

Best Evidence Statement (BESt)

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Use of motor and self-care assessment tools for children with autism spectrum disorder (ASD)

Clinical Question

P (population/problem): Among children with ASD up to 9 years of age,
I (intervention): what is the most reliable and valid tool
O (outcome): to measure a child's motor skills?

P (population/problem): Among children with ASD up to 9 years of age,
I (intervention): what is the most reliable and valid tool
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Target Population

Inclusions:

- Children up to nine years of age who present with a diagnosis of ASD according to the DSM-IV criteria.

Exclusions:

- Children with a diagnosis of the following subcategories of ASD: Rett Syndrome or Childhood Disintegrative Disorder

Recommendations

1. It is recommended that standardized testing of motor and self-care skills be administered only when indicated (*Clark 2004 [5]*).

Note 1: Although standardized testing of motor and self care skills is not frequently completed with children diagnosed with autism, times at which testing may be indicated include when requested by referral source (*Clark 2004 [5]*), 3rd party payer, or caregiver, or upon therapist judgment based on clinical observations and clinical reasoning (*Local Consensus [5]*).

Note 2: "Additionally, individuals with autism have been described as distractible, demonstrating variability in skill performance, having low tolerance for incoming sensory stimuli, and impervious to the usual verbal and even tangible motivators that are used to support optimal performance during testing (*Koegel 1997, Cook 1991, Rapin 1991*). Therefore, a standardized testing process does not play to the strengths of individuals with autism and, consequently, the testing process often is not well tolerated, nor does it result in an accurate reflection of the individual's abilities" (*Tomchek 2009 [5]*).

2. It is recommended that if standardized testing of motor and self-care skills is warranted, one of the following assessment tools be administered during or after the initial occupational therapy (OT) evaluation:
 - 0 through 5 years of age: Peabody Developmental Motor Scales 2 (PDMS-2)
 - 4 years through 9 years: Bruininks-Oseretsky Test of Motor Proficiency -2 (BOT2)
 - 6 months through 7.5 years of age: Pediatric Evaluation of Disability Inventory (PEDI)(*Local Consensus [5]*).
3. It is recommended that the assessment results be interpreted with caution as some of the tools are not standardized for children with ASD (*Local Consensus [5]*).

Note 1: The PDMS 2 has not been normed for children with ASD, however many studies report the use of the Peabody with children who have ASD (*Provost 2007 [4b], Connolly 2006 [4b], Provost 2004 [4b]*).

Note 2: Although the BOT-2 is not standardized on children with ASD, data was collected showing that the BOT-2 is sensitive enough to identify motor deficits in children with high-functioning autism/Asperger's Disorder (Bruininks 2005 [5]).

Note 3: One of the limitations of the PEDI for this population is the limited sample size of children with cognitive and social disabilities (Feldman 1990 [4b]). The authors propose that the PEDI is most appropriate to use with children who have physical or combined physical and cognitive disabilities. The validity of using the PEDI with children who have primarily behavioral and social concerns such as autism is unknown (Haley 1992 [5]).

Discussion/summary of evidence

The body of evidence for the use of standardized tests with children who have a diagnosis of ASD is low. In addition, the value of standardized testing is questionable with children who have ASD. Results may “bear little relationship to the children’s abilities to function” (Clark 2004 [5], Local Consensus [5]). Children with ASD may perform better than their usual abilities during standardized assessments due to the highly structured test setting as opposed to the child’s natural setting, which may be less structured. Performance may be below or above their usual abilities depending on the client’s level of interest and/or motivation; test procedures may need to be modified to increase child’s motivation and comprehension (Clark 2004 [5]). If tests are not completed or conducted in a standardized way, the results would need to be interpreted with caution since they would no longer be standardized (Local Consensus [5]).

1. Peabody Developmental Motor Scales 2 (PDMS-2)

The Peabody Developmental Motor Scales second edition (PDMS-2) is a standardized test, which assesses motor functioning of children from birth to 6 years. The complete battery includes six subtests, which provide information regarding the child’s performance in areas of gross and fine motor skills. The six subtests include:

- reflexes (birth – 11 months) (Folio 2000 [5])
- stationary (control of body) (Folio 2000 [5])
- locomotion (ability to move from one area to another) (Folio 2000 [5])
- object manipulation (children 12 months and older, use of bilateral coordination skills to manipulate ball handling skills) (Folio 2000 [5])
- grasping (ability to use hands in functional activities) (Folio 2000 [5])
- visual motor integration (Folio 2000 [5]) (“the ability to use visual-perceptual skills to complete complex eye-hand coordination tasks” (Provost 2007 [4b])).

The child’s cognitive skills need to be at a level that will allow him/her to understand instructions for each of the test items (Provost 2007 [4b]).

Reliability: Studies show that test-retest reliability is good and inter-rater reliability is high (Wang 2006 [4a]). Test-retest and inter-rater reliability ranged from 0.82-0.93 and 0.96-0.99 respectively (van Hartingsveldt 2005 [4b], Provost 2004 [4b], Asher 2007 [5], Folio 2000 [5]).

Validity: There is a high correlation of concurrent validity of the PDMS-2 and the Mullen Scales of Early Learning: AGS Edition (Wang 2006 [4a], Folio 2000 [5]). In addition, there is a high correlation between age equivalence and subtests raw scores of the PDMS-2 (Wang 2006 [4a], Folio 2000 [5]). According to Provost et al, when the PDMS-2 was compared to the Bayley Scales of Infant Developmental 2 “the correlation coefficients were high to very high for age equivalent scores and the Locomotion Subscale”; however, the author concluded there is poor agreement between the standard scores (Provost 2004 [4b]). This means that the concurrent validity of the Bayley and the PDMS-2 is high for the age equivalents and the Locomotion Subscale, but is low for the standard scores (Connolly 2006 [4b], Provost 2004 [4b]).

2. Bruininks-Oseretsky Test of Motor Proficiency -2 (BOT2)

The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition is a standardized test which assesses fine and gross motor functioning of children ages 4 to 21 years. The complete battery includes 53 items divided into four motor area composites with two subtests each:

- fine manual control (fine motor precision and fine motor integration subtests)
- manual coordination (manual dexterity and upper limb coordination subtests)
- body coordination (bilateral coordination and balance subtests)
- strength and agility (running speed and agility and strength subtests)

(Bruininks 2005 [5]).

Reliability: Inter-rater reliability is good with all subtests and composite scores >0.90 with the exception of the Fine Motor Precision subtest which was 0.86. Test-retest reliability is ≥ 0.80 for Total Motor Composite. For the other composite scores and related subtests, the test-retest reliability was <0.80 with the exception of the Strength and Agility composite, which was >0.80 (Deitz 2007 [5], Bruininks 2005 [5]).

Validity: “The test manual provides theoretical and empirical evidence of validity in test content, internal structure, clinical group differences, and relationships with other motor skills tests” (Asher 2007 [5]).

3. Pediatric Evaluation of Disability Inventory (PEDI)

The PEDI evaluates capability and functional performance in young children ages 6 months to 7.5 years with a variety of disabilities. The PEDI evaluates function in three domains: self-care, mobility and social function. It can be administered through a structured interview with a parent or by judgment of a professional familiar with the functional abilities of the child. The PEDI was initially standardized on a normative sample of 412 non-disabled children. Although the PEDI can be appropriately used with children older than 7.5 years whose functional skills are delayed, normative standard scores for these older children are not available; however, the scaled scores are appropriate to use with a child of any age. Each scale may be used separately (Haley 1992 [5]). The six scales include:

- functional skill - self-care
- functional skill - mobility
- functional skill - social function
- caregiver assistance - self-care
- caregiver assistance - mobility
- caregiver assistance - social function

Reliability: The six scales of the PEDI demonstrate excellent internal consistency ranging from 0.95 and 0.99 (Haley 1992 [5]). Inter-rater reliability for all scales is also very high (Haley 1991 [4b]).

Validity: The PEDI has been validated as a discriminative measure as well as an evaluative measure. The content, construct, concurrent, discriminant and evaluative validity of the PEDI have been established (Haley 1991 [4b], Feldman 1990 [4b], Haley 1992 [5]).

Health Benefits, Side Effects and Risks


Benefits:



- Family will gain an understanding of where their child is functioning compared to other children his/her age (Local Consensus [5]).

Risks:

- No studies specifically evaluating the validity of these instruments with children diagnosed with autism were identified. Therefore, test results may not be valid and need to be interpreted with caution (Local Consensus [5]).

References/Citations

Note: When using the electronic version of this document,  indicates a hyperlink to the PubMed abstract. A hyperlink following this symbol goes to the article PDF when the user is within the CCHMC network.

1. **AOTA:** Occupational Therapy Practice Framework: Domain and Process - 2nd edition. *Am J Occup Ther*, 62(6): 625-683, 2008, [5] .
2. **Asher, I. E.:** Occupational therapy assessment tools: An annotated index 2007, [5] .

3. **Bruininks, R., and Bruininks, B.:** *Bruininks-Oseretsky Test of Motor Proficiency, Second Edition*. Circle Pines, MN, 2005, [5] 🗄️.
4. **Clark, J.; Miller-Kuhaneck, H.; and Watling, R.:** *Autism: A Comprehensive OT approach*. Edited, 2004, [5] 🗄️.
5. **Connolly, B. H.; Dalton, L.; Smith, J. B.; Lamberth, N. G.; McCay, B.; and Murphy, W.:** Concurrent validity of the Bayley Scales of Infant Development II (BSID-II) Motor Scale and the Peabody Developmental Motor Scale II (PDMS-2) in 12-month-old infants. *Pediatr Phys Ther*, 18(3): 190-6, 2006, [4b] _____ 🗄️ _____.
6. **Cook, D.:** The assessment process. In *Pediatric occupational therapy: Facilitating effective service provision*, pp. 35-72. Edited by Dunn, W., Thorofare, NJ, Slack, 1991, 🗄️.
7. **Deitz, J. C.; Kartin, D.; and Kopp, K.:** Review of the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2). *Phys Occup Ther Pediatr*, 27(4): 87-102, 2007, [5] _____ 🗄️ _____.
8. **Feldman, A. B.; Haley, S. M.; and Coryell, J.:** Concurrent and construct validity of the Pediatric Evaluation of Disability Inventory. *Phys Ther*, 70(10): 602-10, 1990, [4b] _____ 🗄️ _____.
9. **Folio, M., and Fewell, R.:** *Peabody Developmental Motor Scales. Examiners Manual. 2nd ed.* Austin, TX, 2000, [5] 🗄️.
10. **Haley, S. M.; Coster, W. J.; and Faas, R. M.:** A Content Validity Study of the Pediatric Evaluation of Disability Inventory. *Pediatr Phys Ther*, 3(4): 177, 1991, [4b] 🗄️.
11. **Haley, S. M.; Coster, W. J.; Ludlow, L. H.; Haltiwanger, J. T.; and Andrellos, P. J.:** *Pediatric Evaluation of Disability Inventory (PEDI) - Examiners Manual*. Boston, 1992, [5] 🗄️.
12. **Koegel, L. K.; Koegel, R. L.; and Smith, A.:** Variables related to differences in standardized test outcomes for children with autism. *J Autism Dev Disord*, 27(3): 233-43, 1997, _____ 🗄️.
13. **Local Consensus:** at the time the BESt was developed. [5].
14. **Provost, B.; Heimerl, S.; McClain, C.; Kim, N. H.; Lopez, B. R.; and Kodituwakku, P.:** Concurrent validity of the Bayley Scales of Infant Development II Motor Scale and the Peabody Developmental Motor Scales-2 in children with developmental delays. *Pediatr Phys Ther*, 16(3): 149-56, 2004, [4b] _____ 🗄️ _____.
15. **Provost, B.; Lopez, B. R.; and Heimerl, S.:** A comparison of motor delays in young children: autism spectrum disorder, developmental delay, and developmental concerns. *J Autism Dev Disord*, 37(2): 321-8, 2007, [4b] _____ 🗄️ _____.
16. **Rapin, I.:** Autistic children: diagnosis and clinical features. *Pediatrics*, 87(5 Pt 2): 751-60, 1991, _____ 🗄️.
17. **Tomchek, S., and Case-Smith, J.:** Occupational Therapy Practice Guidelines for Children and Adolescents with Autism. Report for *The AOTA Practice Guidelines Series*, 2009, [5] 🗄️ _____.
18. **van Hartingsveldt, M. J.; Cup, E. H.; and Oostendorp, R. A.:** Reliability and validity of the fine motor scale of the Peabody Developmental Motor Scales-2. *Occup Ther Int*, 12(1): 1-13, 2005, [4b] _____ 🗄️ _____.
19. **Wang, H. H.; Liao, H. F.; and Hsieh, C. L.:** Reliability, sensitivity to change, and responsiveness of the peabody developmental motor scales-second edition for children with cerebral palsy. *Phys Ther*, 86(10): 1351-9, 2006, [4a] _____ 🗄️ _____.

Note: Full tables of evidence grading system available in separate document:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) (abbreviated table below)

Table of Evidence Levels (see note above)

<i>Quality level</i>	<i>Definition</i>
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5	Other: General review, expert opinion, case report, consensus report, or guideline

†a = good quality study; b = lesser quality study

Table of Recommendation Strength (see note above)

Strength	Definition
“Strongly recommended”	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
“Recommended”	There is consensus that benefits are closely balanced with risks and burdens.
No recommendation made	There is lack of consensus to direct development of a recommendation.
Dimensions: In determining the strength of a recommendation, the development group makes a considered judgment in a consensus process that incorporates critically appraised evidence, clinical experience, and other dimensions as listed below.	
<ol style="list-style-type: none"> 1. Grade of the Body of Evidence (see note above) 2. Safety / Harm 3. Health benefit to patient (<i>direct benefit</i>) 4. Burden to patient of adherence to recommendation (<i>cost, hassle, discomfort, pain, motivation, ability to adhere, time</i>) 5. Cost-effectiveness to healthcare system (<i>balance of cost / savings of resources, staff time, and supplies based on published studies or onsite analysis</i>) 6. Directness (<i>the extent to which the body of evidence directly answers the clinical question [population/problem, intervention, comparison, outcome]</i>) 7. Impact on morbidity/mortality or quality of life 	

Supporting information

Introductory/background information

Occupational therapy evaluations follow the Occupational Therapy Practice Framework: Domain and Process using a client centered Occupational Profile and analysis of occupational performance (AOTA 2008 [5]). Interviews and skilled clinical observations are the first step in evaluating a child with ASD. The focus of the initial evaluation is on the child’s engagement in occupations or activities that occupy his or her day. There are certain characteristics, performance skills, and client factors related to the medical diagnosis of ASD that are helpful for the OT examiner to keep in mind. These characteristics include: “limitations in social interactions and social participation, difficulties in play skills, limited independence in activities of daily living (ADLs), difficulties with performance skills, and limiting factors such as inefficient sensory processing”(Clark 2004 [5]). In order to gain a better understanding of these characteristics, a therapist may choose to do standardized testing during or after the initial evaluation (*Local Consensus [5]*).

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Search strategy

1. Databases

OVID MEDLINE
OVID EBM Reviews (Cochrane)
OVID CINAHL
Other:

1. EBM Reviews Full Text - Cochrane DSR, ACP Journal Club, and DARE
2. All EBM Reviews - Cochrane DSR, ACP Journal Club, DARE, CCTR, CMR, HTA, and NHSEED
3. Cincinnati Children's Full Text Journals@Ovid
4. Websites: www.otseeker.com, www.otcats.com, www.pedro.fhs.usyd.edu.au
5. Pratt Journal Portal searched the Journal of Autism and Developmental Disorders
6. Additional articles from reference lists

2. Search Terms: Motor skills, self-care skills, BOT-2, Bruininks-Oseretsky Test of Motor Proficiency -2, Peabody Developmental Motor Scales, PEDI, Pediatric Evaluation of Disability Inventory (PEDI), autism, development, pediatrics

3. LIMITS AND FILTERS: none

Known conflicts of interest: *Conflict of interest declarations were completed as stated above and none were found.*

Copies of this Best Evidence Statement (BESt) are available online and may be distributed by any organization for the global purpose of improving child health outcomes. Website address: <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm>
Examples of approved uses of the BESt include the following:

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- the BESt may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
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Note

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

Reviewed by Clinical Effectiveness