

**PEDIATRIC UPPER EXTREMITY
MOTOR ACTIVITY LOG-REVISED
(PMAL) MANUAL**
Pediatric CI Therapy Group

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1. **General**

The PMAL is a structured interview intended to examine how often and how well a child uses his/her involved upper extremity (UE) in their natural environment outside the therapeutic setting. The child's primary caregiver is asked standardized questions about the amount of use of the child's involved arm (How Often Scale or HO) and the quality of the child's movement during the functional activities specified in the instrument (How Well Scale or HW). These two scales range from 0 to 10. The HO and HW scales are printed on separate sheets of paper and are placed in front of the caregiver during test administrations. Caregivers should be told that they can give half scores (i.e., 0.5, 1.5, 2.5, 3.5, 4.5) if this is reflective of their ratings.

During the first (pre-treatment) test administration, the test should be given by the therapist after the therapist has had a period of time to observe a child's behavior. The tester should discuss the rating with the caregiver to develop the common frame of reference. The frame of reference for each child should be their less affected UE. The therapist should verify the response (e.g., "So, you rated that activity a '3'. However, your child moved his/her arm just as well as the less affected arm. According to the frame of reference for this outcome measure that would be scored more like a '5'. Do you agree?"). The final rating must be agreed to by the caregiver. Establishing a common frame of reference for the rating scales during the pre-treatment testing, before therapy has begun, is a critically important step. For suggestions on how to accomplish this see **Comments 3 and 4** at the end of this document. The pre-treatment administration of the PMAL is very important and as much as an hour or even more if needed should be devoted to it so that an appropriate frame of reference is established. During this test

administration, copies of the two rating scales should be left with the caregiver for their future use.

2. Instructions to Caregiver before Test Administration

“The purpose of this questionnaire is to assess your child’s ability to use his/her impaired arm. There is a list of 22 items and you will be asked to rate each item on two different 6 point scales. On the first scale you will rate *how often* your child carries out each of the activities with his/her involved arm. On the second scale you will rate *how well* your child uses the involved arm for that activity. Your ratings can be in *half* steps if needed (i.e., 1.5, 2.5, 3.5, etc.). Please consider your responses carefully so that you can give as accurate a picture of your child’s activities as possible.”

3. Rating Scales

The How Well Scale (HW) is used during all test administrations. The How Often Scale (HO) should be used at pre-treatment, the day after the cast is removed, post-treatment, and follow-up testing. It should not be administered during treatment (when a cast or splint is worn on the less-involved arm -see **Comment 1**). Caregivers should first be asked to rate all tasks using the HO scale. In a separate iteration, caregivers should be asked to rate each item with the HW scale. The tester should describe in detail the differences between the HO and HW scales (as suggested in the instructions below). The tester should not ask the caregiver to rate items on the HW scale if they have already scored use of the involved arm a 0 for HO. However, for post-testing if the caregiver rates an item a 0 for HO then the score for HW should be carried over from TD 15. It is unlikely that performance would decline from TD 15 to post-testing.

HOW OFTEN SCALE

- 0 - Not Used -Your child did not use the weaker arm for the activity.
- 1 - Very Rarely – 5% -10% of the time - Your child occasionally used the weaker arm for the activity, but only very rarely.
- 2 - Rarely – About 25% of the time - Your child used the weaker arm at times, but did the activity with the stronger arm most of the time.
- 3 - Sometimes –About 50% of the time - The weaker arm was used in performing the activity, but only about half as much as the stronger arm.
- 4 - Often – About 75% of the time - The weaker arm was used in performing the activity regularly, but just three-quarters as often as the stronger arm.
- 5 - Normal – 90%-100% of the time -The weaker arm was used as often as the stronger arm to perform the activity.

HOW WELL SCALE

- 0 - Not Used - Your child did not use the weaker arm at all for the activity.
- 1 - Very Poor - Your child had very little functional use of the weaker arm for the activity. The arm may have moved during the activity but was of no real functional help.
- 2 - Poor - Your child had minor functional use of the weaker arm for the activity. The arm actively participated in the activity, but the stronger arm or caregiver did most of the work.
- 3 - Fair or Moderate - The weaker arm was used to accomplish the activity, but the performance was very slow and/or involved great difficulty.
- 4 - Almost Normal - The weaker arm was able to accomplish the activity independently, but did so with some difficulty and/or inaccuracy.
- 5 - Normal -The weaker arm did the activity normally.

4. Asking Questions

Step One: The tester should remind the caregiver that these questions pertain to what their child actually does outside the treatment setting – not what they think the child may be able to do.

Step Two: The tester should inquire about each activity by asking the following questions:

- a. First Test Administration and Follow-Up Administrations – “During the past week, did your child (state the activity) with their right/left arm?”
- b. Administrations During Treatment and Post-Treatment – “Since the last time I asked you, did your child (state the activity)?”

Step Three: Rating How Often and How Well the Involved Arm Was Used.

- a. How Often Rating: Ask the subject, “Using the How Often (HO) Scale, tell me how often your child used his/her weaker arm to (state the activity).” Once the caregiver selects a rating, *verify the response* by repeating the selected rating and say; “So, you believe that your child (read the HO rating). Is that correct?” Once they agree, record the response in the blank HO space provided on the Score Sheet for the *initial response* for that question

- b. Probing the Response during all test administrations other than pre-treatment: The tester should refer back to the score sheet of the previous test administered which should be kept on the table at which they are sitting (but hidden from the caregiver’s view). If a rating change has occurred since the last test administration, the tester should *probe the response* by asking the following questions in sequence:

1. “I see you rated your child (state either “higher” or “lower” – whichever is accurate) today than the last time. Do you think there has been a real change?”
2. “Now that you have thought about it more, how would you rate it?”

3. “You believe that the rating should be (read the HO or HW rating). Is that accurate?” (If *Yes*, record the rating in the *second* blank space on the answer sheet and go to the next question. If *no*, ask “Why” and go back to question 2, just above). (**See Comment 5**)

c. How well Rating: Ask the subject, “Using the How Well (HW) Scale, tell me how well your child used his/her involved arm when he/she did use it to (state the activity).” For the pre-treatment administration, emphasize the difference between the HO and HW scales (**See Comment 3**). Once the subject selects a rating, *verify the response* by repeating the selected rating and say; “So, you believe that your child (read the selected HW rating). Is that correct?” Once they agree, record the response in the blank HW space provided on the Score Sheet for the *initial response* for that question.

4. Administration times

The PMAL is to be administered at the following times:

- a. During the pre-treatment testing day the full PMAL (HO, HW).
- b. Every Monday during the treatment and the day after the cast has been removed a full HW scale.
- c. Half of the HW scale should be administered on the remaining treatment days (Tuesday – Friday), excluding the last day of treatment.
- d. Full PMAL (HO and HW) on the last day of treatment after the cast has been removed the day before. (For example, when treatment is three weeks, the cast is removed at the beginning of TD 14. Then treatment on TD 14 and TD 15 is bilateral.)
- e. During the post-treatment testing day the full PMAL (HO, HW).
- f. During each follow-up testing day the full PMAL (HO, HW).

5. **Scoring:** After administering the PMAL, mean PMAL scores are calculated for the two scales by adding the rating scores on each of the scales and dividing by the number of items asked. It is important that the parent/caregiver refer to the same items in the environment each day when answering questions on the PMAL. This is to insure that the items in question remain consistent throughout the course of the study. For example, item 12 “Open a door or cabinet” involves different motor behaviors and levels of difficulty depending on which door or cabinet is opened. If the parent first scores the child opening a particular cabinet, then that should be noted in the comments section and that cabinet should be scored for the remainder of the study. As noted above, if a caregiver answers “no” (they did not do the task), then try to determine why. If you find that it is impossible for the child to carry out the activity (e.g., physically impossible for child to do, activity never carried out in that family, or developmentally inappropriate), the question is dropped from that and all other PMALs for that child and the mean score is calculated with the remaining items only (e.g., divide by 21 instead of 22). Otherwise, a rating score of zero is entered for “no” responses, and the mean scores are calculated using the entire PMAL (e.g., divide by 22). Use of the n/a category should be very sparing, since virtually all children will have an opportunity to carry out each of the activities in the PMAL in their home. If the child does not do a task because the caregiver does it for them (e.g., take off shoes or socks), the therapist should ask the parent to let the child attempt that activity by themselves.

If a child does an activity *during treatment* and then does not do it on subsequent treatment days because an opportunity did not present itself since the last PMAL administration, the last score is carried forward. This is a conservative method of scoring since it is unlikely that performance would get worse during treatment and much more likely that it would get better. If a child does an activity pre-treatment, but cannot do it during treatment (e.g., in the hotel room

where the child is staying during treatment there is no riding, pulling or push toy), the score for that item is “not applicable” (n/a or a dot or left blank, depending on the data entry system being used). However, when the subject returns home and that activity can again be performed, scoring of that item is resumed. During treatment, if a child is able to perform an activity but the parent/caregiver did not see the child do it since the last time the therapist asked, then the last HO and HW score is carried forward. HO and HW scores may only be carried forward until post-testing.

COMMENTS

Comment 1: *Using the rating scales*

The HO rating scale should be used during the pre- and post-treatment test administrations, the day after the cast is removed and in follow-up. It should not be used during treatment, as the treatment involves restraint of the uninvolved arm, thereby inducing greatly increased use of the involved arm. This would artificially inflate the appearance of a therapeutic effect that might not persist after the end of treatment. However, if the cast is removed at the beginning of TD 14, this would provide time on the last two treatment days for a child to exhibit the full range of behaviors of which they are capable using both arms. Therefore, it is meaningful to obtain HO information on those days. Post-treatment testing should be done approximately two days after the end of treatment (e.g., after the weekend following the end of treatment; treatment should ideally be completed on a Friday).

Comment 2: *Time frames used in questions*

In pre-treatment and follow-up test administrations ratings should be obtained for activities carried out during the previous week. During treatment, ratings should be obtained for the time since the caregiver was last asked about that specific task.

Comment 3: *Differentiating between the How Well and How Often rating scales*

When both scales are being used to rate activities, particularly during pre-treatment testing, it is very important to make sure that the caregiver understands the difference between the scales. To accomplish this the following statement should be made before asking for ratings on the HW scale, “Remember that I am asking you to rate something different on this scale, the How Well Scale, than you did before on the How Often Scale. Before you were supposed to rate how often your child used his/her involved arm. Now I would like you to rate how well your child used his/her involved arm. For example, he/she might have used the involved hand only rarely to brush his/her teeth or to throw a ball. The How Often rating might therefore be a 1.5 or 2. However when your child did use it, his/her use of the hand was really quite good; let us say between fair and almost normal, or a 3.5. Do you understand the difference between the two types of ratings?” Go over this several times if necessary and have the caregiver verbalize the difference between the two types of ratings to make sure that it is understood.

Comment 4: *Establishing a context or a common frame of rating reference for the HW Scale on the first testing occasion.*

On the first testing occasion, the PMAL is administered by the therapist in order to establish the project-standard frame of reference for rating. The frame of reference for each child should be their less affected UE. The therapist should verify the response (e.g., “So, you rated that activity a ‘3’. However, your child moved his/her arm just as well as the less affected arm. According to the frame of reference for this project that would be scored more like a ‘5’. Do you agree?”).

When a clear disparity exists between the caregiver's HW rating and what the therapist has observed concerning the child's motor ability, the therapist should explain the meaning of the HW rating scale for the task in question with examples being given for each step, especially those that focus on the HW rating in question (e.g., "You rated that activity a '4'. However, your child moved his/her arm very slowly to do the activity. So, for this project that would be more like a '3'. Do you agree?").

Comment 5: *Probing a change in the response after the beginning of treatment*

During the standardized questioning, the caregivers should not be told their previous scores. However, if their report reflects a change in score, whether an increase or a decrease, the change in rating should be probed to determine whether it reflects a true change. In the treatment of adults with CI therapy, probing results in revisions in the direction of performance decrement upwards and downwards about equally often (Uswatte et al., 2005).

Comment 6: *History and clinimetric properties of the adult MAL*

The MAL was developed in 1986 by Edward Taub and Karen McCulloch. It was first used in 1987 in a study published several years later (Taub et al., 1993). Three studies have shown that the adult MAL has strong clinimetric properties (Uswatte et al., 2005; Uswatte et al., 2006; van der Lee et al., 2004). Additional reliability and validity data relating to the adult MAL are as follows:

Taub and co-workers (2006) administered the adult MAL to a placebo control group (for UE CI therapy) and found that the scores for the period before treatment and two weeks later (after the end of the placebo treatment) were not significantly different. The correlation between pre- and post-treatment Quality of Movement (How Well) scores was $r = .94, p < .001$. Miltner and co-workers (1999) obtained similar findings; the second test administration in the Miltner et al.

study occurred after two weeks during which time no therapy was administered. The scores on the two tests were not significantly different from one another; they diverged by just 0.1 rating step. Excellent agreement has been recorded between subjects and informants. There was individual variability between some pairs, but on a group basis disagreement was small (0.3 rating steps). The intraclass correlation for pre- to post-treatment change scores for subjects and informants was .97. Scores on both the adult and Pediatric MALs have real world referents and are therefore not arbitrary numerical values. A study has been carried out on the 45-item higher functioning adult UE/MAL's reliability and validity (Johnson et al., 2004). The test-retest reliability of the test over a period of 2 weeks (the duration of adult UE treatment) was .99 and .98 for the two scales of the test, respectively. The correlation of the two MAL scales with the Abilhand (a reliable and valid test of real world UE use) was .88 and .71, respectively (all p 's < .05). The validity of the MAL has also been supported by high correlations between its two scales and objective accelerometer-based measures of impaired arm movement, r 's > .75, p 's < .001 (Uswatte et al., 2000).

Comment 7: *History and clinimetric Properties of the PMAL*

The precursor of the PMAL was initially used in a study by Taub, Ramey, DeLuca, and Echols(2004). The PMAL in its current form was described in a study by Taub, Griffin, Nick, Gammons, Uswatte, & Law (2007, 2011). The PMAL has a high internal consistency (Chronbach's α - .93) and test-retest reliability ($n = .91$). Convergent validity was supported by a strong correlation ($r = .5$) between changes in the PMAL scores and use of the more-affected arm during play sessions (Uswatte et al., In press).

References

Adult MAL

Johnson A, Judson L, Morris D, Uswatte G, Taub E. The validity and reliability of the 45 Item Upper Extremity Motor Activity Log. Presented at the American Physical Therapy Association Combined Sections meeting, Nashville, TN, February 2004.

Miltner WH, Bauder H, Sommer M, Dettmers C, Taub E. Effects of Constraint-Induced Movement therapy on patients with chronic motor deficits after stroke: a replication. *Stroke* 1999;30:586-592.

Taub E, Miller NE, Novack T, Cook EW, III, Fleming WC, Nepomuceno CS, Connell JS, Crago J. Technique to improve chronic motor deficit after stroke. *Arch Phys Med Rehabil* 1993;74:347-354

Taub E, Uswatte G, King DK, Morris D, Crago J, Chatterjee A. A placebo controlled trial of Constraint-Induced Movement therapy for upper extremity after stroke. *Stroke* 2006;37:1045-1049.

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Uswatte G, Taub E, Morris D, Light K, Thompson, P. The Motor Activity Log-28: assessing daily use of the hemiparetic arm after stroke. *Neurol* 2006;67: 1189-1194.

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Van der Lee J, Beckerman H, Knol D, de Vet H, Bouter L. Clinimetric properties of the Motor Activity Log for the assessment of arm use in hemiparetic patients. *Stroke* 2004;35:1-5.

Pediatric MAL (PMAL)

Taub E, Griffin A, Nick J, Gammons K, Uswatte G, Law CR. Pediatric CI therapy for stroke-induced hemiparesis in young children. *Devel Neurorehabil* 2007;10:1-16

Taub E, Griffin A, Uswatte G, Gammons K, Nick J, Law CR. Treatment of congenital hemiparesis with pediatric Constraint-Induced Movement therapy. *J Child Neurol* 2011;26: 1163-1173.

Uswatte G, Taub E, Griffin MA, Vogtle L, Rowe J, Barman J. The Pediatric Motor Activity Log-Revised: assessing real-world arm use in children with cerebral palsy. *Rehabilitation Psychology*; In press.

INSTRUCTIONS TO CAREGIVER BEFORE TEST ADMINISTRATION

“THE PURPOSE OF THIS QUESTIONNAIRE IS TO ASSESS YOUR CHILD’S ABILITY TO USE HIS/HER IMPAIRED ARM. THERE IS A LIST OF 22 ITEMS AND YOU WILL BE ASKED TO RATE EACH ITEM ON TWO DIFFERENT 6 POINT SCALES. ON THE FIRST SCALE YOU WILL RATE *HOW OFTEN* YOUR CHILD CARRIES OUT EACH OF THE ACTIVITIES WITH HIS/HER MORE INVOLVED ARM. ON THE SECOND SCALE YOU WILL RATE *HOW WELL* YOUR CHILD USES THE MORE INVOLVED ARM FOR THAT ACTIVITY. YOUR RATINGS CAN BE IN *HALF* STEPS IF NEEDED (I.E., 1.5, 2.5, 3.5, ETC.). PLEASE CONSIDER YOUR RESPONSES CAREFULLY SO THAT YOU CAN GIVE AS ACCURATE A PICTURE OF YOUR CHILD’S ACTIVITIES AS POSSIBLE.”

**PEDIATRIC MOTOR ACTIVITY LOG (PMAL) - 2-8 Years
SCORE SHEET
Pediatric CI Therapy Group
University of Alabama at Birmingham and
The Children's Hospital of Alabama**

Patient Name: _____ Date: _____

Parent's Name: _____ (Circle one) Pre During _____ Post F/U _____
Day Wk/Mo

Group (circle):

Research: *Experimental* *Control* *Crossover* _____ weeks

Clinic: *Initial* *Brush-up* _____ weeks

Examiner: _____

Please record the subject's initial response; then after probing, record the final response for both HW and HO for all tasks. The HO rating scale should only be used during the pre- and post-treatment test administrations, as well as the day after the cast is removed and during follow-up. The full HW scale should be administered pre- and post-treatment, and TD 1, 6, and 11 (e.g., Mondays), as well as follow-ups. Successive halves of the PMAL should be administered on each of the remaining treatment days (e.g. Tuesdays- Fridays).

PART I

<u>HO</u>		<u>HW</u>	
Initial	Final	Initial	Final

1. Eat finger foods _____ If no, what do you think is the reason? (use code)
(e.g., cookie, sandwich) _____

Comments _____

2. Pick up a small item _____ If no, what do you think is the reason? (use code)
(e.g., cheerio, raisin, small bead, or dice) _____

Comments _____

3. Self-feed with _____ If no, what do you think is the reason? (use code)
fork/spoon _____

Comments _____

Codes for recording "no" responses:

1. "Child used the stronger arm entirely." (assign "0").
2. "Someone else did it for the child." (assign "0").
3. "Child never has the opportunity to do that activity." (assign "0" and ask caregiver to provide an opportunity).
4. "Child sometimes does that activity, but I did not see the child do it since the last time I answered these questions." (carry-over last assigned score for that activity).
5. Child only did activity in therapy (carry-over last assigned score for that activity).
6. Impossible for child to do/developmentally inappropriate. (remove item from scoring; to get the mean score for the test, subtract this item from the number of total scores in denominator)

PMAL Score Sheet

4. Brush teeth _____ If no, what do you think is the reason? (use code)

Comments _____
5. Gesture (e.g., wave, _____ If no, what do you think is the reason? (use code)
blow kiss, peak-a-boo) _____
Comments _____
6. Push arm through _____ If no, what do you think is the reason? (use code)
sleeve of clothing _____
Comments _____
7. Turn a page in a book _____ If no, what do you think is the reason? (use code)

Comments _____
8. Point to a picture _____ If no, what do you think is the reason? (use code)

Comments _____
9. Reach for an object _____ If no, what do you think is the reason? (use code)
above head _____
Comments _____
10. Push a button or key _____ If no, what do you think is the reason? (use code)
(e.g., toy, doorbell, _____
keyboard) _____
Comments _____
11. Steady self _____ If no, what do you think is the reason? (use code)
(e.g. use for postural support) _____
Comments _____

Codes for recording “no” responses:

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5. Child only did activity in therapy (carry-over last assigned score for that activity).
6. Impossible for child to do/developmentally inappropriate.

PMAL Score Sheet

PART II

HO HW
Initial Final Initial Final

12. Open a door or cabinet (push or pull) _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

13. Turn a knob (e.g., toy, door) _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

14. Use arm to move across floor (e.g., creep, crawl, scoot) _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

15. Take off shoes _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

16. Take off socks _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

17. Push large object across floor (e.g., box, chair, stool) _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

18. Hold a small ball _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

19. Throw a ball or other object _____ _____ _____ _____ If no, what do you think is the reason? (use code)

Comments _____

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4. "Child sometimes does that activity, but I did not see the child since the last time I answered these questions." (carry-over last assigned score for that activity).
5. Child only did activity in therapy (carry-over last assigned score for that activity).
6. Impossible for child to do/developmentally inappropriate.

PMAL Score Sheet

20. Use a cylindrical object (e.g., crayon, marker) _____ If no, what do you think is the reason? (use code)

- Comments _____
21. Hold a handle while riding, pulling, or pushing a toy (e.g., tricycle, shopping cart, baby buggy) _____ If no, what do you think is the reason? (use code)

- Comments _____
22. Placement of object (e.g. puzzle piece, shape sorter) _____ If no, what do you think is the reason? (use code)

- Comments _____

Codes for recording “no” responses:

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(assign “0” and ask caregiver to provide an opportunity)
4. “Child sometimes does that activity, but I did not see the child do it since the last time I answered these questions.”
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5. Child only did activity in therapy
(carry-over last assigned score for that activity)
6. Impossible for child to do/developmentally inappropriate.
(remove item from scoring; to get the mean score for the test, subtract this item from the number of total scores in the denominator)

HOW OFTEN SCALE

0 - Not Used -Your child did not use the weaker arm for the activity.

1 - Very Rarely – 5% -10% of the time - Your child occasionally used the weaker arm for the activity, but only very rarely.

2 - Rarely – About 25% of the time - Your child used the weaker arm at times, but did the activity with the stronger arm most of the time.

3 - Sometimes –About 50% of the time - The weaker arm was used in performing the activity, but only about half as much as the stronger arm.

4 - Often – About 75% of the time - The weaker arm was used in performing the activity regularly, but just three-quarters as often as the stronger arm.

5 - Normal – 90%-100% of the time -The weaker arm was used as often as the stronger arm to perform the activity.

HOW WELL SCALE

0 - Not Used - Your child did not use the weaker arm at all for the activity.

1 - Very Poor - Your child had very little functional use of the weaker arm for the activity. The arm may have moved during the activity but was of no real functional help.

2 - Poor - Your child had minor functional use of the weaker arm for the activity. The arm actively participated in the activity, but the stronger arm or caregiver did most of the work.

3 - Fair or Moderate - The weaker arm was used to accomplish the activity, but the performance was very slow and/or involved great difficulty.

4 - Almost Normal - The weaker arm was able to accomplish the activity independently, but did so with some difficulty and/or inaccuracy.

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