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Understanding Developmental–Behavioral Screening Measures

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Educational Gap

With nearly half of pediatricians still not using standardized screening tools, primary care clinicians should know that the periodic use of general developmental and social–emotional screening tools has been proven to identify promptly two to six times more children (age 0– 5 years) with suspected delays than a clinician's unstructured surveillance alone.

Objectives   After completing this article, readers should be able to:

1. Recognize the many methods available to detect a wide spectrum of developmental and behavioral conditions with screening tools, and the screening schedule recommended by the AAP.
2. Recognize that universal, periodic screening with psychometrically sound developmental–behavioral instruments greatly enhances a clinician's ability to detect, refer, and monitor children who have evolving developmental and behavioral problems. A pediatric provider's impression has good specificity but poor sensitivity and thus has difficulty identifying the less obvious delays.
3. Know that children who have false-positive screens (screening test concerning but subsequently ineligible for early intervention or early childhood special education services) are a high-risk group in need of close monitoring and other community services such as evidence-based parenting programs and Head Start.
4. Know the main limitations of applying standardized screening tools into a primary care setting.
5. Be aware that screening measures which adhere to core psychometric and feasibility standards are more likely to perform consistently well and be found sustainable in a primary care setting.

Abbreviations

ASQ:	Ages and Stages Questionnaire
ASQ-3:	Ages & Stages Questionnaire, Third Edition
ASD:	autism spectrum disorder
ECSE:	early childhood special education
EI:	early intervention
M-CHAT:	Modified Checklist for Autism in Toddlers
NPV:	negative predictive value
PEDS:	Parents' Evaluation of Developmental Status
PEDS:DM:	Parents' Evaluation of Developmental Status– Developmental Milestones
PPV:	positive predictive value

Introduction

Developmental and behavioral problems are among the most common conditions of childhood and adolescence; 15% of children have a developmental disability and 21% have a mental health disorder. If intervention is instituted before kindergarten entrance, many problems can be prevented and the large majority can be ameliorated. In the United States, early detection depends heavily on primary care providers. Primary care clinicians should know that the periodic use of general developmental (1)(2)(3)(4) and social-emotional (5) screening tools has been proven to identify promptly two to six times more children (age 0–5 years) who have suspected delays than a clinician's surveillance alone. (1)(2)(3)(4)(5) This difference in outcome includes foster care populations, in whom pediatricians possess knowledge of children being at higher risk for a developmental delay or social-emotional disorder. (4)(5)

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Periodic screening leads to substantial increases in early intervention (EI) and early childhood special education (ECSE) eligibility rates. (1)(2) Interestingly, the percentage of pediatricians "who self-reported always/almost always using ≥1 screening tools" has increased significantly from 23.0% to 47.7% from 2002 to 2009. (6) With greater numbers of clinicians incorporating standardized screening tools into their practices, a better understanding of how to optimize their performance is needed. With nearly half of pediatricians still not routinely using standardized tools, further education is warranted about which tools are feasible for use in primary care, with attention paid to which tools are psychometrically sound. Education also is warranted on how practitioners can better employ screens in a 1) safe, 2) equitable, 3) effective, 4) timely, 5) patient- and parent-centered, and 6) efficient manner. These are the Institute of Medicine's six quality aims.

Surveillance is the process in which clinicians watch for signs of developmental or behavioral problems in the course of caring for children. Screening refers to the use of brief standardized tools to differentiate those who need a further evaluation for potential problems from those who probably do not. Although screening measures help to refine the pattern of delays in children who have detectable problems, they are meant primarily for children perceived to be asymptomatic by the clinician and for those in whom surveillance demonstrates risk.

Developmental-behavioral screens are different from many other medical screens, which seek to identify a strictly positive or negative condition (eg, cystic fibrosis, congenital hypothyroidism, phenylketonuria). In fact, research indicates that children who have false-positive screens (screening test positive/concerning but subsequently ineligible for EI/ECSE services) are a high-risk group in need of diligent monitoring and other community resources. (2)(7)

There are numerous categories of developmental-behavioral screening instruments (Table 1) used to identify a wide spectrum of developmental-behavioral conditions with variable prevalence rates at different ages (Table 2). Parent-report screens (Figs 1–3) typically are designed to measure one of the first three components of developmental-behavioral surveillance: 1) eliciting and addressing parents' concerns; 2) maintaining a developmental-behavioral history (reviewing milestones and behaviors); and 3) identifying developmental-behavioral risk and protective factors (biological and environmental).

Table 1. Common Developmental–Behavioral Screening Tool Categories

I. Parent-report: measures parental concerns versus; milestones/skills and behaviors versus; developmental-behavioral (biological and environmental) risk and/or protective factors versus; a history of parent–child interactions versus a combination of all of the above.

II. Practitioner-administered: directly eliciting and/or observing milestones/skills and behaviors about the child and/or the parent–child interactions. In reality, many practitioner-administered tools have parent-report items.

Broad–band Screening Measures	Narrow–band Screening Measures
A. Broad–band family psychosocial	1. Parental mood disorder/depression-specific[a] 2. Parental substance abuse–specific 3. Domestic violence–specific 4. Parental adverse childhood experience–specific
B. Broad–band (general) developmental[a]	1. Social-emotional 2. Language- and cognitive-specific 3. Communication–specific 4. Autism-specific[a] 5. Motor-specific
C. Broad–band mental health/behavioral/psychosocial function[a]	1. ADHD-, oppositional defiant-, conduct disorder–specific 2. Academic- and/or literacy-specific 3. Anxiety disorder–specific 4. Depression/mood disorder–specific[b] 5. Substance abuse–specific[a] 6. Suicide-specific

ADHD=attention-deficit/hyperactivity disorder.
[a]The AAP recommends universal postpartum maternal mood disorder screening in the first year (experts recommend 2, 4, and/or 6 months), general developmental screening at 9, 18, and 30 (or 24) months (AAP experts also recommend a "kindergarten readiness" screening at 4 years), autism-specific screening at 18 and 24 months, mental health/psychosocial function screening at every health supervision visit ≥5 years, and substance abuse–specific screening at every health supervision visit throughout adolescence.
[b]The US Prevention Service Task Force recommends depression-specific screening at every health supervision visit throughout adolescence.

Table 2. **Prevalence of Developmental–Behavioral Conditions in Children**[a]

Any developmental disability	15.0% (3–17 y in 2006–2008)
Condition	Prevalence (%; most studies conducted in the United States)
Common conditions (≥1%)	
1. Social-emotional/behavioral disorders	• 21% (children and adolescents who meet criteria for a mental health disorder with at least minimal impairment in 1999) • 9.5%–14.2% ("serious emotional disturbance," 0–5 y in 2006)
2. Speech and language impairment	• 13.5% (expressive speech delays, 18–23 mo in 1996–2000) • 17.5% (expressive speech delays, 30–36 mo in 1996–2000) • 7.4% (language impairment, kindergarten in 1997)
3. Attention-deficit/hyperactivity disorder	• 7.6% (3–17 y in 2006–2008) • 4.1% (4–8 y in 2006–2008)
4. Learning disability	• 7.2% (3–17 y in 2006–2008)
5. Developmental coordination disorder	• 6% (5–11 y in 2000); 1.7% (7–8 y in 2009)
6. Intellectual disability/mental retardation	• 1.2% (3–10 y in 1991) • 0.67% (3–17 y in 2006–2008)
7. ASDs	• 0.66% (8 y and 3–10 y in 1998) • 1.1%[b] (3–17 y in 2006–2008)
Less common conditions (< 1%)	
8. Cerebral palsy	• 0.24% (3–10 y in 1991)
9. Hearing impairment[c]	• 0.38% (3–17 y in 2006–2008)
10. Vision impairment[d]	• 0.13% (3–17 y in 2006–2008)

ASD=autism spectrum disorder.
[a]Please note that all of these developmental-behavioral conditions have high rates of comorbidity.
[b]In 2007, the ASD point prevalence was 110 per 10,000 (1.1%). Diagnosis of ASD was defined by 1) a physician or other health-care provider who said that the child had ASD and 2) that the child currently had the condition. Nearly 40% of those ever diagnosed with ASD did not currently have the condition at the time of a random-digit-dial telephone National Survey of Children's Health (sample size = 78,037).
[c]Defined by the Centers for Disease Control and Prevention as moderate hearing loss (40 dB) or worse, unaided, in the better ear.
[d]Defined by the Centers for Disease Control and Prevention as 20/70 visual acuity or worse, with correction, in the better eye.

Practitioner-administered screens (Fig 4), which directly elicit or make observations about the child's skills and behavior, generally measure another component of surveillance, making accurate and informed observations about the child and parent–child interactions. Screens may be broad-band (general) (Figs 1 and 4), meaning they tap all or most developmental-behavioral domains (expressive speech and language, receptive language, gross motor, fine motor, cognitive/problem-solving, self-help and adaptive skills, social-emotional/behavior) or narrow-band (Fig 2), meaning domain-, disorder-, or disability-specific. Narrow-band screens may partially tap one or more domains but are not designed to assess the wide spectrum of development-behavioral conditions at various ages (Table 2) and, therefore, ideally should always be used in conjunction with a broad-band screen.

Current Recommendations

The American Academy of Pediatrics (AAP) currently recommends universal postpartum mood disorder screening in the first year after birth; general developmental screening at 9, 18, and 30 (or 24) months; autism-specific screening at 18 and 24 months; social-emotional screening whenever a general or autism-specific instrument is abnormal; "kindergarten readiness" screening at 4 years; social-emotional/mental health/psychosocial function screening at every health supervision visit from ages 5 to 18 years; and substance abuse–specific screening at every health supervision visit throughout adolescence.

In addition, according to the AAP, an appropriate screen should be administered whenever a clinician's surveillance determines "risk." All of these screening recommendations have heightened the need for clinicians to implement office-based and community-based systems that are simultaneously effective and efficient, especially for those for whom research suggests interventions are most effective: the 25.7 million children in the United States who are age <5 years (projected population in 2012 per http://www.childstats.gov).

Incorporating Periodic Screening Into Ongoing Surveillance

Figure 5 provides a collaborative model for screening and surveillance in a medical home setting and is a combination of the 2006 developmental, 2007 autism spectrum disorders (ASDs), and 2010 mental health AAP

Psychometric Properties	ASQ-3	IDI & CDR-PQ	PDQ II	PEDS	PEDS:DM
Type of measure	Parent-report w/ observable skills (or via interview)	Parent-report w/ observable skills (or via interview)	Parent-report w/ observable skills (or via interview)	Parent-report concerns (or via interview)	Parent-report w/ observable skills (or via interview)
Scores produced	age-specific cut-offs (typical, refer, monitor) in 5 developmental domains	cut-offs (typical, delayed, borderline) in 5 domains If delayed, then CDI assessement	single cutoff w/ items at 75th & 90th%tiles; if Y/N 90th% item failed then do Denver II	refer/ no-refer (5 pathways based on predictive developmental & behav concerns)	age-specific cut-offs (refer/ no-refer), 8 domains (including SE)
National (USA) & diverse sample*	yes & yes (diverse sample but not entirely representative of U.S. popul.)	no (St Paul, Minn) & no (primarily mod. SES/ white working class)	no & maybe (because English-speaking only in Colorado)	yes & yes (well matched to U.S. Census Bureau demographics)	yes & yes
General/ naturalistic sample*	yes	yes	questionable	yes	yes
Standardization sample size ok* (≥200 children per age interval is preferred; 100 per age-interval is acceptable)	12695 (352 - 2088 children/ age-interval but wide interval spacings)	568 IDI (not validated); 220 CDR-PQ (validated but low sample size)	284, extrapolated from Denver II standardization sample	47,531 standardization; validated on 1158 but #/age interval is unclear	1171 (241 - 579 children/ age-interval & good interval spacings)
Last re-normed or published (≤10 y)*	2009	2004	1988 (publ 1998)	2012	2007
Inter-rater reliability (> 80%)*	93%	not available	83%?, for R-PDQ	95-97% (online)	82 - 96%
Test-retest reliability (> 80%)*	75 - 82%	not available	93%?, for R-PDQ	94% (online)	98 - 99%
Internal consistency (≥80%)*	60 - 85%	70% (for the CDI)	not available	"moderately high"	98%
Appropr, equiv reference standards*	acceptable	acceptable	not available	acceptable	acceptable
Noteworthy forms of validity bias	small sample- wide intervals q 9-18 mo	selection & small sample bias	selection & procedural bias	less bias but note: PEDS Online used	procedural bias (see below box)
Concurrent, criterion-related validity: Sensitivity (core standard ≥70%)*	82.5 - 89.2% user manual; 75- 89% in gen. primary care sample w/ ASQ-2	85% for IDI; 68% for CDR-PQ	unclear ("96% agreement with Denver II" not ok)	86% per user manual; 44 - 78% in general primary care sample	70% - 96% but extrapolated from Brigance, a practitioner admin. tool
Concurrent, criterion-related validity: Specificity (≥70%)*	77.9 - 91.3% user manual; 74 - 83% in gen. primary care sample w/ ASQ-2	77% for IDI; 88% for CDR-PQ	unclear ("96% agreement with Denver II" not ok)	74% per user manual; 63 - 81% in general primary care sample	77% - 93%, but extrapolated from Brigance, a practitioner admin. tool
Construct, convergent and/ or discriminant validity studies	yes & supportive	no	no	yes & supportive	no
Predictive validity studies	yes & supportive	no	no	yes & supportive	no
Feasibility Properties	ASQ-3	IDI & CDR-PQ	PDQ II	PEDS	PEDS:DM
Feasible & sustainable in primary care per a peer-reviewed journal	yes	yes	yes	yes (all ages get same 10 items)	no but studies are pending
Costs/ screen, Materials	$0.36	$0.55	$0.30-37	$0.31	$0.02
Costs/ screen, Scoring (time)	$2.00 (2 min)	$2.00 (2 min)	$1.00 (1 min)	$1.00 (1 min)	$1.00 (1 min)
Costs/ screen, Total with self-report	$2.36	$2.55	$1.30 - 1.37	$1.31	$1.02
Costs/ screen, Interview (time)	$12.00 (12 min)	$12.00 (12 min)	$10.00 (10 min)	$3.00 (3 min)	$3.00 (3 min)
Costs/ screen, Scoring + Materials	$2.36	$2.55	$1.30 -1.37	$1.31	$1.02
Costs/ screen, Total with interview	$14.36	$14.55	$11.30 - 11.37	$4.31	$4.02
Costs/ screen, Direct admin. (time)					$5.02 (4 min)
Time frame to administer & score (≤10 min at office; <20 min at home)*	10 - 20 min	10 - 20 min	7 - 10 min	2 - 5 min	3 - 5 min
Number of items	36-37 (30 scored)	25-30 items	~7-10 items/ age	10 items	6-8 items
Electronic/ online version	yes	yes	yes	yes	yes
Training resources available	yes	yes	yes (by DVD)	yes	yes
Materials kit needed	no but kit available	no	no	no	no
Readability (grade level) (≤ 5th)*	4th - 5th	6th	not reported	4th - 5th	2nd - 3rd
English & Spanish (for USA)*	yes	yes	yes	yes	yes
Para-professional administration ok*	yes	yes	yes	yes	yes
Clear admin & scoring directions*	yes	yes	yes	yes (but interview needed if no written comments)	yes
Clear interpretation guidelines*	yes	yes	yes	yes	yes
Dev-behav. promotion tools	yes	yes	yes	yes	yes
Referral guidelines or forms	yes	yes	unclear	yes	yes
Dev-behav. charts/ monitoring tools	yes (online only)	yes	yes w/ Denver II	yes	yes
Age range approximately 0 - 5 yrs	1 mo - 5.5 yrs	0- 18 mo - 5 yrs	0 through 4-6 y	0 - 8 yrs	0 - 7 yrs

Figure 1. Broad–band (general) developmental: parent–report screening measures. Core standards are highlighted in yellow. See text to explain shading and see Table 3 for abbreviations.

algorithms. (8) When a psychometrically sound screen raises concerns, the algorithm emphasizes system-wide referral care coordination and a secondary screening or assessment, which, in a primary care setting, is best accomplished with the help of an EI/ECSE agency and an early return (≤1 month) office visit.

In this algorithm, pediatric clinicians are encouraged to refer automatically when their clinical impression confidently detects a developmental delay or if the child possesses a biological or environmental condition associated with a sufficiently high probability of a delay; developmental-behavioral promotion has been formally incorporated as a component of surveillance to make the process safer, more effective and parent-centered; plus greater detail has been provided about the decisions and action steps that should reliably occur after a screening test is administered (ie, postscreening surveillance). (8)

"Structured surveillance" means that the process and decision-making are enhanced with periodic screening by using evidence-based measures. (8) "Unstructured surveillance" means that the process and decision-making are reliant on subjective impressions or casual observations. (8) In a systematic review, a pediatric clinician's unstructured surveillance, when compared with a validated screening tool or a diagnostic interview, has good specificity (the proportion of children correctly identified as not having a developmental-behavioral problem) ranging from 69% to 100%, but poor sensitivity (the proportion of children correctly identified as having a developmental-behavioral problem) ranging from 14% to 54%. (9)

When pediatric health-care providers detect a problem, they usually are correct; however, they struggle to identify the majority of delays, most likely because they over-rely on psychometrically unsound milestone checklists with vague referral criteria. (1)(2)(8) As a result, the large majority of children who have evolving developmental-behavioral problems can be deprived of the benefits of EI, ECSE, or other evidence-based community services before kindergarten entrance.

Periodic screening (ie, structured surveillance) has been proven repeatedly to enhance a clinician's ability to detect, refer, and monitor children who have evolving developmental-behavioral problems. (1)(2)(3)(4)(5)(8)

Limitations of Screening in Primary Care

Although standardized screening improves the quality of care at health supervision visits, increases parental satisfaction, leads to substantial cost savings for society, and positively affects the lives of children and families via the

Psychometric Properties	ASQ: SE	BITSEA	Greenspan SEGC	CSBS DP ITC	M-CHAT
Type of tool & function	SE, parent-report	SE, parent-report	SE, parent-report	Commun. & SE, parent-report	autism-specific, parent-report
Scores produced	age-specific cutoffs (refer/ no-refer for suspected SE disorder)	age & sex-specific cut-offs (pass/fail) for SE problems & competence	age-specific cut-offs ("significant", "moderate" or "mild" challenges vs. "mastery"/ normal)	age-specific cutoffs (pass/ fail for lang. &, social commun) 5 checklists	cutoff (pass/ fail for possible autism) Fail = ≥3 of 23 or ≥2 of 3 critical items
National (USA) & diverse sample*	yes & yes	no & yes	yes & no (English-speaking only)	no (most from Florida) & yes	yes & yes
General/ naturalistic sample*	yes	yes	no (at-risk populat.)	yes	yes
Standardization sample size ok*	3014 (intervals x 8, 298- 471/ age-interval)	600 (intervals x 4, 150/ age-interval)	1700 (but extrapolated from the Bayley-III)	2188 total for standardization	1293
Last re-normed or published (≤10 y)*	2002	2001	2000 re-normed, 2004 published	2002	1999, revision of M-CHAT pending
Appropr. equiv. reference standards*	acceptable	acceptable	acceptable	acceptable	acceptable
Inter-rater reliability (>80%)*	not available	55% - 78%	not available	'good'	not reported
Test-retest reliability (>80%)*	94%	79% -92%	not available	'good'	not reported
Noteworthy form of validity bias	small sample bias	selection bias	small sample & procedural bias	selection bias	verification bias
Internal consistency (≥80%)*	67 - 97%	SE problem 83%-89%, Competence 66% -75%	SE problem 90%, sensory processing problem 83%	86 - 92%	85% for 23-items, 83% for 6 critical items
Concurrent, criterion-related validity: Sensitivity (≥ 70%)*	71 - 85%	80 - 85%	67.2 -98.5%, (67.2 - 86.6% for ASD)	76%	85 - 87% (but see below)
Concurrent, criterion-related validity: Specificity (≥ 70%)*	90 - 98%	75 - 80%	68.5 -97.8%, (90.2 - 98.5% for ASD)	82%	93 - 99% (but see below)
Construct, convergent and/ or discriminant validity studies	yes	yes	yes (good sens. & spec. for ASD if "moderate emerging challenges")	yes (has good sensitivity for ASD at 12 mo well-child visit)	In gen. pop., 6 - 10% fail M-CHAT at 18 & 24 mo so many false (+)s
Predictive validity studies	no	yes & supportive	no	no	yes
Feasibility Properties	**ASQ:SE**	**BITSEA**	**Greenspan SEGC**	**CSBS DP ITC**	**M-CHAT**
Feasible & sustainable in primary care per peer-reviewed journal	yes (used at 6 mo to 5.5 yrs)	no	no	yes (but used at 12 mo only)	yes (mostly at 18 and 24 mo)
Costs/ screening- Materials	$0.40	$1.56	$1.56	$0.12	$0.06
Costs/ screening- Scoring (time)	$2.00 (2 min)	$2.00 (2 min)	$2.00 (2 min)	$3.00-$10.00 (3-10 min)	$1.00 (transparent sheet, 1 min)
Costs/ screeening- Total, self-report	$2.40	$3.56	$3.56	$3.12-$10.12	$1.06
Costs/ screen, Interview (time)	$10.00 (10 min)	$10.00 (10 min)	$10.00 (10 min)	$8.00 (8 min)	$5.00 (5 min)
Costs/ screen, Scoring + Materials	$2.40	$3.56	$3.56	$3.12 - $10.12	$1.06
Costs/ screen, Total with interview	$12.40	$13.56	$13.56	$11.12 - $18.12	$6.06
Time frame to administer& score (≤10 min at office; ≤20 min at home)*	12 min	12 min	12 min	5 - 10 min	7 min
Number of items	19 - 33	42	35	24	23 (yes/ no)
Electronic/ online version	yes & CD-ROM available	no but CD-ROM available for scoring, interpret.	no	no but CD-ROM available for scoring, interpr.	yes & download-able, automated scoring available
Training resources	yes	no	no	yes	yes
Materials kit needed	no	no	no	yes (in toolkit)	no
Readability (grade) level (< 5th)*	5th -6th	4th - 6th	not reported	~3rd	4th - 6th
English & Spanish? (for USA)*	yes	yes	no	yes	yes
Para-professional administration ok*	yes	yes	yes	yes	yes
Clear admin. & scoring directions*	yes	yes	yes	yes	yes
Clear interpretation guidelines*	yes	yes	yes	yes	yes
Dev-behavior promotion tools	yes	no	no	no	no
Referral guidelines or forms	yes	yes	yes	yes	yes
Dev-behav. monitoring charts/ tools	no	no	yes	no	no
Age range	3 - 66 mo	12 - 36 mo	0 - 42 mo	6 - 24 mo	15 - 30 mo

Figure 2. Narrow–band parent–report: social–emotional (SE), communication & autism–specific screens. Data not included for the M–CHAT Follow–up Interview (FI), which is recommended for any failed M–CHAT. Core standards are highlighted in yellow. See text to explain shading and see Table 3 for abbreviations.

benefits of EI and ECSE, clinicians should be aware that screening has its limitations. No single instrument will suffice to identify every developmental-behavioral problem and match the needs of every population or practice setting. The population screened and the method of implementation affect the psychometric properties of a screening measure. Screens can be falsely negative (ie, they can yield negative or borderline results, but the child could be promptly deemed eligible for EI/ ECSE services) or falsely positive (ie, the screening test is positive or concerning, but the child is subsequently deemed EI/ECSE ineligible). However, a clinician's

longitudinal surveillance can be used to better interpret the typical or borderline results of a screening test.

For example, when a pediatrician confidently suspects a delay and, simultaneously, a screen such as the Ages and Stages Questionnaire (ASQ) is found to be typical or borderline, 92% of pediatrician-referred children (blind to ASQ results) promptly receive some form of EI services (40% are found to be EI-eligible; 52% are placed on an EI-monitoring list). (1) However, there is no evidence to support the concept that unstructured surveillance should be used to override the concerning results of a psychometrically sound screen and negate the need for a community-based referral. (8) Children who fail screening tests and subsequently are not promptly found to have a developmental-behavioral diagnosis (false-positives) nonetheless tend to have numerous psychosocial risk factors and exhibit performance well below average in the better predictors of school success: pre-academics, language, and intelligence. (7) Indeed, children found to have false-positive screening results are a high-risk group in need of closer monitoring, repeat screenings at subsequent visits, and other community resources (eg, evidence-based parenting programs, nurse home visit programs, high-quality child care, structured preschools such as Head Start).

Evaluating Specific Characteristics of Screening Measures

Although experts agree that no single screening instrument will suffice to identify every developmental-behavioral problem in every practice setting, it is also true that all screening tools are not constructed equal. In 2008, Drotar et al (10) provided guidelines to help pediatricians select which screening tools were best-suited to their practices based on their population's risk level.

Psychometric Properties	PSC	SDQ	Connors 3	Vanderbilt scales
Type of tool & function	Screen; parent & youth report; broad- band behavioral (internaliz., externaliz., inattention) 17, 35 or 37 items; Pictorial PSC for Spanish- speaking or low SES patients	Screen; Parent, self (11-15 yrs) & teacher report; broad-band behav. (emotions, conduct, hyperactivity, inattention & prosocial behaviors + impact supplement)	Assessment tool; parent, child & teach-er-report; (ADHD & learning, oppositional defiant, conduct, anxiety, depression/ mood d/o + academic & behav. impairment)	Assessment tool; parent & teacher-report; (ADHD & oppositional defiant, conduct, anxiety, depression/ mood d/o; academic & behav. impairment)
Scores produced	single cutoff (refer/ no refer to mental health); no borderline zone	cufoffs ('close to ave' or 'slightly raised' vs. 'high' or 'very high')	cutoffs (normal, borderline, abnormal)	single cutoffs for each disorder; no borderline zones
National (USA) & diverse sample*	yes & yes	yes & yes	yes & yes	no (TN sample) & yes
General/ naturalistic sample*	yes	yes	yes	no (high-risk sample)
Standardization sample size ok*	21065 in USA; 12506 in Chile	9878 in USA (validated on 7984 in Britain)	~6000 (parent, child & teacher ratings)	8257 (teacher); valid-ated on 237 (parent)
Last re-normed or published (≤10 y)*	1998	2001	2000	1994 & 1999
Approp., equiv. reference standards*	acceptable	acceptable	acceptable	acceptable
Inter-rater reliability (>80%)*	84%	unclear vs 34%?	52% - 94%	not reported
Test-retest reliability (>80%)*	84% - 91%	72%-85%	71% - 98%	not reported
Internal consistency (≥80%)*	91%	51%-82%	77% - 97%	93% (parent- ADHD)
Noteworthy form of validity bias	some selection bias	some selection bias	some selection bias	selection bias
Concurrent, criterion-related validity: Sensitivity (≥ 70%)*	95% middle income, 88% lower income	63.3% (for parent + teacher + child SDQ)	78% - 92%	63% (but using teacher-report only)
Concurrent, criterion-related validity: Specificity (≥ 70%)*	68% middle income, 95-100% low income	94.6% (for parent + teacher+ child SDQ)	84% - 94%	78% (but using teacher-report only)
Construct, convergent and/ or discriminant validity studies	yes (on sub-scales + in many countries, SES groups, clinic settings)	yes (65% of false (-)s w/ (+) psychiatric dx rated 'slightly raised')	yes (on sub-scales)	yes (on sub-scales); Parent-report =79% correlation C-DISC-IV
Predictive validity studies	yes & supportive	yes & supportive	yes & supportive	no
Feasibility Properties	**PSC**	**SDQ**	**Connors 3**	**Vanderbilt scales**
Feasible & sustainable in primary care per peer-reviewed journal	yes (many supportive studies but use PPSC if parents not literate)	yes (many supportive studies but few in U.S. primary care settings)	no for universal use; yes for assessment reasons	no for universal use; yes for assessment reasons
Costs/ screen- Materials	$0.06	$0.06 - $0.18	$1.80	$ 0.24
Costs/ screen- Scoring (time)	$2.00 (2 min)	$2.00 (2 min)	$10.00 (10 min)	$10.00 (10 min)
Costs/ screen- Total, self-report	$2.06	$2.06 - $2.18	$11.80	$10.24
Costs/ screen, Interview (time)	$5.00 (5 min)	$5.00 (5 min)	$20.00 (20 min)	$20.00 (~20 min)
Costs/ screen, Scoring + Materials	$2.06 (2 min)	$2.06-$2.18 (2 min)	$11.80 (10 min)	$10.24 (10 min)
Costs/ screen, Total with interview	$7.06	$7.06-$7.18	$31.80 (that varies)	$30.24 (direct adm.)
Time frame to administer & score (≤10 min at office; ≤20 min at home)*	7 min	7 min	10 - 30 min (parent/ child, teacher forms)	20 - 30 min (parent & teacher forms)
Number of items	17 vs. 35	25 - 35	27 - 80	55 + 43 = 98
Electronic/ online version	yes (free online)	yes (free online)	yes (online CD-ROM)	yes (free download)
Training resources	yes (in AAP toolkit)	yes	no	yes
Materials kit needed	no	no	no	no
Readability (grade) level (≤ 5th)*	~2nd	<5th grade	4th - 5th grade	4th grade
English & Spanish (for USA)*	yes	yes	yes	yes
Para-professional administration ok*	yes	yes	yes	yes
Clear admin. & scoring directions*	yes	yes	yes	yes
Clear interpretation guidelines*	yes	yes	yes	yes
Dev-behavioral promotion tools	no	yes	yes	yes (w/ AAP toolkit)
Referral guidelines or forms	yes	yes	yes	yes
Dev-behav. monitoring charts/ tools	no- paper/ yes- online	no	no	no-paper/ yes-online
Age range (years)	3 - 18 yrs per authors	3 - 16 yrs	3 - 17 yrs	6 - 12 yrs

Figure 3. Mental health/behavior screening & assessment measures (used mostly in school age children). Commonly used ADHD tools were included per the editor's request; however, an exhaustive list of depression-, anxiety-, and substance abuse-specific screening tools was not included. Core standards are highlighted in yellow. See text to explain shading and see Table 3 for abbreviations.

For general developmental parent-report tools, Drotar et al recommended the ASQ and Parents' Evaluation of Developmental Status (PEDS) for general primary care populations and the ASQ specifically for high-risk populations. For ASD-specific screening tools, the Modified Checklist for Autism in Toddlers (M-CHAT) was recommended for general primary care populations. For further details and recommendations, refer to http://www.cmwf.org/Content/Publications/Fund-Manuals/2008/Feb/Pediatric-Developmental-Screening–Understanding-and-Selecting-Screening-Instruments.aspx.

Since 2008, new tools have been developed (eg, Parents' Evaluation of Developmental Status–Developmental Milestones [PEDS:DM], Quantitative Checklist for Autism in Toddlers), and others have undergone revisions (eg, Ages & Stages Questionnaire, Third Edition [ASQ-3]). In 2009, an AAP periodic survey, in concert with the screening tool selection trends in national and statewide implementation initiatives, collectively suggested that the ASQ, PEDS, and M-CHAT have emerged as the three most commonly selected screening instruments for children age 0 to 5 years in US primary care settings. (6)

For broad-band developmental screening tools, from 2002 to 2009, pediatricians' use of the ASQ increased from 7.3% to 22.4% and use of the PEDS increased from 2.4% to 15.9%. (6) In 2011, a well-designed study indicated that the ASQ (second edition) was significantly more accurate than the PEDS, especially for children over age 30 months, in the identification of developmental delays in a primary care setting. (11) The strengths of the ASQ include its accuracy (both overall and across all age ranges) and its ability to be used as a developmental promotion tool. When caregivers mark "not yet" to an item because they have never tried that particular developmental task with their child, this is considered a "teachable moment," where clinicians can promote a new developmental activity.

Although multiple primary care studies suggest that the paper-based ASQ is feasible, it does require getting all items on the correct age-interval ASQ thoughtfully completed by caregivers (and then correctly scored) before the health supervision visit. In contrast, the strength of the PEDS is its feasibility as a previsit screen with its 2- to 5-minute administration time, fourth- to fifth-grade reading level, and single questionnaire format for all ages.

Interestingly, the PEDS has been designed to detect a broader array of "at-risk" (not just "delayed") children and can be used not only as a screening and surveillance measure but also as a scaffold to enhance parent–provider communication. Compared with the ASQ, a higher

Psychometric Properties	BDIST-II	BINS	Brigance II	CAT/CLAMS	Denver II	PEDS:DM (AL)
Type of tool	Practitioner-elicited via combination of interview, direct admin. & observ.	Practitioner-elicited (well suited for NICU follow-up)	Practitioner-elicited via parent-report/interview from 0 2 years	Practitioner-elicited (not broad-band; cognitive & lang.-specific)	Practitioner-elicited via direct interview and observation	Parent-report (PR)/ Interview vs. Practitioner-elicited (Direct)
Scores produced	cutoffs, age-equivalents, percentiles, scaled quotients	cutoff risk categories (low, mod. & high risk)	cutoffs, age equivalents, quotients & growth indicat.	cutoffs, age-equivalents & quotients	risk categories (normal, questionable, abnormal)	cutoffs, age-equivalents
National & diverse sample*	yes & yes	yes & yes	yes & yes	yes & yes	no & maybe	yes & yes
General/ naturalistic sample*	yes for standard-ization, no for validity studies	no (low birth weight sample)	yes	no (preterm, referred for delay, VLBW)	yes (but English - speaking only from Colorado)	yes
Standardization sample size ok*	2500	1795	1366	1239	2096	1619
Last re-normed (< 10 y)*	2005	1995	2005 acceptable	2005	1988 (> 20 y)	2008
Appropriate equiv ref standards*	acceptable	acceptable	acceptable	acceptable	acceptable	acceptable
Inter-rater reliability (≥ 80%)*	93 - 94%	79 - 96%	90 - 99%	manual: ≥80%	95 - 100%	82 - 96%
Test-retest reliability (> 80%)*	90 - 99%	71 - 84%	84 - 99%	not reported	50 - 100%	98 -99%
Internal consistency (> 80%)*	85 - 95%	73 - 85%	97 - 99%	not reported	not available	98%
Noteworthy form of validity bias	selection bias	selection	less bias noted	selection bias	selection bias	procedural bias
Concurrent, criterion-related validity: Sensitivity (≥ 70%)*	72 - 93%	75 - 86%	73% - 100% across ages	21%-67% low-risk; 5%-88% high-risk pop.	56 - 83%	75-88% by domain, 70-96% across ages
Concurrent, criterion-related validity: Specificity (≥ 70%)*	79 - 88%	75 - 86%	72% - 100% across ages	95-100% low-risk & 82-98% high-risk pop.	43 - 80%	81-87% by domain, 77-93% across ages
Construct, convergent and/ or discriminant validity studies	yes + see "over-referrals" above	yes	yes, see "over-referrals"	yes, cognitive vs. lang disab.	unclear but see "over-referrals"	no
Predictive validity studies	no	yes	yes	yes	no	no
Feasibility Properties	BDIST-II	BINS	Brigance II	CAT/CLAMS	Denver II	PEDS:DM (AL)
Feasible & sustainable in primary care per peer-reviewed journal	no	yes	no	no	no	yes
Costs/ screen- Materials
Costs/ screen- Admin/scoring (costs vary with hourly salary)
Costs/ screen- Total	$1.94
$10.00-$30.00 (costs vary)
$11.94-$31.94	$1.88
$10.00 (costs vary)
$11.88	$1.25
$10.00-$20.00 (costs vary)
$11.25-$21.25	$1.25
$12.00-$24.00 (costs vary)
$13.25-$25.25	$0.32-$0.36
$15.00-$25.00 (costs vary)
$15.32-$25.36	$3.00
$5.00 (PR) vs. $10.00-$25.00
$8.00 (PR) vs. $13.00-$28.00
Time frame to admin. & score (≤10 min vs. ≤20 min at office)*	10 - 30 min	10 min	10 - 20 min	10 - 20 min	15 - 25 min	10 - 25 min
Number of items	32-100, varies by success	11-13 items	52+, varies by age & success	100 (CAT 58 + CLAMS 42)	24-125, varies by age/ success	36+, varies by age/ success
Electronic/ online version	yes	no	yes	no	yes	yes
Training resources	yes	not yet	yes	no	yes	yes
Materials kit needed	yes	yes	yes	yes	yes	optionally yes
Readability (grade) level (≤5th = core standard if parent-report)*	not applicable (n/a)	n/a	4th (0-2 yrs), otherwise n/a	n/a	n/a	2nd
English & Spanish (for USA)*	yes	no but n/a	yes	yes	yes	yes
Para-profess. administration ok*	no	yes	yes	yes	yes	yes
Clear admin, scoring directions*	yes	yes	yes	yes	yes	yes
Clear interpretation guidelines*	yes	yes	yes	yes	yes	yes
Dev-behavior promotion tools	no	no	yes	no	yes	yes
Referral guidelines or forms	yes	yes	no	no	no	yes
Dev-behav. monitoring tools	no	no	no	no	yes	yes
Age range	0 through 7-11 y	3 - 24 mo	0 through 4-8 y	2 - 36 mo	0 through 4-6 y	0 through 7-11y

Figure 4. Broad–band (general) developmental: practitioner–administered screening and assessment measures. Core standards are highlighted in yellow. See text to explain shading and see Table 3 for abbreviations.

percentage of children who have concerning or positive screens on the PEDS, which casts a "broad net," will be found ineligible for EI/ECSE services and a higher percentage of children who have delays will be missed because of a negative screening result (although this finding varies by age).

Of note, the accuracy and feasibility of the ASQ and PEDS theoretically improve with online modalities that automatically correct for prematurity, foster a more thoughtful at-home/previsit implementation approach, and score results without interference from human error. Also, with its online modality, the PEDS can be used in combination with the PEDS:DM.

For autism-specific screening tools, research now indicates that the M-CHAT follow-up interview should be administered routinely for any positive or borderline M-CHAT result due to a high false-positive rate (~90% are not subsequently diagnosed as having ASD) when using the M-CHAT at 18 and 24 months in a general, primary care population. (8)

The strength of the M-CHAT is its feasibility and that it is far less likely to miss a case of autism, compared with a clinician's unstructured surveillance. (8) Any positive M-CHAT result should lead to an EI/ECSE agency referral and, ideally, an early return office visit for further assessment. Unfortunately, a positive M-CHAT does not necessarily justify an expensive, comprehensive ASD-specific evaluation and EI plan in all cases. Children who screen positive on the M-CHAT plus Follow-up Interview should be referred for an ASD-specific EI plan and comprehensive evaluation. Although some children will not be diagnosed as having ASD, ultimately over-referrals are not a major concern because those not diagnosed as having ASD generally have other developmental disorders, predominantly language impairment or cognitive disabilities.

Of note, unstructured surveillance (eg, caregiver concerns about ASD; worrisome social-communication deficits or behavioral observations; or having a sibling who has ASD) still should be used in combination with the interpretation of a screening tool (eg, a number of "critical" M-CHAT items failed) to determine the need for an ASD-specific comprehensive evaluation and EI plan without need for the follow-up interview.

To develop a deeper understanding about the strengths and weaknesses of various screening tools, an understanding is needed about the basic precepts behind psychometric and feasibility standards. Core standards affect a screening tool's application to a primary care setting (eg, performance on a wide variety of populations, screening tool completion rates, sustainability over time). The question arises, what is a core standard? Throughout this article, a core standard is defined as an inflexible property
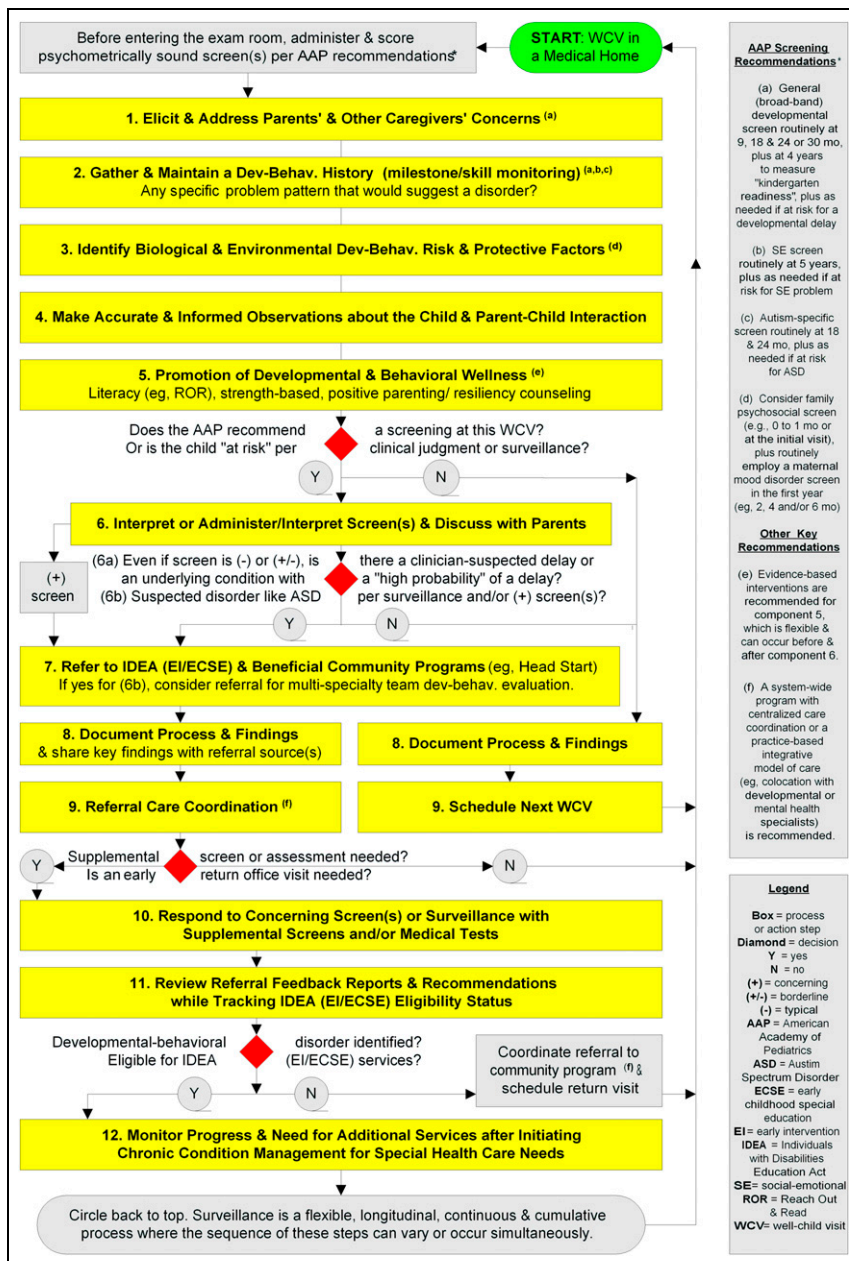
Figure 5. Algorithm for developmental–behavioral surveillance and screening (0 to 5 years) in a medical home setting. Permission to print this adapted figure was obtained from Sage Publishing. © Kevin Marks MD, 2012

that is critically important for the effective and feasible performance of a screening measure on a primary care population but is not necessarily dependent on the individual needs of a medical home.

Core standards provide a frame of reference to assure that relevant technical information is provided, with the hope that practitioners thereby will make wiser, more informed decisions when selecting, implementing, and interpreting screening tools. To learn more about what technical properties make a screening tool psychometrically sound, go to http://pedsinreview. aappublications.org/content/33/ 10/448/suppl/DC1, and to learn what properties make a screening tool feasible, go to http://pedsinreview. aappublications.org/content/33/ 10/448/suppl/DC2.

Application of Psychometric and Feasibility Standards to Primary Care

The AAP strongly endorses the use of properly standardized, reliable (≥80%), well-validated, and accurate (sensitivity and specificity ≥70%) screening instruments for the early identification of developmental-behavioral problems. However, highly accurate practitioner-administered instruments often possess undesirable feasibility characteristics for busy primary care settings. Practitioners should look hard at how practical any given instrument they are considering will be in the office setting. Suboptimal feasibility lowers screening tool completion rates. Lower completion rates logically hinder early detection rates because early detection is more apt to rely on subjective, unstructured surveillance instead of psychometrically sound screens.

For the early detection of a broad range of developmental delays before kindergarten entrance, parent-report tools such as the ASQ-3, PEDS, and the PEDS:DM are good examples of effective and feasible screening tools that are well-suited to a wide array of primary care settings; however, the use of yes/no checklists such as the Denver Prescreening Developmental Questionnaire II, is not recommended. For the early detection of a broad range of social-emotional/mental health problems, the Ages & Stages Questionnaire: Social-Emotional for

children age 3 months to 5 years and the Pediatric Symptom Checklist (PSC) for children age 6 to 18 years are good examples of effective and feasible tools.

For autism-specific screening, the M-CHAT is currently a commonly selected tool. However, whenever the M-CHAT is positive (failed), it is important to administer its follow-up interview to filter out which children are truly in need of an ASD-specific comprehensive evaluation and EI plan.

When selecting instruments, be aware that medical home differences often exist in patient sociodemographic characteristics, patient access, patient flow and volume, office staff resources, state EI/ECSE eligibility criteria, and the availability of early childhood community resources. For all these reasons, different practices may require a different combination of tools to optimize their early detection and referral rates. Table 3 provides a list of commonly used tools, along with their abbreviations and Web links.

Objectively Comparing Measures for Primary Care Settings

Although all screens have their individual strengths and weaknesses, Figs 1–4 (which are by no means an exhaustive list of measures) allow practitioners to compare some of the more commonly selected measures objectively. Ask yourself: 1) Which measures meet the majority of technical standards (white boxes) and best fit the needs of my practice? 2) Which measures do not meet the majority of technical standards (dark gray boxes)? 3) Which measures variably or questionably meet many of these technical standards (light gray boxes)? The authors of this article do not have any conflicts of interest and have extrapolated data directly from user manuals, official Web sites, and published, peer-reviewed articles.

Of note, reported psychometric properties typically were determined in a combination of at-home, day care, preschool, and, less frequently, primary care settings by

Table 3. **Abbreviations and Web Links for Commonly Used Measures**

A. Broad-band developmental: parent-report screening measures
 1. ASQ-3 = Ages & Stages Questionnaire, Third Edition; http://www.pbrookes.com/
 2. IDI = Infant Development Inventory; http://www.childdevrev.com/index.html
    CDR-PQ = Childhood Development Review–Parent Questionnaire; http://www.childdevrev.com/index.html
    CDI = Child Development Inventory; http://www.childdevrev.com/index.html
 3. PEDS = Parents' Evaluation of Developmental Status; http://www.pedstest.com
 4. PEDS:DM = Parents' Evaluation of Developmental Status–Developmental Milestones; http://www.pedstest.com
 5. PDQ-II = Prescreening Developmental Questionnaire II; http://www.denverii.com/PDQ.html

B. Broad-band developmental: practitioner-administered screening or assessment measures
 1. BDIST-II = Battelle Developmental Inventory Screening Test–II; http://www.riversidepublishing.com
 2. BINS = Bayley Infant Neurodevelopmental Screener; http://www.psychcorp.co.uk/product.aspx?n=1316&skey=2070
 3. Brigance Screens II; http://www/curriculumassociates
 4. Capute Scales: CAT/CLAMS = Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scales; http://products.brookespublishing.com/The-Capute-Scales-P360.aspx
 5. Denver II; http://www.denverii.com/DenverII.html
 6. PEDS:DM (AL) = Parents' Evaluation of Developmental Status–Developmental Milestones (Assessment Level); http://www.pedstest.com

C. Narrow-band: social-emotional-, communication-, and autism-specific screening measures
 1. ASQ:SE = Ages & Stages Questionnaire: Social-Emotional; http://www.pbrookes.com/
 2. BITSEA = Brief Infant Toddler Social Emotional Assessment; http://pearsonassess.com/
 3. Greenspan SEGC = Greenspan Social-Emotional Growth Chart; http://www.pearsonassessments.com/cgi-bin/MsmGo.exe?grab_id=0&page_id=8765&query=Greenspan&thiword=Greenspan%20
 4. CSBS DP ITC = Communication and Symbolic Behavior Scales Developmental Profile Infant/Toddler Checklist; http://www.pbrookes.com,
 5. M-CHAT = Modified Checklist for Autism in Toddlers (and its M-CHAT follow-up interview); http://www2.gsu.edu/~psydlr/Diana_L._Robins,_Ph.D.html

D. Mental health screening and assessment measures (for school-age children)
 1. PSC = Pediatric Symptom Checklist; http://www2.massgeneral.org/allpsych/psc/psc_home.htm
    PPSC = Pictorial Pediatric Symptom Checklist; http://www2.massgeneral.org/allpsych/psc/psc_forms.htm
 2. SDQ = Strengths and Difficulties Questionnaire; http://www.sdqinfo.com/
 3. Conners 3 = Conners Rating Scale–3rd edition (which can be used in children age 3–17 y); http://portal.wpspublish.com/portal/page?_pageid=53,112710&_dad=portal&_schema=PORTAL
 4. Vanderbilt Assessment Scales; http://peds.mc.vanderbilt.edu/cdc/childdevelopcenter.htm

using paper-based and, more recently, online screening modalities. Some forms of bias are present with varying degrees of severity within the validation studies for all of these measures, but noteworthy issues are highlighted for each instrument. Under feasibility, costs have been calculated uniformly (the same for each tool) by using a paper-and-pen, modifiable model from Dobrez et al. (13) A cost of $60 per hour was used to account for the combination of practitioner and clinic staff wages. Clinic costs will vary based on implementation procedures, staff salaries, the percentage of caregivers with literacy problems, and the percentage of positive or concerning screens in one's practice.

and/or Parents' Evaluation of Developmental Status–Developmental Milestones [PEDS:DM], Ages & Stages Questionnaire: Social-Emotional, Pediatric Symptom Checklist) helps practitioners to optimize their early identification rates for children who have developmental-behavioral problems, which leads to more effectively and efficiently enrolling greater numbers in early intervention (EI), early childhood special education (ECSE), and other beneficial community services.
- Nevertheless, to achieve a screening tool's reported reliability and accuracy, it is essential that the tool be administered and interpreted thoughtfully as described in its user's manual or official Web site.
- Careful attention to proper implementation and interpretation also leads to a more collaborative conversation between parents and practitioners.
- When screening results are concerning, proper implementation and same-day interpretation ensure that referrals occur in a 1) safe, 2) equitable, 3) effective, 4) timely, 5) parent- and patient-centered, and 6) efficient manner, fulfilling the six quality aims of the Institute of Medicine.
- If a practice has failed to implement the periodic use of evidence-based screening measures successfully, then the clinicians should strongly consider selecting some broad-band developmental, social-emotional/behavioral, and autism-specific screening tools for the practice.

Summary

- Although development and behavior are more complex than most anthropomorphic functions that are measured in clinical practice, they are quantifiable, even when applied to a busy primary care setting.
- Informal approaches to eliciting concerns or measuring milestones, such as yes/no checklists extrapolated from lengthier measures, surely contribute to low detection rates of developmental-behavioral problems discerned by primary care providers.
- The periodic use of screening tools that better adhere to core psychometric and feasibility standards (eg, Ages & Stages Questionnaire, Third Edition [ASQ-3], Parents' Evaluation of Developmental Status [PEDS]

Note: To view the references for this article and to view larger versions of the figures, visit the October issue at http://pedsinreview.aappublications.org and click on the "Understanding Developmental-Behavioral Screening Measures" article.

PIR Quiz

This quiz is available online at http://www.pedsinreview.aappublications.org. NOTE: Since January 2012, learners can take *Pediatrics in Review* quizzes and claim credit online *only*. No paper answer form will be printed in the journal.

New Minimum Performance Level Requirements

Per the 2010 revision of the American Medical Association (AMA) Physician's Recognition Award (PRA) and credit system, a minimum performance level must be established on enduring material and journal-based CME activities that are certified for *AMA PRA Category 1 Credit*[TM]. In order to successfully complete 2012 *Pediatrics in Review* articles for *AMA PRA Category 1 Credit*[TM], learners must demonstrate a minimum performance level of 60% or higher on this assessment, which measures achievement of the educational purpose and/or objectives of this activity.

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1. A 17-year-old mother has concerns about her 3-year-old boy's repeated temper tantrums and his frequently ignoring her verbal communication. She is feeling increasingly frustrated. As a primary care provider, which of the following is the most appropriate next step?

    A. Administer a narrow-band ADHD screen.
    B. Administer and interpret a general developmental and social-emotional screen.

   C. Refer to a developmental-behavioral specialist.
   D. Refer to a teenage mother self-help group for counseling.
   E. Schedule a follow-up visit in 6 months and evaluate if symptoms persist.

2. A 2-year-old otherwise healthy girl has not yet started to say "mama" and "dada." Her motor development appears normal. Mother states that she does not appear to interact normally with her older siblings. Which of the following statements is the most accurate regarding developmental and social-emotional screening in this situation?

   A. False-positive result will unnecessarily increase parental anxiety.
   B. Normal screening results should reassure the parents that intervention will not be needed.
   C. Periodic screening identifies at-risk children for early intervention, but in this clinical scenario, an automatic referral to an EI agency is justifiable.
   D. Screening is not valid in children age <5 years.
   E. Screening should only be performed by a developmental-behavioral specialist.

3. A mother is concerned about her 9-month-old boy developing autism like her neighbor's child. Which of the following is the most appropriate age to routinely administer an autism-specific screening tool?

   A. 9 months and 15 months.
   B. 18 months and 2 years.
   C. 30 months and 3 years.
   D. 42 months and 4 years.
   E. 54 months and 5 years.

4. Which of the following statements is most correct regarding developmental-behavioral screening measures?

   A. Children who fail screening tests, but subsequently are found not to have a developmental-behavioral problem, later perform as well academically as their peers.
   B. Clinicians' subjective impressions are more accurate in identifying children having developmental-behavioral problem (sensitivity) than excluding those who do not (specificity).
   C. Majority of developmental delays are correctly identified by clinicians on routine examinations during health supervision visits.
   D. Periodic developmental-behavioral screening has been proven to enhance a clinician's ability to detect children who have evolving developmental-behavioral problems.
   E. There is no evidence that early identification and intervention of developmental-behavioral problems before kindergarten entrance improves subsequent academic performance.

5. The mother of a 5-year-old boy replies to your inquiry about developmental or behavioral concerns, "Well, he's a brat sometimes, but I think that's pretty normal for this age." To detect a wide spectrum of developmental-behavioral conditions accurately over time, the American Academy of Pediatrics recommends:

   A. Administering a social-emotional screening instrument only as needed if further history suggests that he is at risk for a previously undetected behavioral disorder.
   B. Automatically referring the child and family to a mental health specialist.
   C. Automatically referring the child to assess eligibility for Early Childhood Special Education (ECSE)/Individual with Disability Education Act (IDEA) services.
   D. Routinely administering a screening test for maternal depression.
   E. Routinely administering a social-emotional screening instrument.

HealthyChildren.org Parent Resources From the AAP

The reader is likely to find material to share with parents that is relevant to this article by visiting these links:
- http://www.healthychildren.org/English/family-life/health-management/pediatric-specialists/Pages/What-is-a-Developmental-Behavioral-Pediatrician.aspx.
- http://www.healthychildren.org/English/ages-stages/toddler/Pages/Assessing-Developmental-Delays.aspx.

Understanding Developmental-Behavioral Screening Measures

Kevin P. Marks and Angela C. LaRosa

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