick up the pencil or have the pencil placed in their hand at the start of the test. Any hand placement, handhold or grip of the pencil is allowed.. The handhold should ensure that the task is completed through hand movement and not movement of the pencil (maneuvering the pencil forward between fingers) or paper.
Instruction	***"Can you complete the path bringing the car to the finish line without stopping or taking pencil off of paper? Do your best to stay within the lines and follow the course"*** Make clear to the patient that it is not necessary to precisely stay within the lines but just follow the course by marking all turns.
Tested function and scoring construct	Hand function (tripod, palmar, jaw chuck), holding objects, drawing/writing. Ability to complete path.
Scoring details	Demonstrate task and consider developmental issues with younger patients. Completes path indicates a continuous line is drawn mostly within drawn path lines **Score 0**: Moves paper during task or does not complete the entire path **Score 1**: Completes path but hand stops or rests and pivots to readjust hand/arm position due to weakness (not due to precision). **Score 2:** Completes full path without stopping or raising pencil to adjust hand/arm position. Hand and pencil move at the same time
Scoring considerations	• Developmental issues for very young patients: Strategy tip, allow patient to follow the evaluator's finger along the path; if unable to understand or perform task as intended consider marking Cannot Test (CNT) • Any hand hold is allowed but the grip cannot be readjusted to extend pencil reach during the movement for a score of 1 or 2

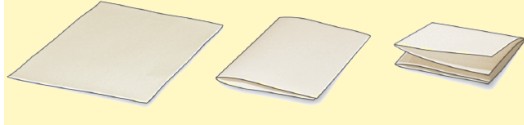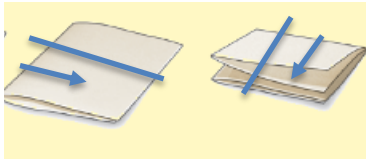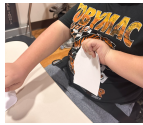|	**0**	**1**	**2**
	With pencil in hand unable to hold it or make a mark on paper. Does not complete whole path Moves paper instead of hand. Moves pencil grip through movement rather than hand. 	Able to complete the path but needs to stop or raises pencil from paper due to muscle weakness. Patient pivots on table or pencil to readjust hand and/or finger	Able to complete the path without stopping or raising hand from paper to readjust hand/finger position. Hand and pencil move together

D. PICK UP TOKENS

Equipment:	2 tokens (see Equipment List for standardized token size)
Start position:	Sitting, start with forearms and/or hand(s) on table. Table positioned as referenced in Notes on Testing Procedure Section. If not possible, adapted position is allowed but hands must be on the table. Place both tokens on the table surface (not stacked) in front of the patient within reach.
Finish position	Picking up coin/s from table surface and holding in the palm of the hand
Instruction:	***"Can you pick up these tokens one at a time with one hand and hold them in your palm?"***
Tested function and scoring construct	Distal motor function, picking up small light objects. Hand manipulation
Scoring details	**Score 0:** Stacking the tokens on top of each other before they are picked up. Sliding tokens off edge of examination surface. Unable to lift 1 token from the surface. **Score 1**: Token is picked up/lifted from surface but no movement to palm is required **Score 2:** Tokens should be picked up with individual fingers versus a raking grasp and transitioned from fingertip to palm individually
Scoring considerations	Can repeat test up to 3 times if tokens are dropped Supination of forearm is not required for score 1 or 2 Document any impact differences in nail length may have on scoring

	0	1	2
	Cannot pick up one token Slides token off edge of table	Can lift/pick up one token from table using any part of fingers. It does not have to transition from fingers to palm of hand 	Can pick up and hold 2 tokens in hand/palm Tokens are picked up one at a time and transitioned to palm

E. PLACE TOKEN INTO CUP ON TABLE OR SHOULDER HEIGHT		

Equipment:	Token, cup, table
Start position:	Sitting, with elbows flexed to 90˚ resting on armrest or on lap. Arm adducted Table positioned as referenced in Notes on Testing Procedure Section Cup placed at target according to scoring detail below. Target should be set by physically assessing the patient's available passive range of motion.
Target position 	Score 1: Token placed in hand Evaluator brings the patient's arm into maximal available elbow extension in front of them, and positions the cup <u>horizontally</u> underneath hand with the rim aligned at the distance of the wrist crease Score 2: Token placed in hand Cup should be held by the evaluator <u>vertically</u> at 90 ˚ of shoulder flexion and in maximal available elbow extension with cup's rim under hand directly in front of patient with the rim aligned at the distance of the wrist crease
Instruction:	***"Can you place the token in the cup with control and without throwing it?"***
Tested function and scoring construct	Moving objects in front of body on table surface and in front of body at shoulder height. Score based upon reaching target with functional movement
Scoring detail:	**Score 0:** throwing coin, hand does not reach cup or arm movement is uncontrolled **Score 1:** hand and forearm can slide on examination surface from armrest or from resting at side. Hand and arm can move segmentally. **Score 2:** Hand must reach and maintain momentarily shoulder level with control. Patient cannot use cup rim as leverage for fingers, weight of hand or arm should not rest on cup rim to maintain end position
Scoring considerations:	Score based on reaching target. Up to 30° trunk forward flexion compensation is allowed Contralateral hand does not contribute or assist in the movement, ideally rests on armrest or lap Any combination of shoulder flexion/abduction is allowed for a score 1 or 2

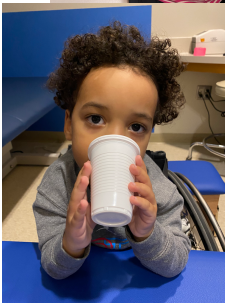|	0	1	2
Finish position	Unable to bring token and place into cup. Throws the coin without reaching cup with fingers	Able to bring token to cup placed horizontally on table Fingers reach inside edge of cup 	Able to bring token to cup placed vertically at shoulder height and maintain momentarily shoulder level with control Fingers reach inside of cup *Note, left hand is resting on table but not assisting with action
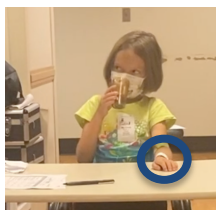
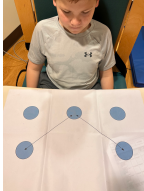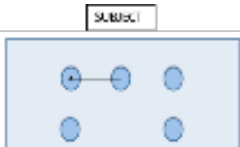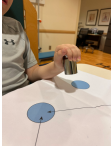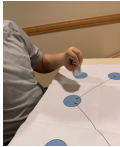| F. REACH TO THE SIDE AND TOUCH TOKEN			
Equipment	Token		
Start position	Sitting, with both elbows flexed to 90 ° resting on armrest or on lap. Arm adducted Contralateral arm on armrest or on lap Token placed at target according to scoring detail below		
Target position 	Target should be set by physically assessing the patient's available passive range of motion. Score 1: Evaluator places token at the height of 90° shoulder abduction(shoulder height), with maximal available elbow extension and <u>wrist length</u> from patient. Score 2: Evaluator places token at the height of 135° shoulder abduction (approximately elbow at least at eye level) maximal available elbow extension at <u>fingertip length</u>.		
Instruction	***"Can you take the token from my hand?"***		
Tested function and scoring construct	Score based on reaching target. Up to 30° trunk lateral flexion is allowed Take/bring objects at side at shoulder height and above. Score based upon reaching target with functional and intentional movement with control		
Scoring details	Up to 30° trunk lateral flexion is allowed Contralateral hand does not contribute or assist in the movement **Score 0:** hand does not reach coin placed at shoulder height **Score 1:** any combination of shoulder external rotation, abduction and/or flexion can be used. Elbow may be flexed due to target placed at wrist length. **Score 2:** any combination of shoulder external rotation, abduction and/or flexion can be used. Elbow will be in maximal available extension due to target placed at fingertip length Hand must reach and maintain target level with control Patient cannot use the coin or evaluator's hand as leverage for fingers, weight of hand or arm should not rest on evaluator's hand to maintain end position		
Finish position	**0**	**1**	**2**
	Target: Shoulder 90° abduction with token at wrist length from patient Cannot bring hand to shoulder height to reach coin Brings hand to shoulder height and reaches coin but uses excessive compensation (more than 30°) Measured target *Score 0 due to excessive compensation with trunk lean and support on table	*Target: Shoulder 90° abduction, token at wrist length from patient* Reaches coin, brings hand to shoulder height. elbow may be bent or extended. Performed with control Measured target Reaches level of lower target	*Target: Shoulder 135° abduction, token at fingertip length from patient* Brings hand above shoulder height, elbow at least at eye level (135 deg abd) and at maximal available extension. Performs with control. Reaches level of higher target

G. PUSH A LIGHT
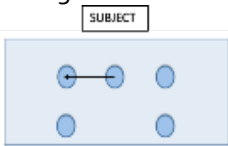
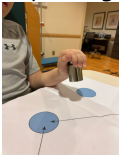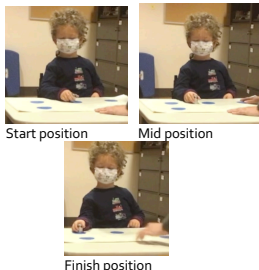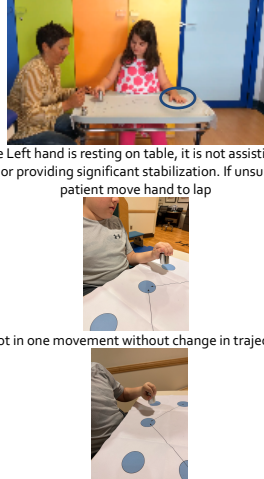| Equipment:	Push button light (pressure dependent light)
Start position:	Sitting, start with forearms and/or hand(s) and forearm on table. table positioned as referenced in Notes on Testing Procedure Section. The light is placed on the table within reach of the patient and may be kept still by contralateral hand of the patient or evaluator without providing counterforce. Ensure the surface is firm.
Instruction:	***"Can you turn the light on by pushing it with the fingers and/or thumb of one hand?"***
Tested function and scoring construct	Pushing/activating buttons Function tested is distal strength. Should not be the weight or force of the arm or trunk performing the motion.
Scoring details:	The light must remain flat on the table and cannot be lifted from surface or squeezed between fingers The light must be kept still/stabilized by a non-slip surface, patient's contralateral hand or evaluator Patient can only use their fingers and/or thumb to activate the light The wrist may be off of the table to accommodate for hyperlaxity of fingers Instruct the patient to press in the center of the light Pictures depict common and acceptable compensations **Score 0:** Squeezing light between fingers or banging on it Activating light with elbow higher than the wrist using the weight of the arm to push the light Activating the light by leaning body weight onto light

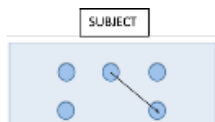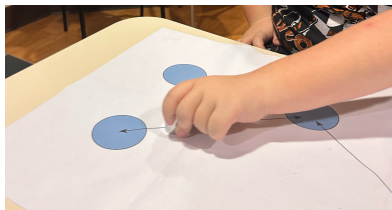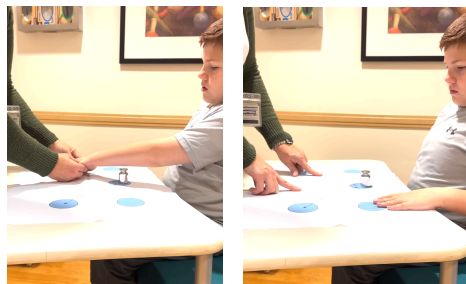|	**0**	**1**	**2**
	Unable to turn the light on with fingers and/or thumb of one hand. Activates light with two hands 	Able to turn the light on momentarily (light does not stay lit when pressure removed) with fingers and/or thumb of one hand. Hand on lit lamp when lifted, light turns off	Able to turn the light on permanently (light stays lit when pressure removed) with fingers and/or thumb of one hand. Hand on lit lamp when lifted, light stays on

H. TEARING PAPER

Equipment:	Several sheets of A4 paper
Start position:	Sitting, start with forearms and/or hands on table. Table positioned as referenced in Notes on Testing Procedure Section. **Score 2:** Piece of paper folded in 4, with fingers placed on folded edge towards top (2 folds as depicted below) **Score 1:** Piece of paper folded in 2, with fingers placed on folded edge towards top (1 fold as depicted below) Not folded Folded in 2 Folded in 4 3 trials allowed. Each trial should be completed with fingers placed at a different location on the folded edge of the paper. At each trial/location, you have a maximum of 3 efforts/movements to initiate the tear. Once a tear is initiated the patient must complete the tear across the width of the paper within 3 additional efforts/movements. This should be a bimanual task and stabilizing the paper on the table to tear with one hand is not allowed.
Instruction:	***"Can you tear this paper starting from the folded edge?"***
Tested function and scoring construct	Distal function, wrist and finger function. Tear initiated with fingertips as a bimanual task. Initiate the tear means that the paper has been torn partially. The complete task is then to complete the tear across the majority of the width of the paper.
Scoring details	To complete the full task, the tear must be started at the folded edge and completed across the majority of the width (approximately >75% of width of paper) of the page or between edges (not across a shortened corner) Folded in 2 folded in 4 **Score 0:** Uses whole hand to initiate tear rather than fingertips, can only tear an unfolded piece of paper

	0	1	2
	Cannot tear folded piece of paper using fingertips 	Tears the sheet of paper folded in 2, beginning from the folded edge 	Tears the sheet of paper folded in 4, beginning from the folded edge

I. OPEN CONTAINER	
Equipment:	Standard round plastic container (refer to equipment list)
Start position:	Sitting, start with forearms and/or hands on table. Table positioned as referenced in Notes on Testing Procedure Section. Container placed in front of patient within patient's reach or evaluator may place container in patient's hands.
Instruction:	***"Can you take the lid off the container?"***
Tested function and scoring construct	Opening containers While this is a bimanual task, both Right and Left sides should be tested independently. The side tested or scored is the hand holding the lid/opening the lid while the other hand holds the body of the container. Left hand tested depicted below
Scoring details	If unable to open the container on first attempt the evaluator can suggest alternative strategies (stabilizing container with one hand against body while prying lid off completely with alternate hand). The patient can complete the task in more than one movement. **Score 0:** lid not removed completely. Uses something other than 2 hands (i.e. edge of examination surface or other parts of body/mouth) to remove the lid **Score 1:** lid is completely removed with hands (with or without support/stabilization of the table or body) Please note: 1. Changing containers may impact scoring, a newer container can be more difficult to open if compared with an "used" one. 2. When the container is closed, air could remained trapped creating a vacuum effect. To avoid this, the evaluator should always open and close the container before asking the person to attempt the task. 3. When testing both right and left sides, ensure that the container is closed completely when switching to assess the second side

	0	1
	Unable to open. 	Able to completely open container, on table surface or against body
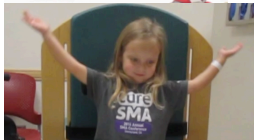
J. RAISE CUP with 200g TO MOUTH	
Equipment:	2 cups one inside each other with 200g calibration weight inside
Start position	Sitting, start with forearms and/or hands on table. Table positioned as referenced in Notes on Testing Procedure Section. Cup may be placed in hand or on table in front of patient within their reach.
Instruction	***"Can you raise the cup to your mouth as if you were drinking?"***
Tested function and scoring construct	Lifting weight at mouth level. Drinking
Scoring details	**Reassess and score even if observed during entry item** Up to 30 ° of trunk forward flexion is allowed Any hand hold and hand placement on cup are allowed Elbow can remain in contact with table while cup is lifted Upper and Inner rim should reach the level (height) of the mouth, however It is not required that the rim of the cup touch the mouth or that the cup be tipped as if to drink **Score 0:** All of cup's upper rim does not reach mouth level Excessive neck and trunk forward flexion by bringing their mouth to their hands **Score 1:** uses two hands on cup or one hand to assist contralateral forearm **Score 2:** brings cup to mouth with one hand

	0	**1**	**2**
	Unable to bring cup to mouth	Able to bring cup with 200g to mouth level using 2 hands	Able to bring cup with 200g to mouth using 1 hand
	 Excessive neck and trunk flexion by bringing their mouth to their hands	 	 Note: hand is resting on table but not assisting with action *Elbow may or may not rest on table
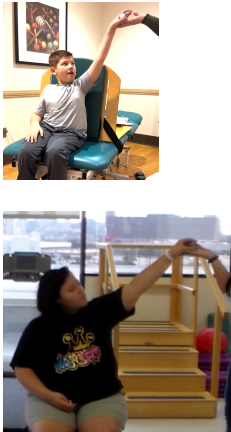
K. MOVING 200gr WEIGHT ON TABLE HORIZONTALLY	
Equipment	- Standard tablecloth with 2 circles drawn 20cm apart (see Appendix 2) - Calibration weight <u>200 g</u> - Table (preferably straight edge)
Start position	Tablecloth should be placed (see Appendix 2) with center circle aligned with patient's umbilicus and aligned with table edge (straight edge) so that innermost circles are 10 cm from examination surface edge Weight is placed on the center circle, and patient's hand and forearm are resting next to the weight. Contralateral hand rests in lap.
Finish position	The patient moves the weight from the center circle to the outer circle on the tested side.
Instruction	*"Can you lift this weight from the center circle to the outer circle with one hand in one motion?"*
Tested function and scoring construct	Hand function (grip, pinch), forearm function, moving objects on horizontal plane. Movement occurs from upper extremity, functional trunk lean allowed but should not be primary method of movement
Scoring details	Up to 30° lateral trunk flexion is allowed Any hand grasp/placement is allowed to hold and move the weight **Score 0:** Patient does not fully bring weight to outer circle. Weight is not moved in one single motion, segmentally moves weight, patient stops or changes trajectory during task. Uses two hands instead of one. **Score 1:** slide is defined as weight and/or hand and/or forearm remain in contact with examination surface. The weight may be pushed or slid by any portion of the hand (dorsal or palmar surface is allowed). Movement occurs in one movement without any change in trajectory. **Score 2**: lift is defined as weight, hand and forearm clear the surface for duration of movement. Pivoting on elbow or proximal aspect of forearm on edge of table is allowed as long as the forearm does not slide along edge of table. Movement occurs in one movement without any change in trajectory straight line across) and with control. Example of pivot, acceptable for a score of 2 if performed in one movement without change in trajectory Example of lift, acceptable for a score of 2 if performed in one movement without change in trajectory

	0	1	2
<u>Between horizontal circles</u> **(CENTER TO OUTER CIRCLE)**	Unable	Slide 200g weight Start position Midmovement Forearm, hand and/or weight slide along table in one movement and without changing trajectory	Lift 200g weight Hand and weight lift from table in one movement and without changing trajectory *While Left hand is resting on table, it is not assisting with action or providing significant stabilization. If unsure, have patient move hand to lap or score down

L. MOVING 500gr WEIGHT ON TABLE HORIZONTALLY

Equipment	- Standard tablecloth with 2 circles drawn 20cm apart (see Appendix 2) - Calibration weight <u>500 g</u> - Table (preferably straight edge)
Start position	- Tablecloth should be placed (see Appendix 2) with center circle aligned with patient's umbilicus and at 10 cm from examination surface edge Weight is placed on the center circle, and patient's hand and forearm are resting next to the weight. Contralateral hand rests in lap.
Finish position	The weight is moved from the center circle to outer circle on tested side Weight placed by patient in outer circle on tested side
Instruction	***"Can you lift this weight from the center circle to the outer circle with one hand in one motion"?***
Tested function and scoring construct	Hand function (grip, pinch), forearm function, moving objects on horizontal plane. Movement occurs from upper extremity, functional trunk lean allowed but should not be primary method of movement
Scoring details	Up to 30° lateral trunk flexion is allowed Any hand grasp/placement is allowed to move the weight **Score 0:** Patient does not fully bring weight to outer circle. Weight is not moved in one single motion, segmentally moves weight, patient stops or changes trajectory during task. Uses two hands instead of one. **Score 1:** slide is defined as weight and/or hand and/or forearm remain in contact with examination surface. The weight may be pushed or slid by any portion of the hand (dorsal or palmar surface is allowed). Movement occurs in one movement without any change in trajectory. **Score 2**: lift is defined as weight, hand and forearm clear the surface for duration of movement. Pivoting on elbow or proximal aspect of forearm is allowed as long as the forearm does not slide along edge of table. Movement occurs in one movement without any change in trajectory (straight line across) and with control. Example of pivot, acceptable for a score of 2 if performed in one movement without change in trajectory

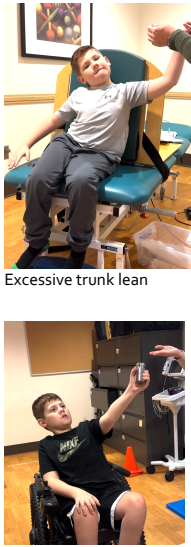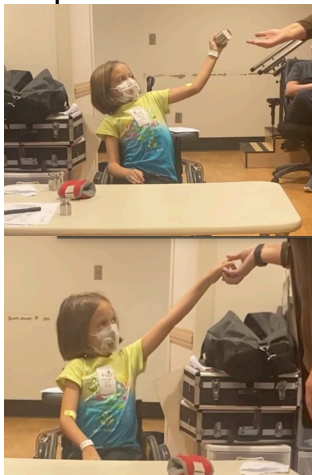|	0	1	2
<u>**Between horizontal circles**</u> **(CENTER TO OUTER CIRCLE)**	Unable	Able to **slide** 500 g weight Start position Mid position Finish position Forearm, hand and/or weight slide along table in one movement and without changing trajectory	Able to **lift** 500 g weight *While Left hand is resting on table, it is not assisting with action or providing significant stabilization. If unsure, have patient move hand to lap Pivot in one movement without change in trajectory Arm fully clear in one movement without change in trajectory

M. MOVING WEIGHT ON TABLE DIAGONALLY	
Equipment	- Standard tablecloth with 2 circles drawn 20cm apart (see Appendix 2) - Calibration weight <u>200 g</u> - Table (preferably straight edge)
Start position	- Tablecloth should be placed (see Appendix 2) with center circle aligned with patient's umbilicus and at 10 cm from examination surface edge Weight is placed on the center circle, and patient's hand and forearm are resting next to the weight. Contralateral hand rests in lap.
Finish position	The weight is moved <u>across midline</u> from the center circle toward the upper outer circle on opposite side. *If patient is unable to reach the upper outer circle at full available passive extension without moving out of his base of support or with excessive trunk lean, a target should be set. To establish target, with the patient sitting upright, bring patient's arm in maximal available passive elbow extension with hand along line and mark target with finger at the patient's center of the palm.
Instruction	***"Can you lift this weight from this circle to this circle with one hand in one motion?"***
Tested function and scoring construct	Hand function, forearm function, moving objects on horizontal plane across midline
Scoring details **<u>Between diagonal circles</u>** **(ACROSS MIDLINE, CENTER TO OUTER CIRCLE OPPOSITE SIDE)**	Patient can be in full elbow extension without moving out of base of support and keeping hand along the line, although not necessarily reaching the opposite diagonal circle according to arm length or maximal available elbow extension Any hand hold is allowed to move the weight **Score 0:** patient does not fully bring weight to outer circle or to established target. Weight is not moved in one single motion, patient stops or changes trajectory during task. Uses two hands on weight. Uses only trunk motion **Score 1:** slide is defined as weight and/or hand and/or forearm remain in contact with examination surface for all or part of the movement **Score 2**: lift is defined as weight, hand, forearm and elbow clear surface for whole duration of movement.

0	1	2
Unable	Slide 200g weight Start Position Mid Position Finish Position	Lift 200g weight Lift with weight,, hand, forearm and elbow clear of the table throughout the movement. 30 deg movement of trunk is allowed.

N. BRING 500G WEIGHT FROM LAP TO TABLE	
Equipment:	500 g ankle/wrist gym sand weight fastened in a tight ring shape Table
Start position:	Sitting, start with hands resting on thighs and weight (500 g) placed on patient's lap. Evaluator may position or adjust handhold with fingers inside weight for stable grip before lifting weight Weight may be positioned horizontal or vertical according to the patient's preferred handhold. Table positioned referenced in Notes on Testing Procedure Section and forearm distance from abdomen to allow hand movement from lap.
Finish position:	Score 1: weight on table Score2: weight lifted to eye level with shoulders at least 90° flexion Evaluator's hand is placed in midline at patient's eye level and wrist length measured at 90° shoulder flexion
Instruction:	*Score 1: Can you bring the weight from your lap onto the table with 2 hands?* *Score 2: Can you bring the weight from your lap onto my hand with 2 hands?*
Tested function and scoring construct	Bring objects from lap onto table or shoulder height with 2 hands
Scoring details	Weight must be lifted with two hands and with any hand grasp/placement (hands around weight, fingers inside weight) Task should be completed with the weight free of the body or examination surface for whole duration of movement Forward Trunk flexion Up to 30° allowed **Score 0:** uses body or edge of examination surface to bring weight (rolls weight up using edge of table); Uses only one hand

	0	1	2
	Unable to bring weight to table using two hands, rolls weight up edge of table. 	Brings weight from lap fully onto table using two hands 	Brings weight from lap to eye level using two hands

O. BRING BOTH ARMS ABOVE HEAD - *Bilateral Shoulder abduction*	
Start position:	Arms resting alongside of trunk. If unable to transfer patient out of wheelchair, arms should be positioned so that the armrests don't interfere with the movement Table removed from testing area
Finish position	Full shoulder abduction with arms in full available extension above head, arms or hands do not need to touch.
Instruction	***"Raise your arms out to the side and above your head keeping your elbows straight."***
Tested function and scoring construct	Full shoulder abduction with or without compensation
Scoring details	**Reassess and score even if observed during entry item A** **Score 0:** cannot fully lift arms overhead simultaneously using only shoulder abduction while maintaining elbow extension. Uses shoulder flexion. Arms do not move independently, simultaneously or clasp together to assist **Score 1:** flexes elbows due to weakness or compensates during movement but reaches final position of full shoulder abduction using only shoulder abduction **Score 2:** Brings fully extended arms above head by only using shoulder abduction while maintaining elbow extension and without compensation. Maintains full available elbow extension throughout the duration of the movement.

	0	1	2
	Unable 	Can **fully abduct** both arms simultaneously above head only by first flexing the elbows (using compensation). Arms move independent of each other *It is not necessary that hands touch at end of movement	Can **fully abduct** both arms simultaneously with elbows in maximum available extension in a full circle . Arms move independent of each other and simultaneously

P. BRING 500 g weight ABOVE SHOULDER HEIGHT WITH EXTENDED ARM- *Unilateral Shoulder abduction*	
Equipment:	500 g calibration weight
Start position:	Both hands hand resting on lap. Evaluator places weight in patient's hand. Any grasp pattern/handhold is allowed. Preferred chair without armrests Table removed from testing area Contralateral hand must remain in the individuals lap
Finish position	Target should be set by physically assessing the patient's available passive range of motion. Score 1&2: evaluator places hand at 135° shoulder abduction, maximum available elbow extension and wrist length from patient. Arm extended out to side above head (elbow to eye level) approximately 135° of shoulder abduction and maximal available elbow extension **Always take weight from them once they have reached maximum height** (to avoid eccentric muscle work).
Instruction	*"Can you give me the weight"*
Tested function and scoring construct	Bringing objects at shoulder height and above using a combination of shoulder external rotation with shoulder abduction and elbow extension, take/bring objects to side of body at shoulder height and above. Score based upon reaching target with/without compensation, with functional and intentional movement and control.
Scoring details	Up to 30° trunk lateral flexion compensation is allowed for a score of 1 or 2. **Score 0:** does not achieve finish position or uses movements other than shoulder abduction (i.e. shoulder flexion), uncontrolled movement, throwing the weight, more than 30° trunk compensation. If patient achieved a score of 0 or 1 on item F you may consider skipping administration and score 0 **Score 1:** achieves finish position using controlled movements predominantly through abduction with upper extremity compensatory strategies such as: Absence or asynchrony of movements described for score 2 **Score 2:** achieves finish position using simultaneous combination of shoulder external rotation with shoulder abduction and elbow extension. Movement predominantly through abduction. Movement is controlled through entire range of motion (Up to 30° trunk lateral flexion compensation is allowed)

	0	1	2
	Unable to lift 500g weight to targe even with compensation 	Able to lift 500g weight **with compensation** Segmental movement to reach finish position	Able to lift 500g weight **without compensation**

Q. BRING 1 kg WEIGHT ABOVE SHOULDER HEIGHT WITH EXTENDED ARM- *Unilateral Shoulder abduction*	
Equipment:	1 kg calibration weight
Start position:	Both hands hand resting on lap. Evaluator places weight in patient's hand. Any grasp pattern/handhold is allowed. Preferred chair without armrests Table removed from testing area Contralateral hand must remain in the individuals lap
Finish position	Target should be set by physically assessing the patient's available passive range of motion. Score 1&2: evaluator places hand at 135° shoulder abduction, maximum available elbow extension and wrist length from patient. Arm extended out to side above head (elbow to eye level) approximately 135° of shoulder abduction and maximal available elbow extension. **Always take weight from them once they have reached maximum height** (to avoid eccentric muscle work).
Instruction	*"Can you give me the weight"*
Tested function and scoring construct	Bringing objects at shoulder height and above using a combination of shoulder external rotation with shoulder abduction and elbow extension, take/bring objects to side of body at shoulder height and above. Score based upon reaching target with/without compensation, with functional and intentional movement and control.
Scoring details	Up to 30° trunk lateral flexion compensation is allowed for a score of 1 or 2. **Score 0:** does not achieve finish position or uses movements other than shoulder abduction (i.e. flexion), uncontrolled movement, throwing the weight, more than 30° trunk compensation. If patient achieved a score of 0 on item P you may skip administration and score 0 **Score 1:** achieves finish position using controlled movements predominantly through abduction with compensatory strategies such as: Absence or asynchrony of movements described for score 2 **Score 2:** achieves finish position using simultaneous combination of shoulder external rotation with shoulder abduction and elbow extension. Movement predominantly through abduction. Movement is controlled through entire range of motion, (Up to 30° trunk lateral flexion compensation is allowed)

0	1	2
Unable to lift 1kg weight even with compensation	Able to lift 1kg weight **with compensation**	Able to lift 1kg weight **without compensation**
 Excessive trunk lean Movement through flexion	 Segmental movement to reach finish position	 Target set Reaches finish position without compensation

R. BRING HAND ABOVE SHOULDER HEIGHT WITH EXTENDED ARM- *Unilateral Shoulder flexion*	
Equipment	None
Start position:	Both hands resting on lap. Preferred chair without armrests Table removed from testing area Contralateral arm must remain in the individuals lap
Finish position	Target should be set by physically assessing the patient's available passive range of motion. Score 1&2: evaluator places hand at 135° shoulder flexion, maximum available elbow extension and wrist length from patient. Arm extended in front above head (elbow to eye level) approximately 135° of shoulder flexion and maximal available extension
Instruction	*"Reach in front and touch my hand"*
Tested function and scoring construct	Bringing objects at shoulder height and above using a combination of shoulder flexion and elbow extension, take/bring objects in front of body at shoulder height and above. Score based upon reaching target with/without compensation, with functional and intentional movement and control.
Scoring details	Up to 30° trunk forward flexion compensation is allowed for a score of 1 or 2. **Score 0:** does not achieve finish position or uses movements other than shoulder flexion (i.e. abduction), uncontrolled movement, throwing hand. **Score 1:** achieves finish position using Movement predominantly through flexion. Movement is controlled. Compensation: Absence or asynchrony of one of the previously mentioned movement components **Score 2:** achieves finishing position using simultaneous combination of shoulder flexion and elbow extension. Movement predominantly through flexion. Movement is controlled through entire range of motion. (Up to 30° trunk forward flexion compensation is allowed)

	0	1	2
	Unable Does not reach target height Excessive trunk lean Movement through abduction	Able **with** compensation	Able **without** compensation

S. BRING 500 g WEIGHT ABOVE SHOULDER HEIGHT WITH EXTENDED ARM- *Unilateral Shoulder flexion*	
Equipment:	500 g calibration weight
Start position:	Both hands hand resting on lap. Evaluator places weight in patient's hand. Any grasp pattern/handhold is allowed. Preferred chair without armrests Table removed from testing area Contralateral hand must remain in the individuals lap
Finish position	Target should be set by physically assessing the patient's available passive range of motion. Score 1&2: evaluator places hand at 135° shoulder flexion, maximum available elbow extension and wrist length from patient. Arm extended in front above head (elbow to eye level) approximately 135° of shoulder flexion and maximal available extension **Always take weight from them once they have reached maximum height** (to avoid eccentric muscle work).
Instruction	*"Can you give me the weight"*
Tested function and scoring construct	Bringing objects at shoulder height and above using a combination of shoulder flexion and elbow extension, take/bring objects in front of body at shoulder height and above. Score based upon reaching target with/without compensation, with functional and intentional movement and control.
Scoring details	Up to 30° trunk forward flexion compensation is allowed for a score of 1 or 2. **Score 0:** does not achieve finish position or uses movements other than shoulder flexion (i.e. abduction), uncontrolled movement, throwing hand. If patient achieved a score of 0 on item R you may skip administration and score 0 **Score 1:** achieves finish position using Movement predominantly through flexion. Movement is controlled. Compensation: Absence or asynchrony of one of the upper extremity movement components **Score 2:** achieves finishing position using simultaneous combination of shoulder flexion and elbow extension. Movement predominantly through flexion. Movement is controlled through entire range of motion. (Up to 30° trunk forward flexion compensation is allowed)

	0	1	2
	Unable to lift 500g weight even with compensation Weight not lifted to correct height Weight lifted through abduction	Able to lift 500 g weight **with compensation** Asynchronous movement through flexion 	Able to lift 500 g weight **without compensation** Target set Finish Position without compensation

T. BRING 1 kg WEIGHT ABOVE SHOULDER HEIGHT WITH EXTENDED ARM- *Unilateral Shoulder flexion*	
Equipment:	1 kg calibration weight
Start position:	Both hands hand resting on lap. Evaluator places weight in patient's hand. Any grasp pattern/handhold is allowed. Preferred chair without armrests Table removed from testing area Contralateral hand must remain in the individuals lap
Finish position	Target should be set by physically assessing the patient's available passive range of motion. Score 1&2: evaluator places hand at 135° shoulder flexion, maximum available elbow extension and wrist length from patient. Arm extended in front above head (elbow to eye level) approximately 135° of shoulder flexion and maximal available elbow extension **Always take weight from them once they have reached maximum height** (to avoid eccentric muscle work).
Instruction	*"Can you give me the weight"*
Tested function and scoring construct	Bringing objects at shoulder height and above using a combination of shoulder flexion and elbow extension, take/bring objects in front of body at shoulder height and above. Score based upon reaching target with/without compensation, with functional and intentional movement and control.
Scoring details	Up to 30° trunk forward flexion compensation is allowed for a score of 1 or 2. **Score 0:** does not achieve finish position or uses movements other than shoulder flexion (i.e. abduction), uncontrolled movement, throwing hand. If patient achieved a score of 0 on item S you may skip administration and score 0 **Score 1:** achieves finish position using movement predominantly through flexion. Movement is controlled. Compensation: Absence or asynchrony of one of the upper extremity movement components **Score 2:** achieves finishing position using simultaneous combination of shoulder flexion and elbow extension. Movement predominantly through flexion. Movement is controlled through entire range of motion. (Up to 30° trunk forward flexion compensation is allowed)

	0	1	2
	Unable to lift 1kg weight even with compensation Hand/Weight does not reach target height	Able to lift 1kg weight **with compensation**	Able to lift 1kg weight **without compensation**

References

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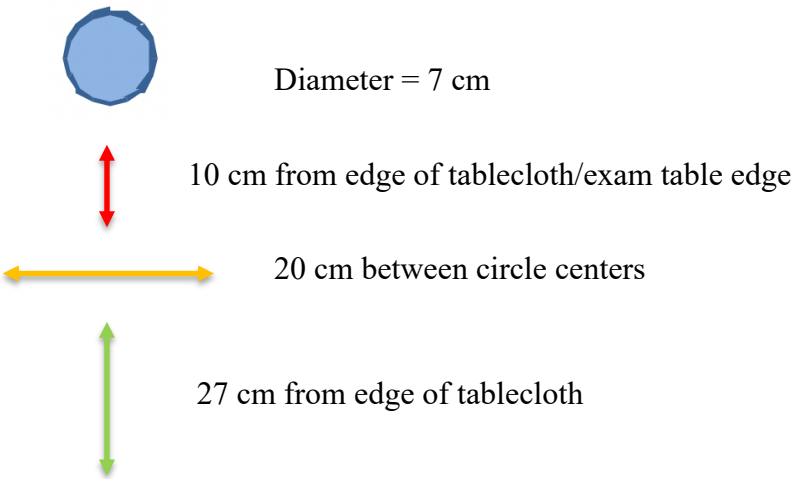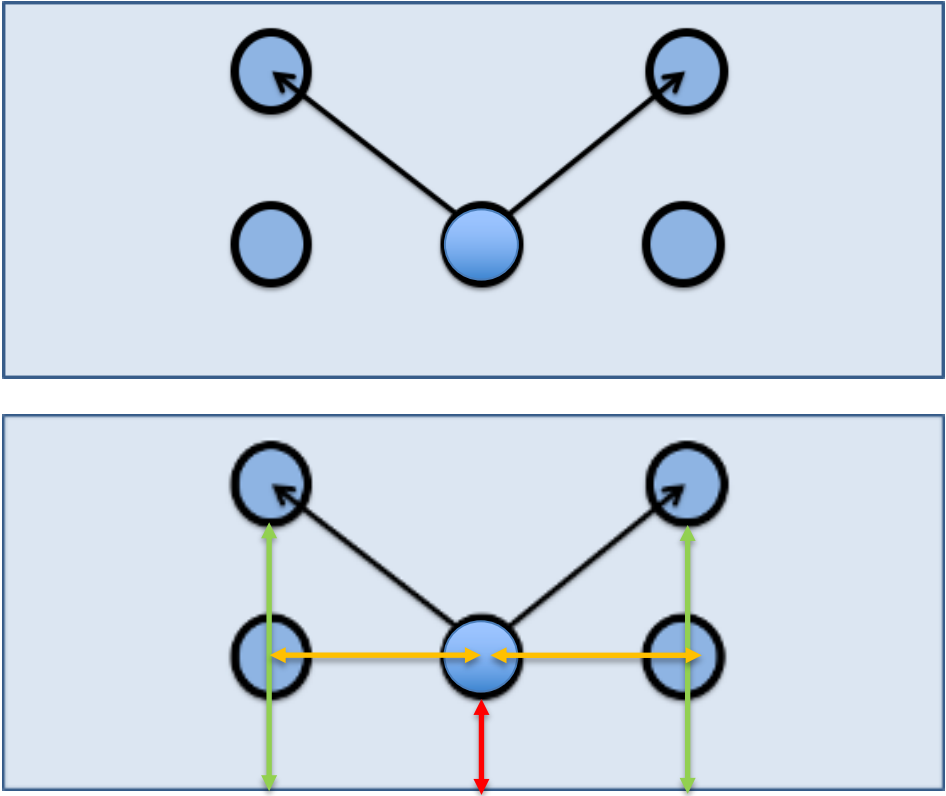
Appendix 1
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Appendix 2
Tablecloth dimensions and layout

Diameter = 7 cm

10 cm from edge of tablecloth/exam table edge

20 cm between circle centers

27 cm from edge of tablecloth

Appendix 3
Dimensions of Path for Item C

Please note: Adjustments may be necessary depending on paper size of printed proforma.
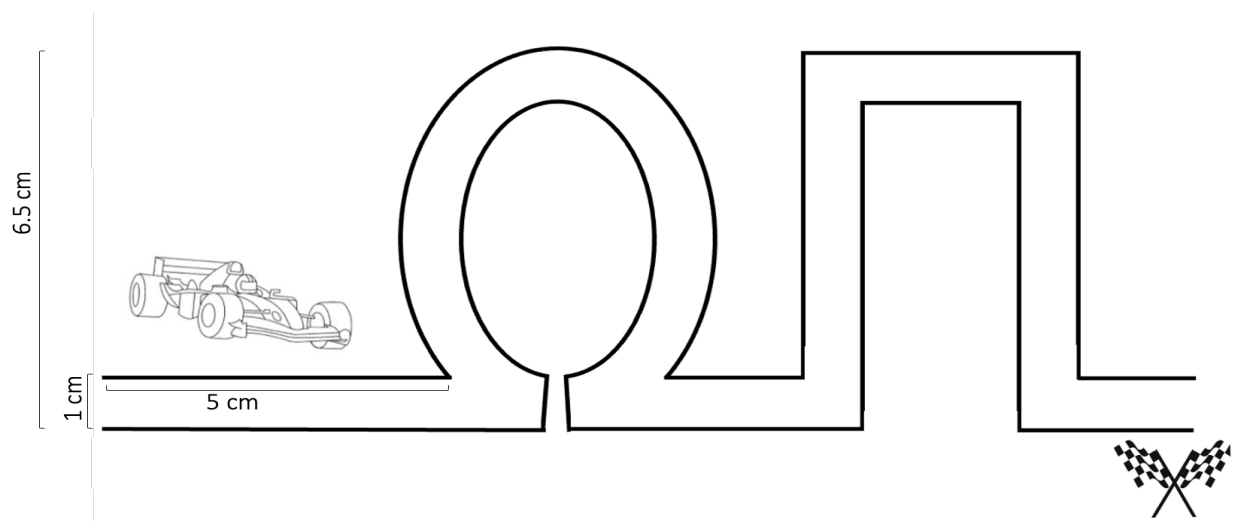
Size below is adjusted for letter size paper. If using A4 paper size, please adjust to ensure dimensions of <u>printed</u> document are as noted above.