

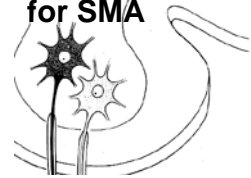


UNIVERSITÀ
CATTOLICA
del Sacro Cuore



SMA REACH UK

**PNCR Network
for SMA**



**Hammersmith
Functional Motor Scale
Expanded for SMA
(HFMSE)**

March 29

2019

Hammersmith Functional Motor Scale Expanded for SMA (HFMSE)

Introduction to this collaboration

Back in 2008 physiotherapists in the UK and part of the Smartnet network (neuromuscular network aimed at improving the management of individuals with SMA) were working on establishing a written manual for the Hammersmith Functional Motor Scale (HFMS). At the same time, yet independently, in the U.S. the Pediatric Neuromuscular Clinical Research Group (PNCR) had been aiming to achieve the same thing for their Expanded version of the Hammersmith Functional Motor Scale (HFMSE) which combines the original HFMS with an add-on module, consisting of items adapted from the Gross Motor Function Measure (GMFM). The 13 add-on items were selected based on their ability to distinguish motor skills among individuals with SMA II and III and has been shown to do this successfully. These groups came together to create one common manual and proformas for both the HFMS and the HFMSE (2009 version).

After 10 years of administration and experience, the International Spinal Muscular Atrophy Consortium (iSMAC) collaboration between SMA REACH UK, the Italian SMA Network and the Pediatric Neuromuscular Clinical Research Network (PNCR) for SMA (USA) has 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. This updated manual version 2019 supports the original 2009 manual without any changes in scoring criteria. We are confident testing conducted using the original 2009 manual is still valid and comparable. This updated manual provides further explanations and descriptions to support clinical evaluators across the world to maintain consistency of administration and scoring of the HFMSE for both ambulant and non-ambulant SMA.

Notes on Testing Procedure

1. Intended Population

The HFMSE is intended to be used in accessing the functional motor abilities of people with SMA who are able to sit and walk. This manual clarifies the procedures and scoring. The HFMSE is intended for clinical use (natural history and treated patients) and for clinical research trial use.

2. Motor Scale Evaluators

HFMSE 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 scales' starting positions, operational definitions and scoring criteria. The reliability and validity of the HFMSE have been documented, 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 and Positional Definitions

The HFMSE was designed with a 3 point scoring system:

Score 2 = performs without modification/adaptation/compensation

Score 1 = performs with modification/adaptation/compensation

Score 0 = unable to perform

Specific scoring criteria per item is outlined in detail in this manual. In general, a score of 0 means the subject did **not** meet the criteria for a score of 1 or 2.

- Supine = Hips and shoulders facing upwards towards the ceiling.
- Prone = Hips and shoulders facing downwards towards the floor.
- Sitting = Sitting up with bottom in contact with mat. Legs should be positioned in front of body, however precise position does not matter. Can include floor sitting (long sit, ring sit, cross-legged sit) or 90/90 over edge of plinth (not 'w' sitting).

- Four-point kneeling = Hands and knees should be roughly positioned under the shoulders and hips respectively. Perfect alignment is not required.
- Half kneeling = Weight taken on one knee and the opposite foot and the buttocks are clear of the lower leg. Alignment is not a consideration.
- Standing = Upright on both feet, taking full weight independently, posture is not important.

Additional specific positioning criteria per item is outlined in detail in this manual.

4. Instructions to the subject & demonstration

This gross motor measure should reflect the subject's best ability and best performance on the day. If after verbal instructions are given, the subject does not understand the command, or if clarification is needed, the evaluator may demonstrate the item. To make the demonstration uniform, the highest scoring for the item (most difficult) may be demonstrated. When the item is to be tested, the item instructions are given verbally followed by an optional demonstration. Any subject especially younger ones may require encouragement to complete the task. Use what is appropriate and works for the individual in order to capture their best abilities.

5. Order of tests

Ideally, all centres would follow the same test order and for research purposes this would be **essential**, as fatigue can be an issue with these children. However, in the clinic setting it may be appropriate to alter the order to suit the needs of the patient.

6. Clinical evaluation

It is recommended that when using the test for clinical use that **all** the items should be attempted, even though you may have seen the child you are assessing before and think you know their level of motor ability. Their ability to score 1 or even 2 points may be unexpected. At subsequent assessments, you may feel it is clearly unnecessary to test the child on some items but they should be attempted once or twice.

7. Trials/ number of attempts to achieve items

The subject is allowed **three** valid trials for each item. The best-performed trial will be scored.

8. Orthotic use

During the testing, **no orthoses are to be used**. This includes scoliosis jackets, Lycra suits/garments, AFOs, socks and shoes. If the subject cannot perform the item without the use of orthotics, the score should be recorded as a zero.

9. Attaining /maintaining starting position

Ideally the subject should get into the starting position themselves. If they are unable to do so they may be placed into the starting position by the therapist where indicated. In order to score an item the correct starting position must be achieved either by the individual or with the assistance of the therapist. If placed by the therapist, they must be able to maintain the position independently.

Contractures: If the subject is unable to maintain the starting or end position of an item, it may often be due to the fact that many children with SMA are prone to soft tissue contractures, specifically of the tendoachilles, hamstrings, and hip flexors. Example positions that may be impacted include long sitting, prone, kneeling, and standing. The impact of contractures on some items needs to be established, therefore please detail on the proforma by ticking the "limited by contracture" column (LBC) and provide any extra information if you perceive it to be a confounding factor. An example for item 11 – prop on forearms, you would score LBC + 0 if the hips or pelvis are not in contact with mat due to contractures.

10. Clothing

Testing should be done with as minimal amount of clothing as is comfortable and does not restrict movement. This will allow the evaluator to assess posture and compensations. T-shirts and shorts are recommended. No socks or shoes.

11. Previous assessments

Please do not examine previous results prior to reassessing a patient as this is likely to bias your current assessment.

12. Compliance issues

When gaining and maintaining compliance is an issue, therapists are asked to make a value judgment as to whether test results give a true value of the patient's ability. If it is felt that data is poor this should be clearly noted on the assessment sheet. Distractions should be kept to a minimum wherever possible during testing.

13. Rest breaks

Rest breaks are allowed if required but should be included in the overall timing of the test.

14. Clinical environment

Ideally the clinical environment should be kept as free of distractions as possible.

15. Time taken to complete

Timing of administration should begin after the test is explained to the subject and parents and the subject is in the starting position for item 1. The subject should not be informed of the timed aspect of the test as it may result in a sped up effort and unnecessary fatigue. Once the final task is attempted, timing should cease. The time taken should be recorded in whole minutes (round up half minutes).

16. Timing tasks

Several tasks depend on being able to hold a position for 3 seconds. In the text this is called "for the count of 3". It is unnecessary to use a stopwatch for this amount of time when involved in a clinical assessment. When counting to 3, time for 3 seconds by saying: "and 1 - and 2 - and 3" so that three seconds is achieved on the word of 3. "For the count of 10" also utilize this approach.

17. Safety

For some tests having the evaluator available to guard the subject whilst attempting the task will be a necessary safety precaution. For some items, such as "standing unsupported" or "stand to sitting on the floor", it may be advisable to have a bench/plinth nearby as well.

18. Equipment

- Plinth/Mat table or floor-mat
- Bench/Height adjustable plinth (mat table)
- Stairs, at least 4 (6 inch/15 cm in height) with a railing (or standard therapy stairs)
- Tape and ruler (see item 29)

Test item 1: Plinth /chair sitting

Starting position

Best attainable independent sitting position on floor/plinth. Sitting on edge of plinth or chair (feet unsupported).

Finish position

Not in wheelchair. Back unsupported.

Instruction

Sitting with arms up, arms not in contact with body

Can you sit on the plinth/chair without using your hands for support for a count of 3?

Scoring detail / Diagram

Score 0: If subject uses both hands on mat or body for support including elbows resting/bracing/contacting on trunk, or holding onto a toy.

Activity Plinth / chair sitting

	2	1	0
	Able to sit using no hand support for a count of 3 or more	Needs one hand support to maintain balance for a count of 3	Needs two hand support to maintain balance Unable to sit

Photographs / Notes



Figure 1a Score 2 Subject able to sit without hand support for more than a count of 3. Arms need to be clear of floor and body for more than a count of 3.



Figure 1b Score 1 Subject able to maintain sitting with one hand support for a count of 3. One hand support may be in contact with the surface or their body.



Figure 1c Score 0 Subject unable to sit without support externally, or unable to maintain a sitting position for a count of 3 without the use of both hands.

Test item 1: Additional postural information

Starting position

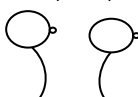
Sitting on floor / plinth. Bottom in contact with mat. Legs should be positioned in front of body; however precise position does not matter.

You can record on the proforma predominant postures seen in the spine and in the legs.

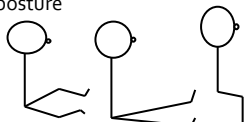
This does not affect the scoring but is for clinical use to monitor change over time.

Details of posture

1 Predominant spinal posture



2 Predominant leg posture



Circle predominant spinal posture and leg position

Ring sitting – ‘frog’ sitting with hips abducted and externally rotated, or cross-legged sitting.

Long sit – with legs straight = knees may be flexed, knee caps pointing upwards, ankles <10cm apart.

90/90 sitting – hips and knees at 90° on the edge of the plinth, feet unsupported (not in wheelchair)

Test item 2: Long sitting

Starting position

Sitting on floor / plinth with the legs in maximal extension and kneecaps pointing to the ceiling. Back unsupported.

Finish position
Instruction

Long sitting with legs straight and arms up, arms not in contact with body

Can you sit on the floor/plinth without using your hands for support and with your legs straight for a count of 3? Don't let your legs roll out.

Scoring detail / Diagram

Legs straight = knees may be flexed but knee caps must be pointing upwards, ankles no more than 10cm apart. This defines neutral hip rotation. If contractures limit scoring mark in "limited by contracture" (LBC) column.

Activity
Long sitting

	2	1	0
	Able to sit on floor/plinth with legs straight without hand support for a count of 3	Able to sit on floor/plinth with legs straight propping with one hand support for a count of 3	Able to long sit using two hands for a count of 3 Or unable to sit with straight legs

Photographs / Notes



Figure 2a Score 2
Subject able to maintain long sitting with neutral hip rotation without the use of hands for a count of 3. Note accommodation of knee contractures.



Figure 2b Score 1
Subject able to maintain long sitting with neutral hip rotation using one hand support for a count of 3. Hand support may be in contact with the surface or their body.



Figure 2c Score 0
Subject unable to maintain neutral hip rotation in long sitting and/or requires both arms to support.

Test item 3: One hand to head in sitting

Starting position

Sitting on floor / plinth or over edge of chair/plinth. The sitting position used should be their best unsupported sitting position for use of their arms. Bottom in contact with mat. Legs should be positioned in front of body; however, precise position does not matter. Arms may be resting on mat or lap. Not tested in wheelchair. No back support.

Finish position

All the fingertips of one hand above ear level (may or may not be in contact with head)

Instruction

Can you get one hand to your head (above your ear) without bending your neck?

Scoring detail / Diagram

Ear level is an imaginary line made around the circumference of the head from the superior tip of the left ear, across the face to the eyebrow line, to the superior tip of the right ear and behind their head back to the starting point.

Mark right or left arm in comments column

Arms free from side = visible space between arms and body, may be using abduction or a combination of abduction and flexion.

Score 1: If uses any neck flexion or side tilt. If you observe minimal head flexion, ask them to repeat the test to see if they can score 2. Able to place hand on head by crawling hand up.

Score 0: Using two hands clasped together or supporting thumb/finger on body.

Activity

One hand to head

	2	1	0
	Able to bring one hand to head – arms free from side. Head and trunk remain stable	Can only bring hand to head by flexing head/trunk or by crawling hand up to top of head	Unable to bring hand to head even using head and trunk movement

Photographs / Notes



Figure 3a Score 2
Subject able to touch head above ear level whilst maintaining stable trunk and head position.



Figure 3b Score 1 Subject able to touch head above ear level, however requires neck flexion to achieve the movement. Repeat the movement if it is not clear whether neck flexion occurred.



Figure 3c Score 0 Subject attempts to reach the head above level of ear but is unable to reach to ear line.

Test item 4: Two hands to head in sitting

Starting position

Sitting on floor / plinth or over edge of chair/plinth. The sitting position used should be their best unsupported sitting position for use of their arms. Bottom in contact with mat. Legs should be positioned in front of body; however, precise position does not matter.
Not tested in wheelchair. No back support.

Finish position

All the fingertips (does not include thumbs) of both hands above ear level (may or may not be in contact with head)

Instruction

Can you lift both hands up at the same time, to your head, without bending your neck?

Scoring detail / Diagram

Must bring hands up to head together (at the same time)

Arms free from side = visible space between arms and body, may be using abduction or a combination of abduction and flexion.

Score 1: If uses any neck flexion or side tilt. If you observe minimal head flexion, ask them to repeat the test to see if they can score 2. Able to place hands on head by crawling hands up.

Score 0: Using two hands clasped together or supporting thumb/finger on body.

Activity

Hands to head in sitting

	2	1	0
	Able to place both hands on head at the same time – arms free from side. Head and trunk remain stable	Able to place hands on head but only using head flexion or side tilt or crawling hands up or one at a time	Unable to place both hands on head

Photographs / Notes



Figure 4a Score 2 Subject can touch both hands to head above the ear line whilst maintaining stable trunk and head position.



Figure 4b Score 1 Subject lifts both hands to his head at the same time and makes contact above ear line but flexes head.

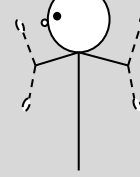


Figure 4c Score 0 Subject touches his face with both hands but is unable to reach above the ear line, despite use of neck flexion.

Test item 5: Supine to side lying

Starting position

Supine arms by side or in mid-position (see diagram), hips and shoulders facing upwards towards the ceiling



Finish position

Shoulders must be perpendicular to the floor, and the trunk and hips are to be in line with the shoulder and body. The lower leg position is not important but the thighs are stacked on top of each other.

Instruction

Can you roll onto your side in both directions?

Scoring detail / Diagram

Can use any strategy to achieve ½ roll except grabbing edge of the mat to help

Score 1: Mark right or left ½ roll in column scoring 1

Activity

2

1

0

Supine to side lying

Able to ½ roll onto side from supine both ways

Can ½ roll onto side only one way
R / L

Unable to ½ roll onto side either way

Photographs / Notes



Figures 5a Score 2

Subject is able to achieve a ½ roll to both sides. His hips roll enough to be in line with his shoulders and perpendicular to the mat.

Score 1 If subject can ½ roll to one side but not the other. Right or left side roll should be circled on the score sheet.

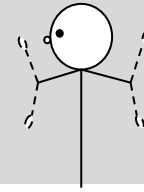


Figure 5b Score 0 Subject rolls his upper trunk but is unable to bring hips in line with shoulders and perpendicular to the mat.

Test item 6: Rolls prone to supine over R

Starting position

Prone, arms in mid position (see diagram) or by side, hips and shoulders facing downwards towards the floor



Finish position

Supine with arms out from underneath body, hips and shoulders facing upwards towards the ceiling

Instruction

Can you roll from your tummy to your back in both directions? Try not to use your hands.

Scoring detail / Diagram

Score 2: Momentum is allowed as long as not pushing or pulling with arms. Can use legs.

Score 1: Locking hands together or using elbows. Can use legs.

Score 0: If unable to bring hips **and** shoulders into supine or grabs the edge of mat to help. This may be due to limitations as a result of contractures. You would score LBC + 0 if patient unable to achieve start/finish position (ie. hips or pelvis are not in contact with mat due to contractures).

Activity

Rolls prone to supine over R

	2	1	0
	Rolls fully into supine with free arms to the right	Rolls fully into supine by pulling /pushing on arms	Unable to roll into supine. Does not initiate or complete final supine position

Photographs / Notes



Figure 6a Score 2
Subject rolls from prone to supine over his right side without using his arms to help.



Figure 6b Score 1 Subject moves from prone to supine independently using one arm to push/pull them through the movement using the surface or on the other arm. Note subject is using two arms locked together.



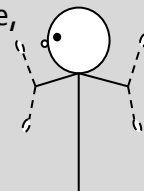
Figure 6c Score 0
Movement to full supine is attempted but not achieved. If due to contractures mark 0 and note this in the LBC column.

Test item 7: Rolls prone to supine over L											
Starting position	Prone, arms in mid position or by side, hips and shoulders facing downwards towards the floor										
Finish position	Supine with arms out from underneath body, hips and shoulders facing upwards towards the ceiling										
Instruction	<i>Can you roll from your tummy to your back in both directions? Try not to use your hands.</i>										
Scoring detail / Diagram	<p>Score 2: Momentum is allowed as long as not pushing or pulling with arms. Can use legs.</p> <p>Score 1: Locking hands together or using elbows. Can use legs.</p> <p>Score 0: If unable to bring hips and shoulders into supine or grabs the edge of mat to help. This may be due to limitations as a result of contractures. You would score LBC + 0 if patient unable to achieve start/finish position (ie. hips or pelvis are not in contact with mat due to contractures).</p>										
Activity	<table border="1"> <thead> <tr> <th></th> <th>2</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td>Prone to supine over L</td> <td>Rolls fully into supine with free arms to the left</td> <td>Rolls fully into supine by pulling /pushing on arms</td> <td>Unable to roll into supine. Does not initiate or complete final supine position</td> </tr> </tbody> </table>				2	1	0	Prone to supine over L	Rolls fully into supine with free arms to the left	Rolls fully into supine by pulling /pushing on arms	Unable to roll into supine. Does not initiate or complete final supine position
	2	1	0								
Prone to supine over L	Rolls fully into supine with free arms to the left	Rolls fully into supine by pulling /pushing on arms	Unable to roll into supine. Does not initiate or complete final supine position								
Photographs / Notes	See item 6										

Test item 8: Rolls supine to prone over R

Starting position

Supine on mat/plinth with arms in mid position (see diagram) or by side, hips and shoulders facing upwards towards the ceiling



Finish position

Prone, with arms out from underneath the body, hips and shoulders facing downwards towards the floor

Instruction

Can you roll from your back to your tummy in both directions? Try not to use your hands.

Scoring detail / Diagram

Score 2: Momentum is allowed as long as not pushing or pulling with arms. Can use legs.

Score 1: Locking hands together. Can use legs.

Score 0: If unable to bring hips **and** shoulders into prone, if one shoulder/hip is raised, or grabs the edge of mat to help. This may be due to limitations as a result of contractures. You would score LBC + 0 if patient unable to achieve start/finish position (ie. hips or pelvis are not in contact with mat due to contractures).

Activity

Rolls supine to prone over R

	2	1	0
Rolls supine to prone over R	Rolls fully into prone with free arms to the right	Rolls fully into prone by pulling /pushing on arms	Unable to roll into prone. Does not initiate or complete final prone position

Photographs / Notes



Figure 8a Score 2
Subject able to roll from supine to prone over his right side without pulling/pushing on his hands.



Figure 8b Score 1 Subject able to achieve the task but uses elbows to push on the mat.



Figure 8c Score 0 If there is an attempt to transition from supine towards, but not achieving full prone. Subject grabs the edge of mat to help.

Test item 9: Rolls supine to prone over L			
Starting position	Supine on mat/plinth with arms in mid position or by side, hips and shoulders facing upwards towards the ceiling		
Finish position	Prone, with arms out from underneath the body, hips and shoulders facing downwards towards the floor		
Instruction	<i>Can you roll from your back to your tummy in both directions? Try not to use your hands.</i>		
Scoring detail / Diagram	<p>Score 2: Momentum is allowed as long as not pushing or pulling with arms. Can use legs.</p> <p>Score 1: Locking hands together. Can use legs.</p> <p>Score 0: If unable to bring hips and shoulders into prone, if one shoulder/hip is raised, or grabs the edge of mat to help. This may be due to limitations as a result of contractures. You would score LBC + 0 if patient unable to achieve start/finish position (ie. hips or pelvis are not in contact with mat due to contractures).</p>		
Activity	2	1	0
Rolls supine to prone over L	Rolls fully into prone with free arms to the left	Rolls fully into prone by pulling / pushing on arms	Unable to roll into prone. Does not initiate or complete final prone position
Photographs / Notes	See item 8		

Test item 10: Sitting to lying

Starting position

Sitting on plinth / floor, bottom in contact with mat. Legs should be positioned in front of body, however precise position does not matter.
Not go/go sitting over edge of bed.

Finish position
Instruction

Supine, hips and shoulders facing upwards towards the ceiling

Can you lie down in a controlled/safe way from sitting?

Scoring detail /
Diagram

Score 2: Controlled fashion can mean through side-lying or by lowering themselves in midline through their arms and legs to a supine position.

Score 1: May use one of the techniques above but lacks some control or flops forward/rolls sideways. However remains safe – does not risk injury.

Score 0: Unable, needs assistance. May need guarding to not risk hitting head.

Activity
Sitting to lying

	2	1	0
	Able to lie down through side-lying or midline using clothes in a controlled/safe way	Able to lie down by flopping forwards and rolling sideways, or through prone in a controlled/safe way	Unable or completes in uncontrolled/unsafe way

Photographs / Notes



Figure 10a Score 2
Subject moves from sitting to supine, through side-lying, or with use of hands in a controlled/safe fashion without collapsing.



Figure 10b Score 1
Subject moves from sitting to prone by flopping forward/collapsing (controlled/safe) and rolling sideways to get to supine.

Test item 11: Props on forearms

Starting position

Prone with forehead resting on mat/plinth, hips and shoulders facing downwards towards the floor (**pelvis in contact with mat**) – arms down by side

Finish position

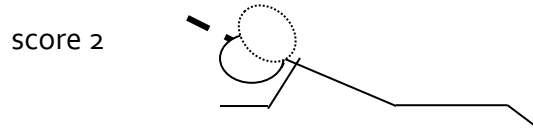
Prone and propping on forearms. Forearms should be on the surface and hands not clasped together. Pelvis must be in contact with the mat.

Instruction

Can you prop yourself on your forearms with your head up (not holding your head) and hold for a count of 3?

Scoring detail / Diagram

Score 2: If head is level with trunk or above it



Score 1: If can only achieve when placed and head is level with trunk or above it

Score 0: If unable to achieve prone position (if hips or pelvis not in contact with the mat due to contractures). You would score LBC + 0 if hips or pelvis are not in contact with mat due to contractures.

Activity

	2	1	0
--	---	---	---

Props on forearms

Able to achieve prop on forearms and hold head up independently for a count of 3

Holds position for a count of 3 when placed

Unable or holds for less than a count of 3

Photographs / Notes



Figure 11a Score 2
Subject able to independently transition from prone to prop on forearms and maintain this position with head up for a count of 3.

Score 1 The subject is unable to attain this position independently but can maintain it for a count of 3 when placed.



Figure 11b Score 0
Subject is unable to prop on forearms and maintain head up. When placed, the subject supports the head with his hands by propping on elbows. Forearms are not in contact with the surface area.

Figure 11c Score 0
Subject is unable to achieve prone position (hips are not in contact with mat). Tick LBC.

Test item 12: Lifts head from prone

Starting position

Prone with forehead resting on mat/plinth, hips and shoulders facing downwards towards the floor - arms down by side. **Pelvis does not need to be in contact with the mat.**

Finish position

Prone with chin clear of the mat. With arms either by side (score 2) or in mid position (abduction between 70° and 110° (score 1))

Instruction

Can you lift your head up keeping your arms by your side for a count of 3?

Scoring detail / Diagram

Score 2: Chin needs to be clear of the mat and held for a count of 3. Achieves neck extension purely in the sagittal plane, no compensations.

Score 1: Chin must be clear of the mat and held for a count of 3. Arm positioned between 70° and 110° shoulder abduction. Can use compensatory movements such as side extension to lift head.

Activity

Lifts head from prone

	2	1	0
	Able to lift head upright through midline in prone, arms down by side for a count of 3	Lifts head upright with arms in a mid position for a count of 3	Unable or lifts head for less than a count of 3

Photographs / Notes



Figure 12a Score 2
Subject able to lift head and break contact with the mat for a count of 3 with arms resting by sides.



Figure 12b Score 1
The subject can only lift his head off the mat when his arms are in the mid position but can do this for a count of 3.



Figure 12c Score 0
Subject is unable to lift head to break contact with the mat with arms by the side or in the mid position.

Test item 13: Prop on extended arms

Starting position

Prone with forehead resting on mat/plinth, hips and shoulders facing downwards towards the floor (**pelvis in contact with mat**) - arms down by side

Finish position

Prone with elbows extended and trunk in extension - umbilicus must be clear of surface.

Head must be **above** neutral position (neutral position means in line with neck represented by the dotted line).

The position of the hands on the mat and the angle of the hands is not important (can still score 1 or 2) but they should be within a radius of the shoulder joint.

Instruction

Can you prop yourself up with straight arms for a count of 3?

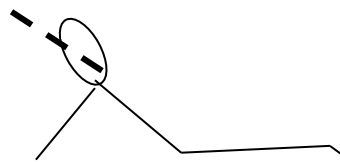
Scoring detail / Diagram

Score 2: Hyperextension of elbows does not influence score. Strategy to get to final end position independently does not matter.

Score 1: Hyperextension of elbows does not influence score.

Score 0: If umbilicus is not clear of surface (belly button touches the surface) or if hands are too far forward.

You would score LBC + 0 if hips or pelvis are not in contact with mat due to contractures.



Activity

Prop on extended arms

	2	1	0
Prop on extended arms	Able to prop on extended arms, head up for a count of 3	Can prop on extended arms if placed for a count of 3	Unable

Photographs / Notes



Figure 13a Score 2
Subject able to transition from prone to prop on extended arms independently and hold for a count of 3.



Figure 13b Score 1
Subject can maintain this position when placed and then hold for a count of 3 without assistance. (Operator hands present for safety reasons however operator support is not allowed during scoring of actual item).



Figure 13c Score 0
Subject is unable to maintain the position with head above neutral for a count of 3.

Test item 14: Lying to sitting

Starting position

Supine arms by side, hips and shoulders facing upwards towards the ceiling

Finish position

Sitting up with bottom in contact with mat. Legs should be positioned in front of body; however, precise position does not matter.

Instruction

Can you get from lying (supine) to sitting without rolling to your tummy?

Scoring detail / Diagram

Score 2: Able to get into sitting by using side-lying or supine – not turning into prone or towards floor.

Supine: Utilizes flexion in the sagittal plane (full sit-up), may use arms to assist.

Side: Able by using side lying / pushing up through side

Score 1: Turns into prone or towards floor and pushes up into sitting

Score 0: Requests to get close to edge of mat to throw legs off to help with transition, or requires assistance from caregiver to complete the transition

Activity

Lying to sitting

	2	1	0
	Able by using supine/side-lying	Turns into prone or towards floor	Unable

Photographs / Notes



Figure 14a Score 2
Subject moves from lying to sitting through side-lying.



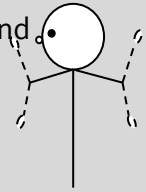
Figure 14b Score 1
Subject can independently move from lying to sitting by turning into prone and pushing up into sitting.

Score 0 If the subject is unable to transition from lying to sitting independently.

Test item 15: Four-point kneeling

Starting position

Prone on mat/plinth, arms in mid position (see diagram) or by side, hips and shoulders facing downwards towards the floor



Finish position

Four-point kneeling position with head extended and looking forward. Hands and knees should be roughly positioned under the shoulders and hips respectively. Perfect alignment is not required.

Instruction

Can you get onto your hands and knees with your head up and hold for a count of 3?

Scoring detail / Diagram

Score 2: Head extended, looking forwards

Score 1: Head may be in line with body or extended beyond neutral when placed in four-point kneeling.

Score 0: Head falls below the line of the body.

Activity

Four-point kneeling

	2	1	0
Four-point kneeling	Achieves four-point kneeling. Head up for a count of 3	Holds position when placed for a count of 3	Unable

Photographs / Notes



Figure 15a Score 2
Subject is shown in independent transition from prone to four-point kneeling, able to maintain this position, with head up for a count of 3.



Figure 15b Score 1
Subject unable to independently achieve position but once placed can maintain four-point kneeling with head in line with body or above for a count of 3.



Figure 15c Score 0
Subject was unable to maintain the position when placed. Head falls below the line of the body.

Test item 16: Crawling

Starting position
Finish position

From four-point kneeling

Remains in four-point kneeling but has moved forwards. Distance moved not important.

Instruction

Can you crawl forwards?

Scoring detail / Diagram

Score 1 or 2: A point equals a hand or a knee. Moving all four points means moving both right and left arm, and both right and left leg (one arm, one leg, one arm and one leg) in any order and does not need to be synchronous.

Score 2: Must be able to move both hands and knees at least two times

Score 1: Must be able to move both hands and knees at least once

Score 0: Moves both arms, but legs are dragged

Activity

Crawling

	2	1	0
Crawling	Able to crawl forwards Moves all four points twice or more	Moves all four points only once	Unable

Photographs / Notes



Figure 16a Score 2 Clear movement of all 4 limbs at least 2 times in a row (any pattern).

Test item 17: Lifts head from supine

Starting position
Finish position

Supine on plinth/mat with arms crossed over chest (elbows clear from mat)

Supine with head flexed using neck flexion (score 2) or off surface of the mat (score 1). Elbows clear from mat.

Instruction

Can you lift your head to look at your toes keeping your arms folded for a count of 3?
Can demonstrate action passively. Useful to assess range of movement.

Scoring detail /
Diagram

If the subject is unable to cross their arms over their chest due to arm weakness you can help fold their arms across their chest.

Score 2: Must be true neck flexion to lift head off floor, not just protraction. Achieves neck flexion purely in the sagittal plane, no compensations.

Score 1: Uses compensatory movements such as side flexion and or protraction to lift head

Score 0: Moves arms down by side or pushes elbows on surface to lift head

Activity

Lifts head from supine

	2	1	0
Lifts head from supine	In supine, can lift head through neck flexion in mid-line. Chin moves towards chest. Held for a count of 3.	Head is lifted but through side flexion, using protraction, or with no neck flexion. Held for a count of 3.	Unable

Photographs / Notes



Figure 17a Score 2
Subject able to flex her neck and break contact with the mat, holding the position for a count of 3.

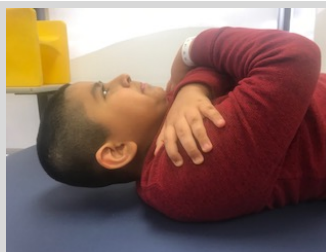


Figure 17b Score 1
Subject able to flex head, breaking contact with the mat for a count of 3 with no neck flexion.

Score 0 Head remains in contact with plinth.

Test item 18: Supported standing

Starting position

Standing barefoot on the floor. No use of orthotics.
The evaluator should be nearby to guard the subject in order to ensure safety.
A table, plinth, bench should be nearby at about hip height if ability is uncertain.

Finish position Instruction

Standing upright on both feet using one hand for support
*Can you stand using **one** hand for support for a count of 3?*

Scoring detail / Diagram

Scoring is not based on qualitative nature of stance.

Definition of support

- Subject uses one hand support on plinth/surface. Plinth is at level of umbilicus.
- Trunk, hip and knees must not be supported.
- Subject must be able to control hip, knee and pelvis independently.
- Can be placed in this position as long as they are able to maintain it.

Score 2: Using their hand as support

Score 1: If assessor needs to place hand on chest to prevent loss of control

Score 0: If needs hip and/or knee support or unable to stand or if leans trunk on support surface or uses **two** hands

When counting to 3 – Use “**and 1 - and 2 - and 3**” so that three seconds is achieved on the word of 3

Activity

Supported standing

	2	1	0
Supported standing	Can stand with one hand support for a count of 3.	Able to stand with one hand support and minimal trunk support (not hip) for a count of 3.	Can stand with one hand support but needs knee/hip support in addition for a count of 3. Or unable to stand supported

Photographs / Notes



Figure 18a Score 2
Subject able to stand with the support of one hand for a count of 3. Trunk support not required.



Figure 18b Score 1 Able to stand for a count of 3 but requires minimal trunk support.



Figure 18c Score 0
Subject unable to achieve standing without additional support at hip and trunk.

Test item 19: Stand unsupported

Starting position

Standing barefoot on the floor, feet should be approximately 10cm/hip width apart (place hand between feet to get approx. 10cm). No use of orthotics. A table, plinth, bench could be nearby and at about hip height if ability is uncertain.

Finish position

Standing upright on both feet, taking full weight independently, posture is not important

Instruction

Can you stand without holding onto anything for a count of 3?

Scoring detail / Diagram

Can be placed in this position as long as they are able to maintain it without support.

Scoring is not based on qualitative nature of stance. Scoring is based on time.

When counting to 3 – Use “and 1 - and 2 - and 3 - and” so that more than three seconds is achieved on the last word “and”

Score 0: Momentarily means less than a count of 3 therefore scores 0 if stands independently for less than a count of 3 or if needs hands on legs to maintain position (counts as support).

Activity

Stand unsupported

	2	1	0
Stand unsupported	Can stand independently for more than a count of 3	Stands independently for a count of 3	Stands only momentarily (less than a count of 3) Or unable

Photographs / Notes



Score 1 Subject able to stand independently for a count of 3.

Score 0 Subject is able to stand only momentarily or not at all.

Figure 19a Score 2
Subject is able to stand independently for more than a count of 3.

Test item 20: Stepping

Starting position

Standing barefoot on a level floor. Tested without orthotics, socks and shoes. Walking aides are not permitted.

Finish position

Remains in standing but has moved forwards. Distance moved not important.

Instruction

Can you walk without using any help or aids? Show me

Scoring detail / Diagram

Score 1 or 2: Any independent gait pattern is acceptable i.e. waddling, no heel strike. Scoring is based on number of independent steps.

Score 0: Requires hand-held for support, hands on knees for support, or if needs aids (including any orthotics) to take steps.

Activity

2

1

0

Stepping

Able to take more than 4 steps unaided

Able to take 2 – 4 steps unaided

Unable

Photographs / Notes



Score 1 Subject may require close supervision, able to keep balance for at least two steps, may have limited movement.

Must be a clear step – foot must leave contact with the floor.

Figure 20a Score 2

Able to take more than 4 independent steps.

Test Item 21 and 22: Right and Left hip flexion in supine

Starting position

Supine on mat/plinth with hips and knees in maximal available extension.
Assess passive range for hip AND knee flexion prior to testing item.
 *Note level of hip/knee flexion contracture in comments section as it may place them at an increased mechanical advantage. **Whilst conducting tests do not hold down opposite leg.**

Finish position

Full active range of hip and knee flexion is achieved and remains in supine.
 Maximum hip flexion = normal AROM or full available ROM. The thigh should approximate the subject's chest and the posterior calf should approximate the thigh. Approximate does not necessarily mean touch.

Instruction

Can you bring your right knee to your chest? Try to go as far as you can.
Now can you bring your left knee to your chest? Try to go as far as you can.
 Individuals should not use their arms to assist this activity

Scoring detail / Diagram

Any strategy to gain hip flexion is permitted (i.e. anti-gravity movement in hip external rotation) however encourage the movement to be in vertical alignment.
 Scoring is based on range of movement, not qualitative movement of lower limb.
Score 2: The subject is able to perform full flexion of unilateral hip and knee. They can use any method to get there including hip external rotation, contacting the other leg. Allow hip range with dissociation, when the opposite leg comes up, that is the end of the range.

Score 1: The subject initiates unilateral hip and knee flexion or flexes through partial range (defined as between 10% of flexion ROM to sub-full range). They can use external rotation at hip or contact the other leg.

Score 0: The subject is unable to initiate unilateral hip and knee flexion or uses ankle dorsi/plantarflexion only to move heel up the mat or rolls to side (raise pelvis) to help pull leg up. Severe hip and knee flexion contractures putting the leg at a mechanical advantage scores a 0.

Activity Right and Left hip flexion in supine

	2	1	0
Full hip flexion achieved Full range is defined as > 110°	Able to initiate unilateral hip and knee flexion >10% but does not achieve full range (<110°)	Unable	

Photographs / Notes



Figure 21a Score 2
 Subject is able to perform full flexion of hip and knee (i.e. beyond 110°). The thigh approximates the subject's chest.



Figure 21b Score 1
 Subject initiates hip and knee flexion or flexes through partial range-visible knee and hip flexion > 10% from starting position. The foot may/may not leave the surface of the bed.



Figure 21c Score 0
 Subject can only flex at hip and knees with both legs moving at same time. Subject also has severe hip and knee flexion contractures putting leg at mechanical advantage.

Test item 23: High kneeling to right half kneel

Starting position

High kneeling, arms free. The evaluator should be nearby to guard the subject in order to ensure safety.

Arms may be used to assist with transition or subject is able to use one arm on a bench to support themselves when placed in this position. It is permitted to use a therapy bench/plinth/their own body for support. This item may require a few "test trials" to determine whether or not the subject will require a bench for support.

Finish position

Half kneeling defined as weight taken on one knee and the opposite foot and the buttocks are clear of the lower leg. Right half kneeling is with the weight bearing on the right knee and left foot forwards. Alignment is not a consideration.

Instruction

*Can you bring your **left** leg up so that your foot is flat on the ground without using your arms and hold for a count of 10?*

Scoring detail / Diagram

Scores 2: The subject transitions from high kneeling to half kneeling on right knee, with or without the use of arm support, and then maintains right half kneel for a count of 10 without arm support. Leg may be in any position.

Scores 1: When placed in right half kneel, or gets there by any method, the subject can maintain the position for a count of 10 with the use of one arm support for balance only. Leg may be in any position. Once in right half kneel, any use of the bench for maintaining this position restricts the subject to a score of 1 or less.

Scores 0: The subject is unable to maintain right half kneeling, even when placed, for a count of 10 with the use of one arm support or if leans trunk or hips on support surface.

Activity

High kneeling to right half kneel

	2	1	0
	Able to achieve half kneel (with or without arm support) and maintains position without arm support for a count of 10	Maintains half kneel with one arm support for a count of 10	Unable

Photographs / Notes



Figure 23a Score 2

Able to complete without need of arms for transition or to maintain half kneeling.



Figure 23b Score 1

Subject requires use of one hand on the bench to get into the position of half kneel or to maintain half kneeling.

Subject able to be placed into half kneel and maintain one arm support for a count of 10.



Figure 23c Score 0

Unable to get into half kneeling or maintain position.

Test item 24: High kneeling to left half kneel

Starting position

High kneeling, arms free. The evaluator should be nearby to guard the subject in order to ensure safety.

Arms can be used to assist with transition or subject is able to use one arm on a bench to support themselves in this position. It is permitted to use a therapy bench/plinth/their own body for support. This item may require a few "test trials" to determine whether or not the subject will require a bench for support.

Finish position

Half kneeling defined as weight taken on one knee and the opposite foot and the buttocks are clear of the lower leg. Left half kneeling is with the weight bearing on the left knee and right foot forwards. Alignment is not a consideration.

Instruction

*Can you bring your **right** leg up so that your foot is flat on the ground without using your arms and hold for a count of 10?*

Scoring detail / Diagram

Scores 2: The subject transitions from high kneeling to half kneeling on left knee, with or without the use of arm support, and then maintains left half kneel for 10 seconds without arm support. Leg may be in any position.

Scores 1: When placed in left half kneel, or get there by any method, the subject can maintain the position for 10 seconds with the use of one arm support for balance only. Leg may be in any position. Once in left half kneel, any use of the bench for maintaining this position restricts the subject to a score of 1 or less.

Scores 0: The subject is unable to maintain left half kneeling, even when placed for 10 seconds with the use of one arm support or if leans trunk or hips on support surface.

Activity

High kneeling to left half kneel

	2	1	0
	Able to achieve half kneel (with or without arm support) and maintains position without arm support for a count of 10	Maintains half kneel with one arm support for a count of 10	Unable

Photographs / Notes

See 23

Test item 25: High kneeling to standing, leading with left leg (through right half kneel)

Starting position
Finish position

High kneeling, arms free

Standing upright on both feet, taking full weight independently, posture is not important

Instruction

Can you stand up from this position starting with your left leg without using your hands?

May need demonstration

Have a bench nearby in case the subject requires support for balance or strength

Scoring detail / Diagram

Scores 2: The subject independently transitions from high kneeling to standing via right half kneel without arm support. Contact with subject's own body, i.e. hands on thigh, is considered arm support and therefore cannot be given a score of 2. Half kneeling on the right knee must be used in the transition from high kneeling to stand.

Scores 1: Stands up through half kneeling with arm support (1 or 2 hands) or initiates transition to standing by un-weighting the weight bearing knee, with or without arm support, or leans trunk on bench, but trunk not weight bearing through top of bench.

Scores 0: The subject is unable to initiate standing.

Activity
High kneel to stand through right half kneel

	2	1	0
	Able to stand with arms free	Able to shift weight off both knees (with or without arm support)	Unable

Photographs / Notes



Figure 25a Score 1
Subject uses arms to initiate standing.

Test item 26: High kneeling to standing leading with right leg (through left half kneel)

Starting position
Finish position

High kneeling, arms free
Standing upright on both feet, taking full weight independently, posture is not important

Instruction

Can you stand up from this position starting with your right leg without using your hands?
May need demonstration
Have a bench nearby in case the subject requires support for balance or strength

Scoring detail / Diagram

Scores 2: The subject independently transitions from high kneeling to standing via left half kneel without arm support. Half kneeling on the left knee must be used in the transition from high kneeling to stand.

Scores 1: Stands up through half kneeling with arm support or initiates transition to standing by un-weighting the weight bearing knee, with or without arm support, or leans trunk on bench, but trunk not weight bearing through top of bench.

Scores 0: The subject is unable to initiate standing.

Activity

High kneel to stand through left half kneel

	2	1	0
	Able to stand with arms free	Able to shift weight off both knees (with or without arm support)	Unable

Photographs / Notes



Figure 26a Score 2
Subject stands from high kneeling through left half kneel without the use of arm support.



Figure 26b Score 1
Subject moves from high kneel to left half kneel and uses arm support to stand.



Figure 26c Score 0
Subject unable to initiate standing from a high kneeling position.

Test item 27: Stand to sitting on the floor

Starting position

Standing barefoot on a level floor or mat. In order to attempt this item, the subject must be able to maintain independent standing without arm support. Guard patient for safety.

Finish position

Sitting up with bottom in contact with mat. Legs should be positioned in front of body, however precise position does not matter.

Instruction

Can you sit on the floor in a controlled/safe way from standing? Try not to use your arms.

Scoring detail / Diagram

Scores 2: The subject is able to lower themselves to sitting on the floor with control and without using their arms. "With control" implies that the movement is regulated or directed, no fast movements or collapse permitted.

Scores 1: The subject is able to lower to sitting on floor with the use of arms or crashes during the transition.

"Crash" indicates a loss of control.

Contact with the subject's own body, i.e. hands on thighs for support is considered arm support and therefore a score of 2 cannot be given.

Scores 0: The subject does not transition to the floor or requires any use of furniture to assist.

Activity Stand to sitting on floor

	2	1	0
	Able to sit down with arms free and no collapse in a controlled manner	Sits on floor using hands on floor/body or crashes	Unable

Photographs / Notes



Figure 27a Score 1
Subject able to sit down using hands on floor.

Test item 28: Squat

Starting position

Standing barefoot independently on a level floor or mat. Guard patient for safety. No orthotics used.

Finish position Instruction

Squat position defined as hips and knees flexed to greater than 90°

Can you squat? Pretend you are going to sit in a very low seat-only go as far down as you are able to get up from on your own

Scoring detail / Diagram

Scores 2: The subject attains a full squat position without arm or external support. Subject does not need to return to standing position. If the subject attains the full squat position but requires the use of arm support (hands on their own body) in order to do so, a score of 2 cannot be given.

Scores 1: The subject crouches more than 10% of the motion (achieves 10° of knee flexion only, hip flexion not required) to less than 90° hip and knee flexion (mid-range squat) with or without the use of arm support. External support (aides and the mat) are not allowed. Subject does not need to return to standing position.

Scores 0: The subject is unable to initiate the squat, only unlocking the knees, or only exhibiting trunk/hip flexion. Subject uses external support.

Activity Squat

2	1	0
Squats hips and knees flexed to greater than 90° with arms free	Initiates squat in both knees (10° to <90°), uses arm support	Unable to control or initiate

Photographs / Notes



Figure 28a Score 2
Subject able to attain a full squat without using arms - hips and knees flexed greater than 90°.



Figure 28b Score 1
Subject using arms to squat greater than 10° but does not reach 90° degrees of hip and knee flexion.

Test item 29: Jumps 12 inches forward

Starting position	Standing barefoot on a level floor. Position the standing subject comfortably in front of two parallel lines [taped 12" (30 cm) apart on the floor]. Guard patient for safety.		
Finish position Instruction	Must have landed without use of arm support and without falling forward <i>Can you jump as far as you can, with both feet, from this line all of the way to the other line?</i>		
Scoring detail / Diagram	The distance jumped is from the starting line to the back of the heels. In the case that the distance travelled by two feet is uneven, the lesser distance should be considered. Scores 2: The subject jumps 12" (30 cm) with both feet simultaneously Scores 1: The subject jumps with both feet simultaneously (clearing both feet from the ground) but travels 2-11" (5-28 cm) Scores 0: The subject is unable to initiate jumping forward with both feet simultaneously. This includes one foot leading in a jump. If falls on landing or if uses hands to land.		
Activity Jumps forward 12"	2	1	0
	Jumps at least 12" (30 cm), both feet simultaneously	Jumps between 2- 11" (5- 28 cm), both feet simultaneously	Unable to initiate jump with both feet simultaneously

Scoring Detail for Item 29

Photographs / Notes



Figure 29a Starting Position. Subject is placed with toes touching the starting line.



Figure 29b Subject jumping with both feet simultaneously leaving the floor.



Figure 29c Shows how the distance of the jump is measured, from the starting line to the back of the heels.

Test item 30: Ascends 4 stairs with railing

Starting position

Standing independently, barefoot at the base of the four stairs

Finish position

Standing at the top of the stairs, both feet on top step. May still use rail for support if required.

Instruction

Can you walk up the steps? You can use one railing (can use two hands to one rail).

Scoring detail / Diagram

Using a set of standard steps (each step 15cm/6 inches in height, therapy stairs if possible), goal is to ascend 4 steps, must complete all 4 steps to score a 2.

Alternating pattern = Step-through pattern, one foot to a step, reciprocal movement with alternate leg on each step

Marking time = Step-to pattern, two feet to a step

1 rail = hand(s) on body and/or rail, 2 hands on 1 rail, providing support of any kind

Scores 2: The subject ascends four steps, holding one rail and utilizes an alternating stepping pattern. Two hands on one rail are acceptable. *If the subject ascends 4 steps using an alternating pattern and without the use of a rail, a score of 2 should be given. Widening base of support is acceptable.

Scores 1: The subject ascends at least 2 steps, holding one rail utilizing a alternating or step-to pattern. Subjects who demonstrate a step-to pattern (moving one leg up one step and then bringing the opposite leg up to the same step) at any time during the four steps would only meet the criterion for a score of 1. This includes subject facing the railing and side-stepping up the steps.

Scores 0: The subject is unable to ascend 2 steps with the use of one rail

Activity
Ascends 4 stairs, with railing
Photographs / Notes

2	1	0
---	---	---

Ascends 4 steps with railing, alternating feet

Ascends 2-4 steps, one rail, any pattern

Unable to ascend 2 steps using one rail



Figure 30a Score 2
Subject ascends 4 steps with alternating steps, holding onto one rail with one hand (two hands on one railing would still score 2).



Figure 30b Score 1
Subject ascends at least 2 steps, holding one rail using an alternating or "step to" pattern. Holds one railing with two hands.



Figure 30c Score 0
Subject ascends 4 steps using two rails or unable

Test item 31: Descends 4 stairs with railing

Starting position
Finish position

Standing independently barefoot at the top of the four stairs
Standing at the base of the four stairs, both feet on floor. May still use rail for support if required.

Instruction

Can you walk down the steps? You can use one railing (can use two hands to one rail).

Scoring detail / Diagram

Using a set of standard steps (each step 15cm/6 inches in height, therapy stairs if possible), goal is to descend 4 steps, must complete all 4 steps to score a 2

Alternating pattern = Step-through pattern, one foot to a step, reciprocal movement with alternate leg on each step

Marking time = Step-to pattern, two feet to a step

1 rail = hand(s) on body and/or rail, 2 hands on 1 rail, providing support of any kind

Scores 2: The subject descends four steps, holding one rail and utilizes an alternating stepping pattern. Two hands on one rail are acceptable. If the subject descends 4 steps using an alternating pattern and without the use of a rail, a score of 2 should be given.

Score 1: The subject descends at least 2 steps, holding one rail utilizing an alternating or step-to pattern.

Subjects who demonstrate a step-to pattern (moving one leg down one step and then bringing the opposite leg down to the same step) at any time during the four steps would only meet the criterion for a score of 1. This includes subject facing the railing and side-stepping down the steps.

Score 0: The subject is unable to descend 2 steps with the use of one rail.

Activity

Descends 4 stairs, with railing

Photographs / Notes

2	1	0
Descends four steps, with railing, alternating feet	Descends 2-4 steps, one rail, any pattern	Unable to descend 2 steps using one rail



Figure 31a Score 2
Subject can descend 4 steps holding onto one railing with one (or two) hand and stepping alternately.



Figure 31b Score 1
Subject can descend at least 2 steps holding onto one railing with two hands but requires both feet on a step to move down to the next step.

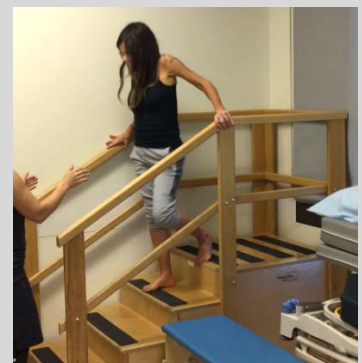


Figure 31c Score 0 Two railings are required to descend steps or unable.

Test item 32: Ascends 4 stairs without arm support

Starting position

Standing independently, barefoot at the base of the four stairs

Finish position

Standing at the top of the four stairs, both feet on top step

Instruction

Can you walk up the steps? This time try not to use the railing.

Scoring detail / Diagram

The subject may not touch the rail or the steps with either hand (i.e. must remain arms free). **Arm support includes contact with the rail or steps or subjects own body.**

Alternating pattern = Step-through pattern, one foot to a step, reciprocal movement with alternate leg on each step

Marking time = Step-to pattern, two feet to a step

Scores 2: The subject ascends 4 steps and utilizes an alternating foot pattern without the use of arm support.

Scores 1: The subject ascends at least 2 steps utilizing either an alternating or step-to pattern without arm support. If, at any time, a step-to pattern (one leg up one step followed by bringing the opposite leg up to the same step) is used, a maximum score of 1 should be given.

Scores 0: The subject is unable to ascend 2 steps without arm support. If the subject touches the railing, their body, or the evaluator for balance or support, a score of 0 should be given.

Activity
Ascends
four stairs
arms free

	2	1	0
	Independently (without support/rail) ascends four steps using alternating feet	Ascends 2-4 steps, arms free, any pattern	Unable to ascend 2 steps arms free

Photographs / Notes



Figure 32a Score 2

Ascending steps hands-free with alternating step-through pattern.

Score 1 Subject climbs at least 2 steps with either an alternating or a step-to pattern without touching rails.

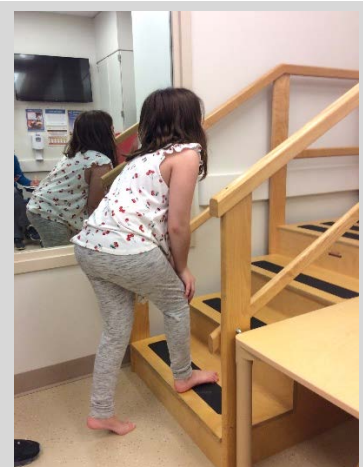


Figure 32c Score 0 A requirement to touch or hold the rails scores 0.

Test item 33: Descends 4 stairs without arm support

Starting position

Standing independently, barefoot at the top of the four stairs

Finish position

Standing at the base of the four stairs, both feet on floor

Instruction

Can you walk down the steps? This time try not to use the railing.

Scoring detail / Diagram

The subject may not touch the rail or the steps with either hand (i.e. must remain arms free). **Arm support includes contact with the rail or steps or subjects own body.**

Alternating pattern = Step-through pattern, one foot to a step, reciprocal movement with alternate leg on each step

Marking time = Step-to pattern, two feet to a step

Scores 2: The subject descends 4 steps utilizing an alternating foot pattern without the use of arm support.

Scores 1: The subject descends at least 2 steps and utilizes either an alternating or step-to pattern without arm support. If, at any time, a step-to pattern (one leg down one step followed by bringing the opposite leg down to the same step) is used, a maximum score of 1 should be given.

Scores 0: The subject is unable to descend 2 steps without arm support. If the subject touches the railing, their body, or the evaluator for balance or support, a score of 0 should be given.

Activity
Descends 4 stairs arms free

	2	1	0
	Independently (without support/rail) descends four steps using alternating feet	Descends 2-4 steps, arms free, any pattern	Unable to descend 2 steps arms free

Photographs / Notes



Figure 33a Score 2

Descends hands-free using alternating step-through pattern.



Figure 33b Score 1

Descends hands-free using step-to, marking time pattern.

Acknowledgements

This manual is the result of the International Spinal Muscular Atrophy Consortium (iSMAC) collaboration between SMA REACH UK, the Italian SMA Network and the Pediatric Neuromuscular Clinical Research Network (PNCR) for SMA (USA). We are also grateful to Marion Main for the creation of the original Hammersmith Functional Motor Scale (HFMS) and her support for its use worldwide. We also would like to acknowledge previous authors for their work in development of the HFMSE 2009 manual upon which this 2019 manual is based. We also thank the previous authors of the manuals for their permission to reproduce their original photographs for this manual. This manual was made possible through generous support by The SMA Trust (UK) who has funded SMA REACH UK, from the Italian Telethon and Famiglie SMA to the Italian SMA network, and the support of the SMA Foundation (USA). We acknowledge Spinal Muscular Atrophy Support UK (formerly The Jennifer Trust for SMA) for the development of previous scales. We are grateful to all of the clinicians and investigators that have provided feedback and input. Finally, we thank those affected with SMA and their families who have given us their time and their permission to use their photographs to illustrate this assessment tool successfully.

References

Glanzman AM, O'Hagen JM, McDermott MP, Martens WB, Flickinger J, Riley S, Quigley J, Montes J, Dunaway S, Deng L, Chung WK, Tawil R, Darras BT, De Vivo DC, Kaufmann P, Finkel RS; Pediatric Neuromuscular Clinical Research Network for Spinal Muscular Atrophy (PNCR); Muscle Study Group (MSG). Validation of the Expanded Hammersmith Functional Motor Scale in spinal muscular atrophy type II and III. *J Child Neurol*. 2011 Dec;26(12):1499-507. doi: 10.1177/0883073811420294. Epub 2011 Sep 21.

Glanzman AM, Mazzone ES, Young SD, Gee R, Rose K, Mayhew A, Nelson L, Yun C, Alexander K, Darras BT, Zolkipli-Cunningham Z, Tennekoon G, Day JW, Finkel RS, Mercuri E, De Vivo DC, Baldwin R, Bishop KM, Montes J. Evaluator Training and Reliability for SMA Global Nusinersen Trials1. *J Neuromuscul Dis*. 2018;5(2):159-166. doi: 10.3233/JND-180301.

Main M, Kairon H, Mercuri E, Muntoni F. The Hammersmith functional motor scale for children with spinal muscular atrophy: a scale to test ability and monitor progress in children with limited ambulation. *Eur J Paediatr Neurol*. 2003;7(4):155-9.

O'Hagen JM, Glanzman AM, McDermott MP, Ryan PA, Flickinger J, Quigley J, Riley S, Sanborn E, Irvine C, Martens WB, Annis C, Tawil R, Oskoui M, Darras BT, Finkel RS, De Vivo DC. An expanded version of the Hammersmith Functional Motor Scale for SMA II and III patients. *Neuromuscul Disord*. 2007 Oct;17(9-10):693-7. Epub 2007 Jul 19.

Pera MC, Coratti G, Forcina N, Mazzone ES, Scoto M, Montes J, Pasternak A, Mayhew A, Messina S, Sframeli M, Main M, Lofra RM, Duong T, Ramsey D, Dunaway S, Salazar R, Fanelli L, Civitello M, de Sanctis R, Antonaci L, Lapenta L, Lucibello S, Pane M, Day J, Darras BT, De Vivo DC, Muntoni F, Finkel R, Mercuri E. Content validity and clinical meaningfulness of the HFMSE in spinal muscular atrophy. *BMC Neurol*. 2017 Feb 23;17(1):39. doi: 10.1186/s12883-017-0790-9.