

# Pediatric Developmental Screening: Understanding and Selecting Screening Instruments

February 26, 2008

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## Introduction

The importance of surveillance and screening for developmental problems in young children is widely recognized by experts and reflected in pediatric practice guidelines. Unfortunately, there are a number of barriers to the practice-based use of developmental screening instruments, including time constraints, practice management problems, and costs.

The large number of available developmental screening methods also makes the selection of instruments challenging. Such instruments differ with respect to their purpose, which may be general screening or screening for specific problems, such as autism, as well as their method, which may be parent-report or practitioner-administered. As a result, practitioners often need guidance in choosing the screening instrument that is right for their practice.

To address this need, we conducted a detailed review of the scientific research on available developmental screening instruments and developed this manual to inform practitioners' selection and application of screening instruments in a range of practice settings.

## Acknowledgments

Susan Wood, for technical assistance in the review and preparation of tables.

Laura Sices, M.D., for consultation.

Desiree Rayl, for secretarial assistance and preparation of tables.

**This manual is divided into the following sections:**

**[Part I: Defining Your Practice's Screening Needs](#)**

**[Part II: Guides to Facilitate Your Choice and Use of Screening Instruments](#)**

**[Appendices](#)**

# Part I: Defining Your Practice's Screening Needs

This section is designed to facilitate the selection of screening instruments by helping you define your practice's needs. It's important to first understand the context in which such instruments should be used. According to the [2006 American Academy of Pediatrics \(AAP\) policy statement](#), the application of developmental screening instruments should be part of a comprehensive approach to developmental surveillance.

## What is developmental surveillance?

Developmental surveillance is defined as a flexible, longitudinal, continuous, cumulative process with the following components:

- Documenting and maintaining the child's developmental history.
- Making accurate and informed observations of the child's development.
- Identifying the presence of risk and protective factors for developmental delay.
- Documenting the process of ongoing developmental surveillance and screening activities.

## When should developmental screening be performed as a part of surveillance?

- Developmental screening is indicated whenever a problem is identified during developmental surveillance or when concerns are raised by parents, other caregivers, or child health professionals.
- Standardized assessments of children's developmental status are much more accurate than clinical impressions. AAP recommended administration of standardized screening tools at targeted ages (9, 11, 24, or 30 months) to enhance the precision of developmental surveillance.

## Why should developmental screening be conducted at multiple time points?

- Repeated developmental screening is more valid and accurate than a single assessment.
- Developmental screening at multiple time points is necessary to document children's developmental progress over time.

## Questions to Consider When Choosing an Instrument

Available data on scientific validity are a critical consideration when selecting a developmental screening instrument.

Our review of developmental screening has found that there is no "one-size-fits-all" instrument. Screening instruments are likely to function differently (i.e., more accurately) with different patients and in different settings. To make an informed decision about the

specific instrument that best suits your practice, we recommend that you consider the following questions, each of which is considered in depth on the following pages:

1. [What is the primary purpose of developmental screening in your practice?](#)
2. [A. What are the characteristics of patients in your practice?](#)  
[B. What are the base rates of developmental problems in your practice?](#)
3. [What resources for implementing developmental screening procedures are available in your practice?](#)
4. [What technical assistance and experience are available to help implement a developmental screening program in your practice?](#)
5. [What resources for assessment of and intervention for developmental problems are available in your community?](#)

# 1. What Is the Primary Purpose of Developmental Screening in Your Setting or Practice?

Before selecting a screening instrument, it is necessary to consider the primary purpose of developmental screening in your setting or practice. For example, do you wish to enhance developmental surveillance, detect general developmental problems, or identify specific developmental problems or disorders? Use the table below to begin to explore your options.

<b>Purpose</b>	<b>Screening Implications</b>
Is your practice interested in a comprehensive approach? Can your practice implement more than one screening procedure?	Consider a "parental concern"-based instrument for developmental surveillance at well-child visits and the administration of a more comprehensive screening measure at intervals recommended by the AAP.
Do you wish to focus efforts on eliciting parental concerns?	Consider an instrument that elicits parental concerns about their children's development such as the Parents' Evaluation of Developmental Status (PEDS).
Do you wish to obtain parents' views on developmental skills in specific developmental domains (e.g., language) for the purpose of referral or treatment planning?	Consider an instrument that measures a range of different developmental skills such as the Ages and Stages Questionnaire (ASQ).
Do you wish to screen for specific developmental disorders such as language delay or autism?	Consider an instrument that is designed for the assessment of specific disorders.

## 2a. What Are the Characteristics of Patients in Your Practice?

The characteristics of patients who are seen in your practice will influence both the screening instrument that you select and the best way to use it in your practice. Consider the following questions and implications.

<b>Characteristics of Patients and Families</b>	<b>Screening Implications</b>
Do you have patients and families with risk factors for delay in your practice?	Consider a screening instrument that documents specific skills rather than concerns alone.
Do you have parents with limited reading skills?	Consider offering the option of completing forms with assistance from staff.
Do you have parents with limited English proficiency?	Consider instruments that have foreign language translations available (e.g., in Spanish) and relevant norms.
Do you have a practice with high base rates of developmental problems and/or risk factors (e.g., histories of very low birth weight) for developmental problems?	Consider instruments that have demonstrated sensitivity, specificity, and predictive value for high-risk populations.

## 2b) What Are the Base Rates of Developmental Problems in Your Practice?

The base rates or prevalence of target developmental problems (e.g., developmental delay, autism, language disorders) in your practice are critical in determining the accuracy or predictive values of developmental screening instruments in your setting. In general, the lower the prevalence of delay in a practice, the more accurate (e.g., higher sensitivity and specificity) a screening method needs to be in order to limit the number of false-positive and false-negative results.

How can you identify the base rates of target developmental problems in your practice setting? Clinic records of rates of diagnoses of developmental problems in your practice are one way to identify base rates. However, unless you are routinely screening every child, this may underestimate the true prevalence of developmental problems in your practice. Another way is to estimate the level of biologic/environmental risk for developmental problems experienced by children seen in your practice. The following table can help you determine the level of risk for the prevalence of developmental problems in your practice.

<b>Biologic and Environmental Risk</b>		
<b>Lower risk</b>	<b>Intermediate Risk</b>	<b>Higher risk</b>
<ul style="list-style-type: none"> <li>• Regular well-child care</li> <li>• Full-term birth</li> <li>• Maternal prenatal care</li> <li>• Normal birthweight</li> <li>• Normal growth</li> <li>• Adequate financial resources</li> <li>• Healthy parent</li> <li>• Two-parent family</li> <li>• Family history of developmental problems</li> </ul>	<ul style="list-style-type: none"> <li>• Intermittent well-child care</li> <li>• Intermittent maternal prenatal care</li> <li>• Prenatal tobacco exposure</li> <li>• Feeding/growth problem</li> <li>• Multiple caregivers</li> <li>• Stressed parent</li> <li>• Single-parent family</li> </ul>	<ul style="list-style-type: none"> <li>• Infrequent well-child care. No maternal, paternal care</li> <li>• Premature birth</li> <li>• Prenatal exposure to drugs/alcohol</li> <li>• Low birthweight</li> <li>• Genetic disorder</li> <li>• Chronic illness</li> <li>• Feeding/growth disorder</li> <li>• Poverty</li> <li>• Foster care</li> <li>• International adoption</li> <li>• Parental depression, mental illness, or substance abuse</li> <li>• Exposure to lead, toxins</li> <li>• Teen parent</li> <li>• Family history of developmental problems</li> </ul>

### 3. What Resources for Implementing Developmental Screening Are Available in Your Practice?

The resources your practice has will play a role in your developmental screening instrument selection and its application. Consider the following implications.

Practice Resources	Screening Implications
Do you have professional staff that can assist families with screening procedures during visits?	<ul style="list-style-type: none"> <li>Consider training staff to administer, score, and possibly interpret results for families.</li> </ul>
Are you in a group practice or do you have a group affiliation?	<ul style="list-style-type: none"> <li>Consider pooling resources to bring in a developmental specialist to administer screening instruments and provide other developmental services.</li> </ul>
How is developmental screening reimbursed in your practice?	<ul style="list-style-type: none"> <li>Consider methods that are more likely to lead to reimbursement. For example, if a standardized instrument is used and results are recorded, then CPT codes (96110) for screening can be used in many practices.</li> <li>Consider consulting with other practices that have used developmental screening instruments about their billing experiences. (See #4 Technical Assistance).</li> </ul>
Who in your office can be in charge of implementation and maintenance of screening procedures?	<ul style="list-style-type: none"> <li>Consider delegating the major responsibilities for developmental screening to someone in your practice.</li> <li>Consider obtaining technical assistance for training and supervision.</li> </ul>
What if you can expect no more than minimal clerical assistance from your office staff?	<ul style="list-style-type: none"> <li>Consider mailing screening forms and instructions to homes before pediatric visits.</li> <li>Focus staff training on scoring and record keeping.</li> </ul>

## 4. What Technical Assistance and Experience Are Available to You to Help Implement a Developmental Screening Program in Your Practice?

Practices can benefit from technical assistance when developing and effectively implementing a developmental screening program. You might wish to consider the following sources of technical assistance when implementing a screening program in your practice.

Technical Assistance	Screening Implications
Do you have access to a pediatric psychologist or developmental behavioral pediatrician in your community?	Consider obtaining consultation to help select instruments to train your staff and implement the screening program.
Do you know of pediatric practices or pediatric residency programs in your community that are conducting developmental screening using a specific instrument?	Consider contacting these practices or residency programs about their experiences and recommendations.
Does your state's early and periodic screening, diagnosis and treatment (EPSDT) program use a developmental screening instrument?	Consider contacting relevant state-level professionals about their experiences and recommendations in developmental screening.
Does your state's AAP chapter offer technical assistance for developmental screening?	Consider obtaining technical assistance from your state's AAP chapter.
Have you chosen a specific developmental screening instrument?	Consider obtaining training and technical assistance from the test developer.



## 5. What Resources for Assessment and Intervention for Developmental Problems are Available in Your Community?

According to the AAP, developmental screening does not result in a specific diagnosis or treatment plan but identifies areas in which a child's development differs from age-related norms. Nevertheless, developmental screening should be followed by a positive clinical action that has the potential to enhance the child's development.

If the child's developmental status is found to be within normal limits, relevant clinical actions include the reassurance of parents and anticipatory guidance addressing the parents' concerns and/or relevant developmental issues for the child. If the screening test is positive, the family should be referred for evaluation and treatment planning, such as to a psychologist or a speech, language, or occupational therapist, and early intervention.

Knowledge of available community resources will improve effective follow-up. Consider the following when researching your options.

<b>Available Community Resources</b>	<b>Implications</b>
What community resources are available to assess the developmental problems that are identified by screening and plan for treatment?	Consider developing a referral network of psychologists, speech/language therapists to provide occupational and physical therapy to your patients and their families.
Does your community's Early Intervention System recommend a specific instrument or method for documenting need for services?	Consider use of the recommended procedures to facilitate and streamline referrals into the early intervention system.
What community resources are available for early intervention for developmental problems?	Find out about available community resources for early intervention. Consider developing a close collaboration with early intervention programs in your community.

## Part II: Guides to Facilitate Your Choice and Use of Screening Instruments

The guides below were designed to facilitate practitioners' abilities to compare developmental screening instruments with respect to clinical utility in practice settings and validity, or sensitivity and specificity in different populations and at various ages.

**The guides include recommendations for the following instruments, among others:**

- [Parents' Evaluation of Developmental Status \(PEDS\)](#), a parent-report instrument used to identify general developmental delay in the general primary care population
- [Ages and Stages Questionnaire \(ASQ\)](#), a parent-report instrument used to identify general developmental delay in the general primary care population and/or broad high-risk population
- [Bayley Infant Neurodevelopmental Screen \(BINS\)](#), a practioner-administered instrument used to identify general developmental delay in the high-risk population
- [Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale \(CAT/CLAMS\)](#), a practioner-administered instrument used to identify general developmental delay in the high-risk population
- [Language Development Survey \(LDS\)](#), a parent-report instrument used to identify language delay in the general primary care population
- [Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale \(CLAMS\)](#), a practioner-administered instrument used to identify language delay in the high-risk population
- [Modified Checklist for Autism in Toddlers \(M-CHAT\)](#), a parent-administered instrument used to screen for autism and developmental delay in the general primary care population

Each guide is divided into the following categories: general developmental problems, language problems, and autism and pervasive developmental disorders. The instruments are listed in alphabetical order within each category.

**The guides are:**

- [Guide 1: Screening Instruments—Recommendations for Use](#)
- [Guide 2: Screening Instruments—General Information](#)
- [Guide 3: Screening Instruments—Standardization Samples and Clinical Applications](#)
- [Guide 4: Screening Instruments—Scientific Validity Based on Test Manuals](#)
- [Guide 5: Screening Instruments—Scientific Validity Based on Published Studies](#)

# Guide 1: Screening Instruments—Recommendations for Use

## Recommendations for the Application of Specific Screening Instruments

Use the interactive web feature/flow chart by clicking on the button at left—or download the PDF—to answer questions about your screening needs and receive an instrument recommendation. The practice recommendations in the flow chart and in Guide 1 (below) were based on a combination of the following:

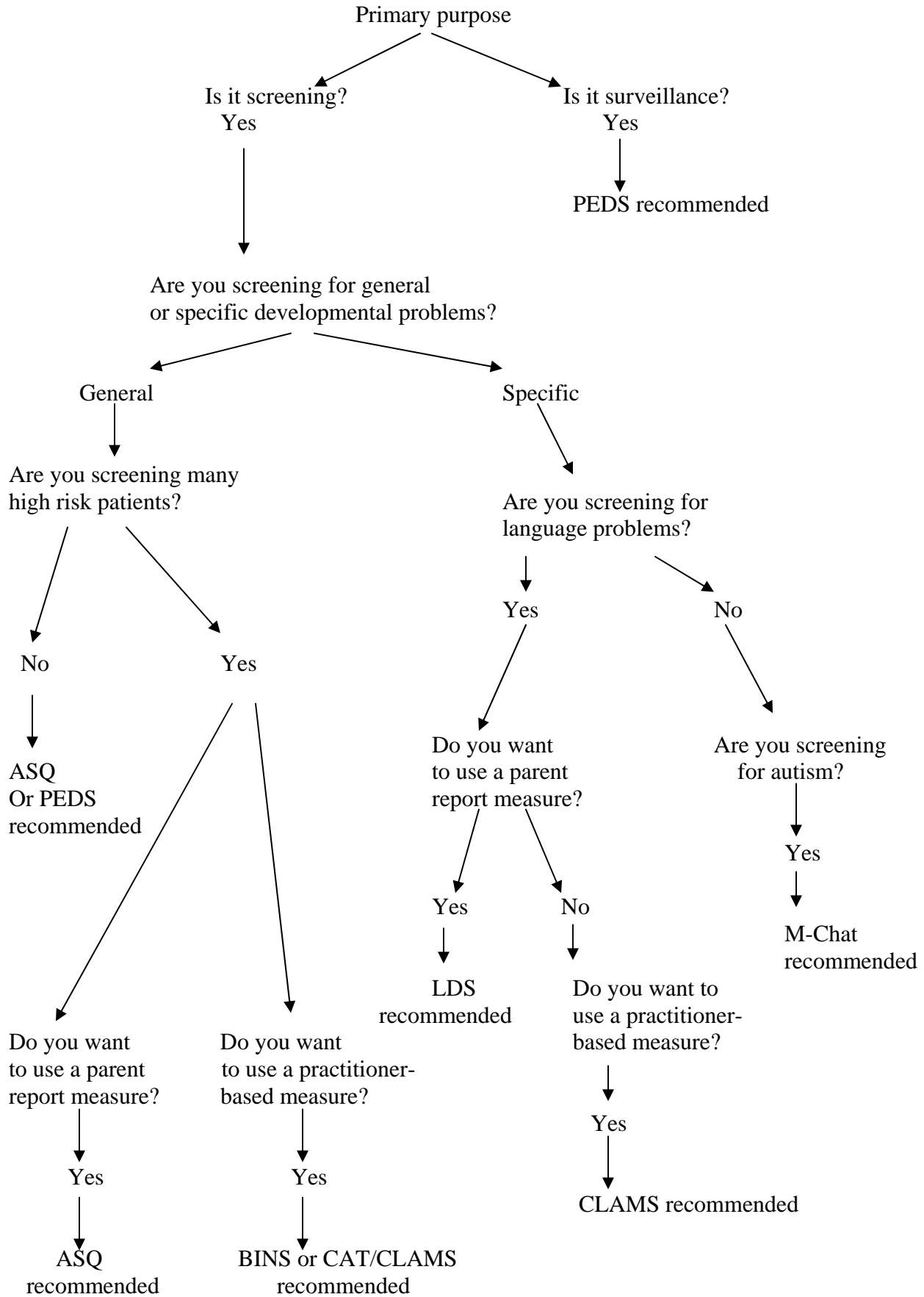
- Clinical relevance of the instrument standardization population as defined by sample size and diversity.
- User-friendliness of available materials to facilitate implementation.
- Quality of the validity studies described in the instrument manual and/or Web site.
- Number and quality of published studies that have used the instrument.
- Availability of sensitivity and specificity data for ages as recommended by the 2006 AAP statement on developmental screening.

<b>GUIDE 1: RECOMMENDATIONS FOR THE APPLICATION OF SPECIFIC SCREENING INSTRUMENTS</b>			
<b>Purpose of Screening</b>	<b>Population to be screened</b>	<b>Type of Instrument</b>	<b>Recommendation and Comments</b>
Identification of general developmental delay	General primary care population	Parental concerns–based surveillance or screening in various developmental domains	Parents' Evaluations of Developmental Status (PEDS) <ul style="list-style-type: none"> <li>• Comprehensive user-friendly manual</li> <li>• Validation in large, diverse standardization sample</li> <li>• Published validation studies</li> </ul>
Identification of general developmental delay	General primary care population and/or high risk	Parent report of multiple items in various developmental domains	Ages and Stages Questionnaire (ASQ) <ul style="list-style-type: none"> <li>• Comprehensive, user-friendly manual</li> <li>• Validation in large, diverse standardization sample</li> <li>• Published validation</li> </ul>

			studies
Identification of general developmental delay	High risk: Premature and low birth weight population	Practitioner administered	<p>Bayley Infant Neurodevelopmental Screen (BINS)</p> <ul style="list-style-type: none"> <li>• Comprehensive user-friendly manual</li> <li>• Large, diverse standardization sample</li> <li>• Published validation study available</li> </ul>
Identification of general developmental delay (language and motor)	High risk: Premature and low birth weight population	Practitioner administered	<p>Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CAT/CLAMS)</p> <ul style="list-style-type: none"> <li>• User-friendly manual</li> <li>• Large standardization sample</li> <li>• Multiple published validation studies available</li> </ul>
Identification of language delay	General primary care population	Parent report	<p>Language Development Survey (LDS)</p> <ul style="list-style-type: none"> <li>• Comprehensive manual</li> <li>• Validation in large, diverse standardization sample</li> <li>• Multiple published validation studies</li> </ul>
Identification of language delay	High-risk: premature, low birth weight population	Practitioner administered	<p>Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CLAMS)</p> <ul style="list-style-type: none"> <li>• User-friendly manual</li> <li>• Standardization sample</li> </ul>

			<ul style="list-style-type: none"> <li>• Multiple published validation studies</li> </ul>
Screening for autism and developmental delay	General primary care population	Parent administered	<p>Modified Checklist for Autism in Toddlers (M-CHAT)</p> <ul style="list-style-type: none"> <li>• User information available on Web site</li> <li>• Published validation study available</li> </ul>

Figure 1: Flow Chart to Facilitate Decision Making Concerning Use of Instruments for Developmental Surveillance/Screening



Abbreviations

ASQ	Ages and Stages Questionnaire
PEDS	Parents' Evaluation of Developmental Status
LDS	Language Development Survey
BINS	Bayley Infant Neurodevelopmental Screen
M-CHAT	Modified Checklist for Autism in Toddlers
CAT/CLAMS	Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale – Expressive and Receptive Language Scale

## **Guide 2—Screening Instruments: General Information**

This guide, available for downloading at right, contains general information about 23 different general and specific developmental screening instruments that were reviewed for this manual. The information may be useful in deciding which instruments best suit a given practice's setting and purpose. For example, the guide describes which tests are in the public domain (free for use) and approximate price estimates (as of 2007) for those tests which must be purchased from test developers.

This guide includes the following information:

- Name of the instrument
- How to obtain the instrument
- Cost of materials
- Method of administration (parent or child)
- Time of administration
- Reading level of parent (if relevant)
- Availability of translations.
- Use with electronic medical records
- Training available



**GUIDE 2: GENERAL INFORMATION CONCERNING SCREENING INSTRUMENTS**

**(Instruments are listed in alphabetical order within categories)**

**X = Available    ----- = Information not available    N/A = Not applicable**

SCREENING FOR GENERAL DEVELOPMENTAL PROBLEMS										
INSTRUMENT	HOW TO OBTAIN MEASURE	COST OF MATERIALS Manual and relevant forms for administration and scoring	ADMINISTERED TO:		TIME (min)	PARENT READING LEVEL	TRANSLATIONS		USED WITH ELECTRONIC MEDICAL RECORD	TRAINING AVAILABLE
			PARENT	CHILD			Spanish	Other		
Ages and Stages Questionnaire	Paul H. Brooks Publishing Co. PO Box 10624 Baltimore, MD 21285-0624 800-638-3775 <a href="http://www.brookespublishing.com">www.brookespublishing.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring (photocopiable)</li> </ul> <b>Total: \$199.00</b>	X	N/A	10-15	4-6 grade	yes	French Korean	yes	On Location Web Based <a href="http://www.agesandstages.com/">www.agesandstages.com/</a>
AGS Early Screening Profiles (ESP)	Pearson Assessments PO Box 1416 Minneapolis, MN 55440 800-627-7271 <a href="http://ags.pearsonassessments.com/">http://ags.pearsonassessments.com/</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring</li> <li>Standardized materials to conduct assessment</li> </ul> <b>Total: \$336.00</b>	N/A	X	15-40	N/A	-----	-----	no	Training video <a href="http://ags.pearsonassessments.com">http://ags.pearsonassessments.com</a>
Battelle Developmental Inventory Screening Test (BDI-2)	Riverside Publishing company 425 Spring Lake Drive Itasca, IL 60143-2079 800-323-9540 <a href="http://www.riversidepublishing.com">www.riversidepublishing.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring</li> <li>Standardized materials to conduct assessment</li> </ul> <b>Total: \$444.50</b>	N/A	X	10-30	N/A	yes	-----	no	In house & independent trainers <a href="http://www.riverpub.com/products/bdi2/training.html">www.riverpub.com/products/bdi2/training.html</a>
Bayley Infant Neurodevelopmental Screens (BINS)	Harcourt Assessment, Inc. Attn: Customer Service P.O. Box 599700 San Antonio, TX 78259 800-211-8378 <a href="http://harcourtassessment.com">http://harcourtassessment.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring</li> <li>Standardized materials to conduct assessment</li> </ul> <b>Total: \$325.00</b>	N/A	X	5-10	N/A	no	Portuguese	no	Training video <a href="http://harcourtassessment.com/">http://harcourtassessment.com/</a>
Brigance Screens II	Curriculum Associates, Inc. 153 Rangeway Rd. N. Billerica, MA 01862 800-225-0248 <a href="http://www.curriculumassociates.com">http://www.curriculumassociates.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring (N=30)</li> </ul> <b>Total: \$148.00</b>	N/A	X	10-15	4.5 <sup>th</sup> grade	yes	-----	In process	Curriculum Associates e-training <a href="http://www.curriculumassociates.com/professional-development">www.curriculumassociates.com/professional-development</a>
Capute Scales: Cognitive Adaptive Test/Clinical	Paul H. Brooks Publishing Co. PO Box 10624	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring (N=20)</li> </ul>	N/A	X	15-20	N/A	yes	Russian Chinese	no	Manual Only

Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CAT/CLAMS)	Baltimore, MD 21285-0624 800-638-3775 <a href="http://www.brookespublishing.com">www.brookespublishing.com</a>	<ul style="list-style-type: none"> <li>Standardized materials to conduct assessment</li> </ul> <b>Total: \$350.00</b>								
Child Development Inventory (CDI)	Pearson Assessments PO Box 1416 Minneapolis, MN 55440 800-627-7271 <a href="http://ags.pearsonassessments.com/">http://ags.pearsonassessments.com/</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring</li> </ul> <b>Total: \$80.00</b>	X	N/A	30-50	-----	no	-----	no	-----
Child Development Review Parent Questionnaire (CDR-PQ)	Behavior Science Systems, Inc. Box 19512 Minneapolis, MN 55419-9998 612-850-8700 <a href="http://www.childdevrev.com">www.childdevrev.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring</li> </ul> <b>Total: \$80.00</b>	X	N/A	10-20	-----	no	-----	In process	-----
Denver II	Denver Developmental Materials, Inc. PO Box 371075 Denver, CO 80237-5075 800-419-4729 <a href="http://www.denverii.com">www.denverii.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring: (N=100)</li> <li>Standardized materials to conduct assessment</li> </ul> <b>Total: \$106</b>	N/A	X	10-20	-----	yes	-----	no	Videotapes and DVDs <a href="http://www.denverii.com/training.html">www.denverii.com/training.html</a>
Denver Prescreening Developmental Questionnaire (PDQ-II)	Denver Developmental Materials, Inc. PO Box 371075 Denver, CO 80237-5075 800-419-4729 <a href="http://www.denverii.com/PDQ.html">www.denverii.com/PDQ.html</a>	<ul style="list-style-type: none"> <li>Forms for administration and scoring</li> </ul> <b>Total: \$84.00</b>	N/A	N/A	3	-----	-----	-----	no	-----
Developmental Profile 3 <sup>rd</sup> Ed. (DP-3)	Western Psychological Services (WPS) 12031 Wilshire Blvd. Los Angeles, CA 90025-1251 800) 648-8857 <a href="http://portal.wpspublish.com/portal/page?_pageid=53,186601&amp;_dad=portal&amp;_schema=PORTAL">portal.wpspublish.com/portal/page?_pageid=53,186601&amp;_dad=portal&amp;_schema=PORTAL</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring (N=25)</li> </ul> <b>Total: \$199.00</b>	N/A	X	20-40	-----	no	-----	no	-----
Infant Developmental Inventory (IDI)	Behavior Science Systems, Inc. Box 19512 Minneapolis, MN 55419-9998 612-850-8700 <a href="http://www.childdevrev.com">www.childdevrev.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms (N=25) for administration &amp; scoring</li> </ul> <b>Total: \$28.00</b>	X	N/A	10-20	-----	yes	-----	no	-----

Parents' Evaluations of Developmental Status (PEDS)	Ellsworth & Vandermeer Press, Ltd. PO Box 68164 Nashville, TN 38206 615-226-4460 <a href="http://www.pedstest.com">www.pedstest.com</a>	<ul style="list-style-type: none"> <li>Forms for administration and scoring (N=50)</li> </ul> <b>Total: \$30.00</b>	X	N/A	2-10	-----	yes	Vietnamese Arabic Swahili Indonesian Chinese, Taiwanese French Somali Portuguese Malaysian Thai Laotian	yes	Training and research materials available on website <a href="http://www.pedstest.com">www.pedstest.com</a>
PEDS: Developmental Milestones (PEDS:DM)	Ellsworth & Vandermeer Press, LLC 1013 Austin Ct. Nolensville, TN 37135 615-776-4121 <a href="http://www.pedstest.com">www.pedstest.com</a>	<ul style="list-style-type: none"> <li>PEDS: DM Family Book</li> <li>Peds: DM Professional Manual</li> <li>PEDS DM Case</li> <li>100 PEDS:DM recording forms</li> </ul> <b>Total: \$275.00</b>	X	X	7	1.8 grade	yes	-----	no	Training and research materials available on website <a href="http://www.pedstest.com">www.pedstest.com</a> Spanish Version: <a href="http://prdstest.com/spanish_resources.php">http://prdstest.com/spanish_resources.php</a>
Parents' Observations of Infants and Toddlers (POINT)	POINT 6125 W. Howard St. Niles, IL 60714-3401 866-534-9394 <a href="http://www.firstpointkids.com">www.firstpointkids.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring</li> </ul> <b>Total: \$200.00</b>	X	N/A	15-20	-----	yes	-----	no	Website useful for questions not covered in manual <a href="http://www.firstpointkids.com">www.firstpointkids.com</a>
<b>SCREENING FOR LANGUAGE PROBLEMS</b>										
Capute Scales: Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CLAMS)	Paul H. Brooks Publishing Co. PO Box 10624 Baltimore, MD 21285-0624 800-638-3775 <a href="http://www.brookespublishing.com">www.brookespublishing.com</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Forms for administration and scoring (N=20)</li> <li>Standardized materials to conduct assessment</li> </ul> <b>Total:\$350.00</b>	N/A	X	15-20	N/A	yes	Russian Chinese	no	Manual Only
Communication and Symbolic Behavior Scales Developmental Profile (CSBS)	Paul H. Brooks Publishing Co. PO Box 10624 Baltimore, MD 21285-0624 800-638-3775 <a href="http://www.brookespublishing.com/store/books/wetherby-csbs/index.htm">www.brookespublishing.com/store/books/wetherby-csbs/index.htm</a>	<ul style="list-style-type: none"> <li>Manual</li> <li>Standardized materials to conduct assessment</li> <li>Sampling videotape</li> <li>Forms for administration and scoring (N=25)</li> </ul> <b>Total: \$599.00</b>  CSBS Infant-Toddler Checklist (ITC) posted on the FIRST WORDS Website and can be downloaded at no charge.	X	X	5-20	6.4	yes Posted: <a href="http://firstwords.fsu.edu/toddlerChecklist.html">http://firstwords.fsu.edu/toddlerChecklist.html</a>	German Chinese Slovenian	no	-----

		<a href="http://firstwords.fsu.edu/toddlerChecklist.html">http://firstwords.fsu.edu/toddlerChecklist.html</a>								
Early Language Milestone Scale (ELM Scale-2)	Pro-Ed 8700 Shoal Creek Blvd. Austin, TX 78757-6897 800-897-3202 <a href="http://www.proedinc.com">www.proedinc.com</a>	<ul style="list-style-type: none"> <li>● Manual</li> <li>● Forms for administration and scoring (N=100)</li> <li>● Standardized materials to conduct assessment</li> </ul> <b>Total: \$160.00</b>	N/A	X	1-10	N/A	no	-----	no	-----
Language Development Survey (LDS)	ASEBA/Research Center for Children, Youth, and Families 1 South Prospect St. Burlington, VT 05401-3456 802-264-6432 <a href="http://www.aseba.org/products/cbc1-1-5.html">www.aseba.org/products/cbc1-1-5.html</a>	<ul style="list-style-type: none"> <li>● Manual</li> <li>● Forms for administration and scoring (N=50)</li> </ul> <b>Total: \$65.00</b>	X	N/A	10	5 grade	yes	French Italian Romanian Dutch Turkish Portuguese Greek	Web-link Program <a href="http://www.web-link.org">www.web-link.org</a>	Workshops Inservice (contact: Leslie Rescorla through ASEBA)
Screening Kit of Language Development (SKOLD)	Slosson Educational Publications, Inc. 888-756-7766 <a href="http://www.slosson.com/onlinecatalogstore_c51704.html">www.slosson.com/onlinecatalogstore_c51704.html</a>	<ul style="list-style-type: none"> <li>● Manual</li> <li>● Forms for administration and scoring</li> <li>● Standardized materials to conduct assessment</li> </ul> <b>Total: \$125.00</b>	N/A	X	15	N/A	no	-----	no	Manual Only
<b>SCREENING FOR AUTISM AND PERVASIVE DEVELOPMENTAL DISORDERS</b>										
Modified Checklist for Autism in Toddlers (M-CHAT)	<a href="http://www.firstsigns.org/downloads/Downloads_archive/m-chat.PDF">www.firstsigns.org/downloads/Downloads_archive/m-chat.PDF</a>	<b>Public Domain - Free</b>	X	N/A	5-10	-----	yes	Chinese Japanese	X	<a href="http://www.utm.edu/pediatrics/general/clinical/m-chat-scoring.pdf">www.utm.edu/pediatrics/general/clinical/m-chat-scoring.pdf</a>
Pervasive Developmental Disorders Screening Test (PDDST-I)	Harcourt Assessment Attn: Customer Service 19500 Bulvarde Rd. San Antonio, TX 78259 800-211-8378 <a href="http://harcourassessment.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1635-106&amp;Mode=summary">http://harcourassessment.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1635-106&amp;Mode=summary</a>	<b>Complete Kit: \$145.00</b>	X	N/A	10-20	-----	yes record forms only	-----	-----	Donna Smith (donna-smith@harcourt.com) & Bryna Siegel (test developer) bryna.siegel@ucsf.edu

## **Guide 3: Screening Instruments—Standardization Samples and Clinical Applications**

This guide, available for downloading at right, provides standardization details about each of the screening instruments that were reviewed. This information is valuable to practitioners who want to examine the diversity of young children included in the studies that lead to the development of the tests, and who are interested in the data that pertain to clinical settings.

This guide includes the following information:

- Date of publication of manual
- Size of the standardization sample
- Characteristics of the standardization sample including: inclusion of physically healthy children and/or children at biologic or environmental risk; whether there was diversity in age, sex, ethnicity
- Whether the manual includes detailed information concerning the application of the instrument in practice including: how to administer; how to score; how to implement in the context of a pediatric practice setting; and how to use the data to inform follow-up in pediatric practice.

**GUIDE 3: INFORMATION FROM MANUAL OR WEBSITE:  
STANDARDIZATION SAMPLE AND CLINICAL APPLICATION**  
**X = Included in Manual and/or Description of Sample    ----- = Not Included in Manual**

Standardization							Clinical Application				
Instrument	Sample Size	Date of Publication	Low Risk Healthy Sample	Age	Sample Diversity			Administration	Scoring	Practice Implementation	Follow-up
					SES	Ethnicity	High Risk				
<b>SCREENING FOR GENERAL DEVELOPMENTAL PROBLEMS</b>											
Ages & Stages Questionnaire	2,008	1999	X	4-48 mos	X	X	X Low birth weight/poverty/age/neglect	X	X	X	X
AGS Early Screening Profiles (ESP)	1,149	1990	X	2-6 yrs	X	X		X	X	-----	-----
Battelle Developmental Inventory (BDIST-2)	2,500	2005	X	0-7 yrs	X	X		X	X	-----	X
Bayley Infant Neurodevelopmental Screens (BINS)	1,795	1995	X	3-24 mos	X	X	X Low birth weight	X	X	X	X
Brigance Screens II	594	2005	X	0-6 yrs	X	X		X	X	X	X
Capute Scales: Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CAT/CLAMS)	1,239	2005	X	2-36 mos		X		X	X	X	X
Child Development Inventory (CDI)	568	1997	X	1-6 yrs				X	X	-----	-----
Child Development Review Parent Questionnaire (CDR-PQ)	220	2004	X	18 mos – 6 yrs				X	X	-----	-----

Denver II	2,096	1996	X	0-6.5 yrs	X	X		X	X	X	X
Denver Prescreening Developmental Questionnaire (PDQ-II)	1,434	1987	X	0-6 yrs	X	X	*	*	*	*	*
Developmental Profile 3 <sup>rd</sup> Ed (DP-3)	2,216	2007	X	0-12 yrs	X	X		X	X	X	-----
Infant Development Inventory (IDI)	568**	2004	X	0-18 mos				X	X	-----	-----
Parents' Evaluations of Developmental Status (PEDS)	971	2002	X	0-7 yrs	X	X		X	X	X	X
PEDS: Developmental Milestones (PEDS:DM)	1,296	2007	X	0-8 yrs	X	X		X	X	X	X
Parents' Observations of Infants and Toddlers (POINT)	1,142	2006	X	2-36 mos	X	X		X	X	X	X
<b>SCREENING FOR LANGUAGE PROBLEMS</b>											
Capute Scales: Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CLAMS)	1,239	2005	X	2-36 mos		X		X	X	X	X
Communication and Symbolic Behavior Scales Developmental Profile (CSBS)	2,188	2002	X	6-24 mo		X		X	X	X	X

Early Language Milestone Scale (ELM Scale-2)	1 <sup>st</sup> ed = 191 2 <sup>nd</sup> ed = 2,500 (various studies)	1993	X	0-36 mos	X	X	X (Low SES, Low birth weight)	X	X	-----	X
Language Development Survey (LDS)	700	2000	X	1.5 – 5 yrs	X	X		X	X	X	-----
Screening Kit of Language Development (SKOLD)	1,065	1983	X	30-48 mos	X	X		X	X	X	-----
<b>SCREENING FOR AUTISM AND PERVASIVE DEVELOPMENTAL DISORDERS</b>											
Modified Checklist for Autism in Toddlers (M-CHAT)	1,293	***	X	16-30 mos	X			X	X	X	-----
Pervasive Developmental Disorders Screening Test (PDDST-I)	1,037		X	12-48 mos			X referred for testing at autism clinic	X	X	X	X

**\*PDQ-II**

Information not available

**\*\*IDI**

Sample size is the same as the CDI, there was no separate standardization.

**\*\*\* M-CHAT**

**Manual not available**



## **Guide 4: Screening Instruments—Scientific Validity Based on Test Manuals**

There is a broad range of evidence supporting the use of screening tests. While some instruments have been subjected to extensive scientific scrutiny, others have very little evidence to support their use. This guide, available for downloading at right, contains relevant psychometric characteristics of each developmental screening instrument as detailed in their test manual.

This guide includes the following information:

- Sensitivity and specificity data for the specific ages recommended for screening by the AAP
- Whether the manual includes the following validity information:
  - Sensitivity
  - Specificity
  - Positive predictive value
  - ROC curve analysis
  - Concurrent validity
  - Predictive validity
  - Factor analysis



Capute Scales: Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CAT/CLAMS)	---		---		---		---		-----	-----	-----	-----	-----	X	X	-----	-----	-----	-----
	---		---		---		---												
Child Development Inventory (CDI)	---	---	---	---	---	---	---	---	-----	-----	-----	-----	-----	X	X	-----	-----	-----	-----
	---	---	---	---	---	---	---	---											
Child Development review (PG)	---	---	---	---	---	---	---	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Child Development Review Parent Questionnaire (CDR-PQ)	---	---	---	---	---	---	---	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	---	---	---	---	---	---	---	---											
Denver II	---	---	---	---	---	---	---	---	-----	-----	-----	-----	-----	-----	-----	-----	X	-----	-----
	---	---	---	---	---	---	---	---											
Denver Prescreening Developmental Questionnaire (PDQ-II) (1987)	---	---	---	---	---	---	---	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	---	---	---	---	---	---	---	---											
Developmental Profile 3 <sup>rd</sup> Ed (DP-3) (2007)	---	---	---	---	---	---	---	---	-----	-----	-----	-----	-----	X	X	X	X	-----	X
	---	---	---	---	---	---	---	---											
Infant Development Inventory (IDI)	---	---	---	---	---	---	---	---	X	X	-----	-----	-----	-----	-----	-----	-----	-----	-----
	---	---	---	---	---	---	---	---											
Parents' Evaluations of Developmental Status (PEDS) (2002)	0-18		18-36		0-18		18-36		X	X	X	-----							
	.75		.79		.80		.80												
PEDS:	---	---	---	---	---	---	---	---	X	X	-----	-----	-----	X	-----	-----	X	X	X



## **Guide 5: Screening Instruments—Scientific Validity Based on Published Studies**

An empirical evaluation of developmental screening methods ultimately relies on research that has been subjected to peer review and published in scientific journals. Unfortunately, there are surprisingly few published studies that describe the psychometric characteristics of the developmental screening tests reviewed in this manual, and even fewer studies that demonstrate their utility and validity in clinical settings. Guide 5 contains the information on the instruments that has been published in peer-reviewed journals. We applied the Standards for Reporting of Diagnostic Accuracy (STARD) statement to the published studies and provided an overall rating. A STARD rating of 25 indicates that all criteria for determining diagnostic accuracy were met. Readers should note that this is an ideal standard for research on diagnostic tests (not only screening instruments).

This guide includes the following information:

- The number of studies reviewed
- Populations studied including risk status
- Overall rating of studies based the Standards for Reporting of Diagnostic Accuracy statement (STARD)
- Sensitivity and specificity data for age ranges assessed in each study
- Link to reference list of articles reviewed.

### GUIDE 5: SCIENTIFIC VALIDITY BASED ON PUBLISHED STUDIES

X = Included in studies    --- = Not Included in studies    N/A – Not Applicable

\*See Appendix 2 for a Summary of the References

	No of Studies	STARD Rating	Population (general)	Population (at risk)	Study	Age	Sensitivity	Specificity		
<b>SCREENING FOR GENERAL DEVELOPMENTAL PROBLEMS</b>										
Ages & Stages Questionnaire	3	12	X	X	Skellern et al. (2001)	12 mos	1.00	.73-.99		
						18 mos	.50-.75	.73-.99		
			X	X Low birth weight		24 mos	1.00	1.00		
					Squires et al. (1997)	4-48 mos	.75	.86		
					Rydz et al. (2006)	17-20 mos	.67	.39		
AGS Early Screening Profiles (ESP)	0	N/A	-----	-----	-----	-----	-----	-----		
Battelle Developmental Inventory Screening Test (BDI-2)	2	10	X	-----	Glascoe & Byrne (1993a)	7-83 mos	.75	.73		
			X		Glascoe & Byrne (1993b)	7-70 mos	.72	.72		
Bayley Infant Neurodevelopmental Screens (BINS)	1	11		X (premature)	Macias et al. (1998)	6-26 mos	.64-.82	.42-.87		
Brigance Screens II	2	7	X	-----	Glascoe (1997)	21-26 mos	1.00	1.00		
			X	-----		27-32 mos	.75	.92		
						33-44 mos	.74	.76		
					Glascoe (2002)	0-24 mos	.76-.77	.85-.86		
Capute Scales: Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CAT/CLAMS)	6	12	-----	X (premature)	Macias et al. (1998)	6-26 mos	.5- .36	.95-.98		
			X		Vincer et al. (2005)	4 mos	.88	.37		
			X			8 mos	.75	.82		
						12 mos	.64	.98		
						18 mos	.88	.97		
					-----	X (referred for delay)	Rossman et al. (1994)	18 mos	.21	.95-1.00
						X (referred for delay)		30 mos	.63	.93
					-----	X very low birth weight	Hoon et al. (1993)	12-48 mos	.88	.67
							Kube et al. (2000)	14-48 mos	.81-1.00	.85-.96
							Leffert et al. (1988)	5-33 mos	.71	.98
Child Development Inventory (CDI)	1	12	X		Rydz et al. (2006)	17-20 mos	.50	.86		

Child Development Review Parent Questionnaire (CDR-PQ)	0	N/A	-----	-----	-----	-----	-----	-----
Denver II	2	12	X X	----- -----	Glascoe et al. (1992) Glasoe & Byrne (1993b)	3-72 mos 7-70 mos	.83 .83	.43 .43
Denver Prescreening Developmental Questionnaire (PDQ-II)	1	14		X Very low birth weight	Heiser et al. (1995)	7-10 mos	1.00	.74
Developmental Profile 3 <sup>rd</sup> Ed (DP-3)	0	N/A	-----	-----	-----	-----	-----	-----
Infant Development Inventory (IDI)	0	N/A	-----	-----	-----	-----	-----	-----
Parents' Evaluations of Developmental Status (PEDS)	2	10	X	X Low birth weight	Glascoe (1992) Pritchard et al. (2005)	21-84 mos 24 mos	.79 .38-.39	.72 .84-.85
PEDS: Developmental Milestones (PEDS:DM)	0	N/A	-----	-----	-----	-----	-----	-----
Parents' Observations of Infants and Toddlers (POINT)	0	N/A	-----	-----	-----	-----	-----	-----
<b>SCREENING FOR LANGUAGE PROBLEMS</b>								
Capute Scales: Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CLAMS)	2	11	X	X (premature) -----	Belcher et al. (1997) Clark et al. (1995)	3-5 mos 9-14 mos 18-24 mos 14-24 mos 25-36 mos	.90 .75 .63 .50-.83 .68-.88	.26 .40 .86 .91-.92 .89-.98
Communication and Symbolic Behavior Scales Developmental Profile (CSBS)	1	16	X	-----	Wetherby et al. (2004)	13-27 mos	.94	.89
Early Language Milestone Scale	3	9	X X	----- -----	Coplan & Gleason (1988)	0-36 mos	.97	.93

(ELM Scale-2)			X	-----	Coplan et al. (1989) Walker et al. (1989)	1-5 yrs 0-12 mos 13-24 mos 25-36 mos	.95 .0-.0 .78-1.00 .94-1.00	.95 .86-1.00 .60-.80 .75-.85
Language Development Survey (LDS)	4	11	X X X X	----- ----- ----- -----	Rescorla (1989) Rescorla (1993) Klee et al. (1998) *Klee et al. (2000)	24-38 mos 18-30 mos 24-29 mos 24-29 mos	.53-.89 .67-1.00 .91 .91	.86-.97 .90-1.00 .87 .96
Screening Kit of Language Development (SKOLD)	1	6	X	-----	Bliss & Allen (1984)	30-36 mos	1.00	.97
<b>SCREENING FOR AUTISM AND PERVASIVE DEVELOPMENTAL DISORDERS</b>								
Modified Checklist for Autism in Toddlers (M-CHAT)	1	10	X	-----	Robins et al. (2001)	27 mos	.95-.99	.95-.99
Pervasive Developmental Disorders Screening Test (PDDST-1)	0	N/A	X	-----	-----	-----	-----	-----

\*Same data set was used as in Klee at al. (1998) with different criteria



## **APPENDIX 1: METHODS FOR INSTRUMENT REVIEW**

**The following principles guided the inclusion of specific instruments in the review:**

- 2006 American Academy of Pediatrics statement on screening.
- Availability of manual or detailed information on Web site to describe instrument standardization and validity as well as facilitate utilization.
- Potential utility in primary-care pediatric practice to screen infants and young children ages 0-36 months for developmental problems.
- Scientific validity of instruments based on data from instrument manuals, and studies published in the peer-reviewed literature. Primary emphasis was placed on sensitivity and specificity of the instruments for detection of developmental problems for infants and young children ages 0-36 months.
- Current version of instrument.

**What data were included in the review?**

- Review of instrument manuals and relevant information on instrument Web site.
- A systematic literature search of peer-related literature using key search terms in the MEDLINE and PsycINFO databases. Based on this search, a list of relevant screening instruments suitable to detect developmental problems in infants and young children ages birth to three years was identified.
- Information from the manuals and published studies of the instruments were summarized in detail in the following areas: sampling methods, population, sample characteristics, study design, reliability, validity studies (e.g., sensitivity and specificity), methods and measures used to establish validity, findings, and conclusions.
- Published studies that reported validity of the instruments were reviewed and rated in accord with the Standards for Reporting Studies of Diagnostic Accuracy, (STARD) (Bossuyt et al., 2003).
- The following criteria were used to select specific studies of instrument validity:
  - ❖ Inclusion of sample of children in the age range of 0-36 months.
  - ❖ Data concerning validation of screening instrument based on a valid criterion measure of developmental outcome (e.g., a standardized psychosocial test such as the Bayley Scale or objective assessment of clinical diagnosis (e.g., autism).
  - ❖ Validity data concerning sensitivity and specificity to detect developmental problems.
  - ❖ Cross sectional or short-term (e.g., 3 month) prospective study design. Data from long-term prospective studies do not directly pertain to concurrent decision making concerning screening in primary care in practice settings.

**APPENDIX 2: SUMMARY OF REFERENCES FOR ARTICLES REVIEWED  
IN GUIDE #5**

<b>GENERAL DEVELOPMENTAL SCREENING INSTRUMENTS</b>	
<b>Ages and Stages</b>	<p>Skellern, C., Rogers, Y., O’Callaghan, M.J. (2001). A parent completed developmental questionnaire: Follow-up of premature infants. <i>Journal of Pediatrics and Child Health</i>, 37, 125-129.</p> <p>Rydz, D., Srour, M., Oskovi, M., Marget, N., Shiller, M., Birnbaum, R., Majnemer, &amp; Shevell, M.I. (2006). Screening for developmental delay in the setting of a community pediatric clinic: A prospective assessment of parent-report questionnaires. <i>Pediatrics</i>, 118, e1178-1186.</p> <p>Squires, J., Bricker, D., &amp; Potter, L. (1996). Revision of a parent-completed developmental screening tool: Ages and Stages Questionnaire. <i>Journal of Pediatric Psychology</i>, 22, 313-328.</p>
<b>Batelle Developmental Inventory Screening Test</b>	<p>Glascoe, F.P., &amp; Byrne, K.E. (1993a). The usefulness of the Batelle Developmental Inventory Screening Test. <i>Clinical Pediatrics</i>, 32, 273-277.</p> <p>Glascoe, F.P., &amp; Byrne, K.E. (1993b). The accuracy of three developmental screening tests. <i>Journal of Early Intervention</i>, 17, 368-379.</p>
<b>Bayley Infant Neurodevelopmental Screens (BINS)</b>	<p>Macias, M.M., Saylor, C.F., Greer, M.K., Charles, J.M., Bell, N., Katikaneni, L.D. (1998). Infant screening: The usefulness of the Bayley Infant Neurodevelopmental Screener and the Clinical Adaptive Test/Clinical Linguistic auditory Milestone Scale. <i>Developmental and Behavioral Pediatrics</i>, 19, 155-161.</p>
<b>Brigance Screens II</b>	<p>Glascoe, F.P. (1997). Do the Brigance Screens detect developmental and academic problems? <i>Diagnostic</i>, 22, 87-103.</p> <p>Glascoe, F.P. (2002). The Brigance Infant and Toddler Screen: Standardization and validation. <i>Journal of Developmental and Behavioral Pediatrics</i>, 23, 145-150.</p>
<b>Capute Scales: Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CAT/CLAMS)</b>	<p>Hoon, A.H., Pulsifer, M.B., Gopalan, R., Palmer, F.B., and Capute, A. (1993). Clinical Adaptive Test/Clinical Linguistic Auditory Milestone Scale in early cognitive assessment. <i>Journal of Pediatrics</i>, 123, S1-8.</p> <p>Kube, D.A., Wilson, W.M., Petersen, M.C., and Palmer, F.B. (2000). CAT/CLAMS: Its use in detecting early childhood cognitive impairment. <i>Pediatric Neurology</i>, 23, 208-215.</p> <p>Leffert, M.L.O., Shank, T.P., Shapiro, B.K., and Capute, A.J. (1998). The Capute Scales: CAT/CLAMS – A pediatric assessment tool for the early detection of mental retardation</p>

	<p>and communicative disorders. <i>Mental Retardation and Developmental Disabilities Research Reviews</i>, 4, 14-19.</p> <p>Macias, M.M., Saylor, C.F., Greer, M.K., Charles, J.M., Bell, N., Katikaneni, L.D. (1998). Infant screening: The usefulness of the Bayley Infant Neurodevelopmental Screener and the Clinical Adaptive Test/Clinical Linguistic auditory Milestone Scale. <i>Developmental and Behavioral Pediatrics</i>, 19, 155-161</p> <p>Rossmann, M.J., Hyman, S. L., Rorabaugh, M.L., Berlin, L.E., Allen, M.C., and Modlin, J.F. (1994). The CAT/CLAMS assessment for early intervention services. <i>Clinical Pediatrics</i>, 405-409.</p> <p>Vincer, M.J., Cake, H., Graver, M., Dodds, L., McHugh, S., and Fraboni, T. A population based study to determine the performance of the cognitive adaptive test/clinical linguistic and auditory milestone scale to predict the mental development index at 18 months on the Bayley Scales of Mental Development –II in very preterm infants. <i>Pediatrics</i>, 116, e814-e867.</p>
<b>Child Development Inventory (CDI)</b>	Rydz, D., Srour, M., Oskovi, M., Marget, N., Shiller, M., Birnbaum, R., Majnemer, and Shevell, M.I. (2006). Screening for developmental delay in the setting of a community pediatric clinic: A prospective assessment of parent-report questionnaires. <i>Pediatrics</i> , 118, e1178-1186.
<b>Denver II</b>	<p>Glascoe, F.P., Byrne, K.E., Ashford, L.G., Johnson, K.L., Chang, B., and Strickland, B. (1992). Accuracy of the Denver-II in developmental screening. <i>Pediatrics</i>, 89, 1221-1225.</p> <p>Glascoe, F.P., Byrne, K.E. (1993b). The accuracy of three developmental screening tests. <i>Journal of Early Intervention</i>, 17, 268-379.</p>
<b>Revised Denver Prescreening Developmental Questionnaire (R-PDQ)</b>	Heiser, A., Grimmer, I., Metze, B., and Obladen, M. (1995). Parents' estimation of psychomotor development in very low birthweight (VLBW) infants. <i>Early Human Development</i> , 42, 131-139.
<b>Parents' Evaluations of Developmental Status (PEDS)</b>	<p>Glascoe, F.P. (1997). Parents' concerns about children's development: Prescreening technique or screening test? <i>Pediatrics</i>, 99, 522-528.</p> <p>Pritchard, M.A., Colditz, P.B., and Beller, E.M.(2005). Parents' evaluation of developmental status in children born with a birthweight of 1250 g or less. <i>Journal of Pediatrics and Child Health</i>, 41, 191-196.</p>

<b>SCREENING FOR LANGUAGE-RELATED PROBLEMS</b>	
<b>Capute Scales: Clinical Linguistic Auditory Milestone Scale Expressive and Receptive Language Scale (CLAMS)</b>	<p>Belcher, H.M.E., Gittlesohn, A., Capute, A.J., &amp; Allen, M.C. (1997). Using the Clinical Linguistic and Auditory Milestone Scale for developmental screening in high-risk preterm infants. <i>Clinical Pediatrics</i>, 36, 635-642. (CLAMS)</p> <p>Clark, J.G., Jorgenson, S.K., Blondeau, R. (1995). Investigating the validity of the clinical linguistic auditory milestone scale. <i>International Journal of Pediatric Otorhinolaryngology</i>, 31, 63-75. (CLAMS)</p>
<b>Communication and Symbolic Behavior Scales Developmental Profile (CSBS)</b>	<p>Wetherby, A.M., Goldstein, H., Cleary, J., Allen, L., &amp; Kublin, K. (2003). Early identification of children with communication disorders: Concurrent and predictive validity of the CSBS Developmental Profile. <i>Infants and Young Children</i>, 16, 161-174.</p> <p>Wetherby, A.M., Woods, J., Allen, L., Cleary, J., Dickinson, H., &amp; Lord, C. (2004). Early indicators of autism spectrum disorders in the second year of life. <i>Journal of Autism and Developmental Disorders</i>, 34, 473-493.</p>
<b>Early Language Milestone Scale (ELM-Scale 2)</b>	<p>Coplan, J., &amp; Gleason, J.R. (1988). Unclear speech: Recognition and significance of untelligible speech in preschool children. <i>Pediatrics</i>, 82, 447-452.</p> <p>Coplan, J., Gleason, J.R., Ryan, R., Burke, M.G., &amp; Williams, M.L. (1982). Validation of an early language milestone scale in a high-risk population. <i>Pediatrics</i>, 70, 677-683.</p> <p>Walker, D., Gugenheim, S., Downs, M.P., &amp; Northern, J.L. (1989). Early Language Milestone Scale and language screening of young children. <i>Pediatrics</i>, 83, 284-288.</p>
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### **Appendix 3: References on Developmental Screening**

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Authors: \_\_\_\_\_  
 Title: \_\_\_\_\_  
 Year: \_\_\_\_\_

STARD: Standards for Reporting Studies of Diagnostic Accuracy		
Section and Topic	Item	Description
Title, Abstract and Keywords	1	Identify the article as a study of screening test validity (recommend MeSH heading "sensitivity and specificity") and whether this is a one stage screening or multiple stage screening
Introduction	2	State the research questions or aims, estimating screening test accuracy or comparing accuracy between tests or across participant groups
Methods		
Participants	3	Describe the study population: the inclusion and exclusion criteria and the settings and locations where the data were collected
	3a	Specify the age range, intervals examined and rationale
	4	Describe participant recruitment: was this based on presenting symptoms, results from previous tests, referral or the fact that the participants had received the screening tests or the reference standard?
	5	Describe participant sampling: was this a consecutive series of participants defined by selection criteria in items 3 and 4? If not, specify how participants were further selected
	6	Describe data collection: was data collection planned before the screening tests and reference standard were performed (prospective study) or after (retrospective study)?
	6a	Describe any aspect of the data collection that might be subject to construct irrelevant variance (e.g., unfamiliarity with strangers, repeated administration of screening test, administration of more than one test in one sitting or day for very young children, fatigue or warm-up.)
Test Methods	7a	Describe the screening test date and standardization (if any), applicable ages, similarity to reference standard
	7	Describe each reference test, its date and standardization (including characteristics of population) its rationale and applicable ages
	8	Describe technical specifications of material and methods involved, including how and when measurements were taken, or cite references for screening tests or reference standard, or both
	9	Describe definition of and rationale for the units, cut-off points, (including ROC analysis if done) or categories of the results of the screening tests and the reference standard
	10	Describe the number, training, and expertise of the persons executing and reading the screening tests and the reference standard
	11	Were the readers of the screening tests blind(masked) to results of the other test? Describe any other clinical information available to the readers.
Statistical Methods	12	Describe methods for calculating or comparing measures of diagnostic accuracy and the statistical

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		methods used to quantify uncertainty (eg 95% confidence intervals) and steps to adjust for potential verification bias
	13	Describe methods for calculating test reproducibility, if done
<b>Results</b>		
Participants	14	Report when study was done, including beginning and ending dates of recruitment
	15	Report clinical and demographic characteristics (eg age, sex, spectrum of presenting symptoms, comorbidity, current treatments, and recruitment centre) for each age interval employed
	16	Report how many participants satisfying the criteria for inclusion did or did not undergo the screening tests or the reference standard, or both; describe why participants failed to receive either test. Include a Flow Diagram (see attached) for each age interval examined and each reference test used.
	17	Report time interval from screening tests to reference standard, and any treatment administered between
	18	Report distribution of severity of disease (define criteria) in those with the target condition and other diagnoses in participants without the target condition
	19	Report a cross tabulation of the results of the screening tests (including indeterminate and missing results) by the results of the reference standard; for continuous results, report the distribution of the test results by the results of the reference standard; include sample size, number of diagnostic positives, sensitivity and specificity, percent referred, positive predictive value, negative predictive value, and likelihood ratios,
	20	Report any adverse events from performing the screening test or the reference standard
Estimates	21	Report estimates of diagnostic accuracy and measures of statistical uncertainty (e.g. 95% confidence intervals)
	22	Report how indeterminate results, missing responses, and outliers of screening tests were handled
	23	Report estimates of variability of diagnostic accuracy between readers, centres, or subgroups of participants, if done
	24	Report estimates of test reproducibility, if done
Discussion	25	Discuss the clinical applicability of the study findings including comparison of base rate and test hit rate, change in odds from pre-screening to post-screening or applicability of SnNout or SpPin

## **APPENDIX 5: RESOURCES FOR IMPLEMENTING DEVELOPMENTAL SURVEILLANCE AND SCREENING**

American Academy of Pediatrics Developmental Surveillance and Screening Project

Upon publication of the American Academy of Pediatrics (AAP) July 2006 policy statement titled *Identifying infants and Young Children with Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening*, the AAP developed the Developmental Surveillance and Screening Policy Implementation Project (D-PIP) to test the feasibility of implementing the developmental surveillance and screening (DSS) algorithm. The recently completed project involved 17 diverse pediatric practices from across the United States, including community health centers, private practices, and academic medical center residency continuity clinics. The goals of the D-PIP were to determine how practical and realistic it was to implement the policy recommendations, specifically the algorithm, and to identify strategies used and barriers identified in implementation. Practice teams developed an office system for DSS implementation, including buy-in from practice leadership and staff, and continually made improvements in their efforts.

As part of the D-PIP, practices serve as “mentors” and offer guidance to other practices interested in implementing developmental screening. The mentor practices are:

- Alexandria-Lake Ridge Pediatrics (Alexandria, VA)
- Boys Town Pediatrics (Omaha, NE)
- Charter Oak Health Center at Connecticut Children’s Medical Center (Hartford, CT)
- Children’s Hospital of Pittsburgh Primary Care Center (Pittsburgh, PA)
- Hospital of Saint Raphael Pediatric Primary Care Center (New Haven, CT)
- Marshall University Pediatrics (Hunington, WV)
- North Arlington Pediatrics (Arlington, Heights, IL)
- Ohio Pediatrics, Inc. (Huber Heights, OH)
- The Children’s Clinic (Long Beach, CA)
- The Kids Clinic (Lawrenceville, GA)
- Wishard Primary Care Center (Indianapolis, IN)
- Ypsilanti Health Center (Ypsilanti, MI)

For more information about the D-PIP, contact Jill Ackerman at [jackermann@app.org](mailto:jackermann@app.org) or visit: <http://www.medicalhomeinfo.org/screening/DPIP.html>