8. DEVELOPMENTAL SCREENING

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The recommended indicators for developmental screening were derived from (1) textbooks on pediatric medicine (Palmer and Capute, in Oski, 1994) and general pediatrics (Shapiro, in Dershewitz, 1993; Simeonsson and Simeonsson, in Hoekelman, 1992), (2) the American Academy of Pediatrics (AAP) Guidelines for Health Supervision II (American Academy of Pediatrics [AAP], 1988), (3) a policy statement of the AAP's Committee on Children With Disabilities (AAP, 1994), and (4) Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents (Green, 1994). A review article by First and Palfrey (1994) was used as well, as were other articles identified from the above list.

IMPORTANCE

Developmental delay has a 10 percent prevalence rate, but early identification is difficult (First and Palfrey, 1994). Early diagnosis of developmental disabilities is important in order to identify etiologic factors, design treatment programs, and provide a prognosis (Shapiro, in Dershewitz, 1993). Assessment of development should be integrated into the pediatric examination. The physician's role in developmental assessment is particularly critical in the preschool years because growth and development are rapid and qualitative developmental indexes such as language and socialization, serve as markers for school readiness (Simeonsson and Simeonsson, in Hoekelman et al., 1992).

Patterns of development in the earliest years of life are sequential and predictable. Development can be viewed as a series of milestones normally achieved at specific ages or a series of critical tasks to be mastered within certain stages of life. Development needs to be assessed repeatedly over time. Observations and assessments should be made on two or more occasions to determine developmental rate. This is particularly necessary to rule out transient deficits resulting from normal variation or from the influence of illness or fatigue (Simeonsson and Simeonsson, in Hoekelman et al., 1992). Though
screening of asymptomatic populations has been advocated to detect developmental disability as early as possible, it is unclear whether this significantly improves the detection of developmental disabilities. However, it does focus attention on the development of infants and young children, so that children with disabilities may be identified earlier (Shapiro, in Dershewitz, 1993).

Developmental delay, which is the failure to reach developmental milestones at the expected age range for normal children, may result from biologic factors (e.g., a chromosomal disorder) and environmental factors (e.g., maternal depression). Delay is most often considered the result of the interaction of both biologic and environmental factors. For example, an inattentive mother might be unable to nurture a child with intrauterine growth retardation through each developmental stage, whereas a supportive mother can promote the development of a child with cerebral palsy or Down syndrome (First and Palfrey, 1994).

The AAP's Committee on Children With Disabilities recommends early identification of children with developmental disabilities because (a) treatment is available for some conditions, and (b) for conditions that cannot be cured, there is nonetheless the opportunity to improve the child's condition and help the family both develop strategies for coping and obtain the resources for successful family functioning (AAP, 1994).

There are a number of causes of developmental disability, and they can primarily manifest as an isolated motor handicap, a cognitive handicap, or a specific processing deficit despite globally normal cognition. For example, cerebral palsy is the most common movement disorder of childhood. It results from a static lesion to the immature central nervous system. Another example is mental retardation, which is significantly subaverage intellectual functioning associated with deficits in social/adaptive function. Specific deficits in processing provide another example. They can be subdivided into peripheral disorders of processing, such as deafness and blindness, and central processing disorders, which preclude function at a level predicted by IQ alone. These include autism (without mental retardation), preschool communication disorder, developmental dysphasia, and specific learning disabilities. We do not have a good understanding of the specific
neural mechanism of these dysfunctions. Attentional problems, hyperactivity, impulsivity, and emotional lability may be part of abnormal neurologic development and not secondary reactions to disability (Shapiro, in Dershewitz, 1993). The other broad category of developmental disabilities is those attributable to emotional/behavioral disorders that may involve abnormal peer relations and socialization.

**Developmental Streams**

For decades, pediatricians have separated the complex developmental processes into separate developmental streams for easier evaluation and detection of delay and deviancy. Streams refer to a series of milestones for related skills, such as language skills. Various authors use different names for these streams and some divide them in slightly different ways, but the various classification systems generally cover the same skills (Palmer and Capute, in Oski et al., 1994). Palmer and Capute describe the following streams: language, visuomotor, gross and fine motor, social development, and self-help. Shapiro includes four major categories of milestones: gross motor, language, fine motor/problem solving, and personal/social (Shapiro, in Dershewitz, 1993). First and Palfrey (1994) include fine and gross motor, language, cognitive, and psychosocial development.

Generally, speech, social and emotional behavior (such as smiling), and fine motor coordination, particularly in a young child, have greater prognostic significance than gross motor skills and toileting. The times at which speech and language skills develop are typically the most useful clues in the determination of normality (though this is not the case for high-functioning autistic children). Appropriate social behaviors are the next most important. Delayed or atypical communication and socialization behaviors are highly significant in identifying children at risk in terms of development (Simeonsson and Simeonsson, in Hoekelman et al., 1992).

Gross motor milestones cover independent locomotion, and the recognition of gross motor delay often leads to the diagnosis of cerebral palsy (Shapiro, in Dershewitz, 1993). Most infants with
moderate or severe cerebral palsy can be identified in the first 6 to 8 months of life (Palmer and Capute, in Oski et al., 1994).

Language milestones cover the development of symbolic thought. They can be subdivided into expression (that which is said), reception (that which is understood), speech (the manner in which things are said), and visual language (nonverbal communication, e.g., play). Language is the best predictor of cognition (Shapiro, in Dershewitz, 1993). The pediatric assessment of early language relies almost entirely on prelinguistic and linguistic milestones, which are related to later cognitive development. Recognition of early language delay is probably the most sensitive indicator of subsequent mental retardation. Subtle manifestations of language delay or deviancy indicate risk for school-age learning disability and general academic underachievement. Language delay is best identified by determining the child's level of consistent language performance by milestone criteria (Palmer and Capute, in Oski et al., 1994).

Fine motor/visuomotor/problem solving milestones cover visual maturation, hand function, problem solving, and visual motor abilities. They comprise the other major cognitive stream of development, and they form the basis for most of the infant intelligence scales. This area covers visual and fine-motor manipulative tasks. These skills are not easily covered by asking parents (history-taking) about previously attained skills. The clinician usually can only determine a current visuomotor age and development quotient. In global mental retardation, there is broad cognitive delay in language and visuomotor skills. In communication disorders, visuomotor skills tend to be preserved (Palmer and Capute, in Oski et al., 1994; Shapiro, in Dershewitz, 1993).

Personal/social abilities are the end result of multiple streams, including problem solving, motor, and language. They depend on environmental factors but are associated with cognitive thresholds; social dysfunction may be a symptom of neurodevelopmental abnormality as well as environmental problems (Palmer and Capute, in Oski et al., 1994; Shapiro, in Dershewitz, 1993). Shapiro (in Dershewitz, 1993) would include feeding, dressing, and hygiene in this category, though Palmer and Capute (in Oski et al., 1994) separate them out into a self-help
category. The latter is described as providing information on how the child integrates the developmental streams into basic daily functioning. Most activities of daily living require a minimum level of motor, language, problem-solving, and attentional maturity (Palmer and Capute, in Oski et al., 1994).

**Assessment**

Bright Futures (Green, 1994) incorporates developmental assessment and milestone checks throughout the first five years of life. The AAP (1988) covers developmental issues throughout childhood, sometimes referring to them as behavioral assessments.

The clinician should consider the assessment of delay as a matter of ongoing surveillance rather than a screening procedure performed at a particular visit in order to detect more problems (First and Palfrey, 1994).

Assessments can be done by standardized tests or by parental recall of the developmental milestones attained by the child. Formal screening tests are limited by applicability to only certain ages or poor test qualities. Most initial screenings are done by the parents, and can be elicited with a question from the clinician. Clinicians should record milestone attainment data at each well-child examination. Usually four or five questions need to be asked about language, motor, and personal/social development. If concerns arise from the questions, then fine motor/problem solving skills can be elicited. Viewing developmental rates over time allows the detection of degeneration or acceleration (Shapiro, in Dershewitz, 1993).

Though developmental screening tests have been widely used in pediatric practice for years, they are not highly sensitive for developmental abnormalities and they also produce too many false positives. Children with mild disabilities, in particular, tend to be missed. To prevent missing many children, the clinician should take a broader clinical approach to developmental detection rather than solely relying on published screening measures (Palmer and Capute, in Oski et al., 1994).
Several formal screening tests exist for developmental assessment. These are generally too long to conduct on a routine basis for every child at every well child visit, though they are used when there is a concern about possible delay and may be done routinely by some clinicians at particular ages. The Denver Developmental Screening Test (DDST) covers ages 0-6 years and provides an overall assessment of development as well as specific data on personal-social, fine motor, language, and gross motor status. A recently revised version is called DDST II. Revisions include an update in norms, an increase in language items, the addition of speech intelligibility items and a subjective behavior rating scale, the removal or modification of items from the DDST that were difficult to administer or interpret, and a new age scale. The DDST II appears to have a high rate of overall sensitivity, but limited specificity and positive predictive value and thus a high overall referral rate (Dworkin, 1992). Dworkin (1992) points out that the DDST II should not be used in isolation as a basis for referral, diagnosis, or prediction of future functioning. It should not be used as a traditional screening test. Instead, it should help with active developmental surveillance by serving as a developmental chart or inventory. In other words, it should be used in a similar manner to growth charts, which serve to document and compare growth over time (First and Palfrey, 1994).

The Denver Prescreening Developmental Questionnaire (PDQ) and its revised form (R-PDQ) are questionnaires for parents to complete. The R-PDQ includes all the DDST items and uses the same categories, which allows a comparison of a child's achievement with that of the standardization sample. When a clinician uses the PDQ or R-PDQ, verification of the parental report should be obtained by administering the DDST either in full or in part (Simeonsson and Simeonsson, in Hoekelman et al., 1992).

Screening measures with high sensitivity and specificity include: the Minnesota Child Development Inventory (MCDI) (6 months to 6 years), the Early Screening Inventory (ESI) (3 to 6 years), and the Minnesota Preschool Screening Inventory (MPSI) (3.5 to 5.5 years). The Peabody Picture Vocabulary Test (PPVT) (2 years to adult) assesses receptive
language in terms of a mental age and an intelligence quotient (IQ) and correlates well with more general measures of intellectual development. The Goodenough-Harris Drawing Test (3 to 15 years) assesses general development and provides an index of self-awareness and social awareness (Simeonsson and Simeonsson, in Hoekelman et al., 1992).

**Definition of Delay and Deviancy**

Developmental delay is quantified by the developmental quotient (calculated as the developmental age divided by chronologic age, and multiplied by 100). Different streams have different recommended cutoffs for what is considered delay. Recognition of dissociations between rates of development in different streams is essential for the early diagnosis of atypical development within a specific stream (Palmer and Capute, in Oski et al., 1994).

When a child is at least one-third below the expected age level in mental or motor development on the basis of developmental assessment or screening, referral for diagnosis and treatment (to a psychologist, neurologist, or physical therapist, depending on the areas of concern) may be appropriate. The DDST, PPVT, MCDI, MPSI, and ESI may be useful for documenting such delays. The conditions most often associated with such delays are mild to moderate mental retardation and mild forms of cerebral palsy. Some children demonstrate wide gaps in developmental skills. When a discrepancy of one third or more is observed in developmental skills between one area and others, the child should be referred for further assessment and possible intervention by developmental specialists. These discrepancies may signal sensory problems, perceptual or learning disabilities, or minimal brain dysfunction (Simeonsson and Simeonsson, in Hoekelman et al., 1992).

Developmental deviancy is a subtle sign of central nervous system abnormality. It refers to atypical development within a single stream, such as developmental milestones occurring out of normal sequence (Palmer and Capute, in Oski et al., 1994).
Treatment

There is no cure for developmental disorders, so treatment should be viewed as palliative. The broad goals of treatment are to allow the child to function at the maximum level permitted by his/her impairment and to prevent secondary social or biologic dysfunctions (Shapiro, in Dershewitz, 1993).

Early intervention is predicated on three assumptions: the condition can be modified by the intervention; earlier intervention is more effective than later intervention for the primary disorder; and secondary problems may be avoided. Early intervention can be categorized as an intervention designed to offset social disadvantage, biological risk, or developmental disability. The assumptions about early intervention are the least well-proven for developmental disability. While the goal of achieving normal function is unlikely in children with developmental disability, early intervention seeks to assist parental acceptance of the child and to prevent secondary disorders. Also, the Education of the Handicapped Act Amendments of 1986, Public Law 99-457, mandates service to children 3 to 5 years of age who demonstrate developmental delays or who are at risk for such delays (in cognitive, speech/language, motor, self-help, or psychological development). The provision of early intervention services under this law must include a multidisciplinary assessment and a written Individualized Family Service Plan (IFSP). It is anticipated that 5 to 10 percent of children will be eligible for early intervention services under this legislation (Shapiro, in Dershewitz, 1993).

There is evidence that even in the absence of an etiologic explanation, early identification helps both children and their parents (First and Palfrey, 1994). The best chance for effecting developmental change is while the nervous system of the young child is still malleable and responsive. Once one has identified problems, it is important to help parents adjust expectations to the child's developmental stage and provide developmentally appropriate equipment, stimulation, and toys. Early identification allows the family members to feel that they are doing all they can to assist the child and to bolster the child’s sense of being appreciated for who he or she is, which helps prevent secondary
emotional disability. When there is a diagnosis of a genetic, metabolic, or infectious disease, early identification can prevent further disability. It can also provide the parents information relevant to future pregnancies (First and Palfrey, 1994).

**RECOMMENDED QUALITY INDICATORS FOR DEVELOPMENTAL SCREENING FOR CHILDREN**

Because of the large number of screening tools and various specific milestones that different clinicians might choose to track, indicators will require documentation that assessment has taken place, but will not require use of any particular tool. It will be sufficient to note that a specific screening tool was used (along with the results) or that specific milestones have or have not been achieved. Furthermore, this review covers routine assessment. It does not cover the specific response to delays that are identified by such assessments. It would be difficult to write indicators that specified at what point referrals or interventions should be made, since developmental assessment frequently requires assessments at multiple time points. Because of the variation in reasonable responses to delay and the dependence of the response on trends, other health conditions, and environmental factors, it would be difficult to develop indicators to evaluate the proper response to developmental delay in the initial phase of this study. Documentation is important both because the same provider may not conduct each assessment and because trends must be examined. It would be unwise to merely document abnormal findings and delay because there is enough variation in what is normal that if one found a delay, one might not be able to determine what milestones had been previously achieved.
## RECOMMENDED QUALITY INDICATORS FOR DEVELOPMENTAL SCREENING FOR CHILDREN

The following criteria apply to developmental evaluation for children.

<table>
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<th>Indicator</th>
<th>Quality of evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
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</thead>
</table>
| 1. Social/personal development should be documented:  
   a. three times during the first year of life;  
   b. two times during the second year of life;  
   c. one time during the third year of life;  
   d. one time during the fourth year of life; and  
   e. one time during the fifth year of life. | III | AAP, 1988; Green, 1994 | Improve social functioning. Improve ability to function with disability. Improve family interactions and coping skills. Improve functioning of autistic children. | Since most physicians would believe that children should be evaluated developmentally at most or all well child visits, these indicators are fairly loose in the number of times per year documentation of developmental assessment is required. Children with severe neurologic devastation who are not expected to improve with age may not have such documentation. However, there should be too few such children to affect the overall quality score for an individual managed care facility. Delay can be due to neurodevelopmental abnormalities or environmental problems. |
| 2. Fine motor/visuomotor/problem solving development should be documented at least:  
   a. three times during the first year of life;  
   b. two times during the second year of life;  
   c. one time during the third year of life;  
   d. one time during the fourth year of life; and  
   e. one time during the fifth year of life. | III | AAP, 1988; Green, 1994 | Improve fine motor and visual functioning. Improve ability to function with disabilities. Improve family interactions and coping skills. | Delay can help in the diagnosis of global mental retardation and visual deficits. Appropriate milestones will be assessed based on age. Documentation of “no deficit” is also adequate to meet this indicator. |
| 3. Language development should be documented at least:  
   a. three times during the first year of life;  
   b. two times during the second year of life;  
   c. one time during the third year of life;  
   d. one time during the fourth year of life; and  
   e. one time during the fifth year of life. | III | AAP, 1988; Green, 1994 | Improve language abilities. Reduce hearing impairment. Improve ability to function with disabilities. Improve family interactions and coping skills. | Language is the best predictor of cognition. Recognition of early language delay is the most sensitive indicator of subsequent mental retardation. Language delay or deviancy can indicate risk of school-age learning disability and academic underachievement. Appropriate milestones will be assessed based on age. Documentation of “no deficit” is also adequate to meet this indicator. |
| 4. Gross motor development should be documented at least:  
   a. three times during the first year of life;  
   b. two times during the second year of life;  
   c. one time during the third year of life;  
   d. one time during the fourth year of life; and  
   e. one time during the fifth year of life. | III | AAP, 1988; Green, 1994 | Improve gross motor functioning. Improve ability to function with disabilities. Improve family interactions and coping skills. | Gross motor delay can be due to cerebral palsy. Appropriate milestones will be assessed based on age. Documentation of “no deficit” is also adequate to meet this indicator. |
<table>
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<tr>
<th>Step</th>
<th>Description</th>
<th>Evidence Level</th>
<th>Summary</th>
<th>Reason</th>
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<td>5</td>
<td>In children with known developmental delay, referral to a specialist for early intervention should be documented.</td>
<td>III Simeonsson &amp; Simeonsson, in Hoekelman, 1992</td>
<td>Improve functioning in area of developmental delay. Improve family interactions and coping skills.</td>
<td>Because of the complex needs of children with developmental problems, it is desirable that assessment and management of the developmental problem be integrated into an overall plan for the child's care.</td>
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<tr>
<td>6</td>
<td>In children with diagnosed language delay, referral to a specialist for speech therapy should be documented.</td>
<td>III Simeonsson &amp; Simeonsson, in Hoekelman, 1992</td>
<td>Improve language abilities. Improve ability to function with disabilities. Improve family interactions and coping skills.</td>
<td>Because of the complex needs of children with developmental problems, it is desirable that assessment and management of the developmental problem be integrated into an overall plan for the child's care.</td>
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<tr>
<td>7</td>
<td>In children with gross or fine motor development delay, referral to a specialist for physical therapy should be documented.</td>
<td>III Simeonsson &amp; Simeonsson, in Hoekelman, 1992</td>
<td>Improve ability to function with disabilities. Improve family interactions and coping skills. Improve gross or fine motor functioning.</td>
<td>Because of the complex needs of children with developmental problems, it is desirable that assessment and management of the developmental problem be integrated into an overall plan for the child's care.</td>
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**Quality of Evidence Codes:**

I: RCT  
II-1: Nonrandomized controlled trials  
II-2: Cohort or case analysis  
II-3: Multiple time series  
III: Opinions or descriptive studies
REFERENCES - DEVELOPMENTAL SCREENING


