REVIEW ARTICLE

Screening for Speech and Language Delay in Preschool Children: Systematic Evidence Review for the US Preventive Services Task Force

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Financial Disclosure: Dr Panoscha has no direct personal financial benefit or conflict of interest involving this research, but there may be a perceived conflict. She is an officer of the Kennedy Fellows Association, which had sold and promoted the Clinical Adaptive Test/Clinical Linguistic Auditory Milestone Scale (CAT/CLAMS) test kit in the past. This test instrument is now published, produced, and sold by a private publishing company (Paul H. Brooks Publishing Co). Dr Panoscha excused herself for the portion of this evidence review that reviewed the abstracts and articles on the screening instruments.

ABSTRACT

BACKGROUND. Speech and language development is a useful indicator of a child’s overall development and cognitive ability and is related to school success. Identification of children at risk for developmental delay or related problems may lead to intervention services and family assistance at a young age, when the chances for improvement are best. However, optimal methods for screening for speech and language delay have not been identified, and screening is practiced inconsistently in primary care.

PURPOSE. We sought to evaluate the strengths and limits of evidence about the effectiveness of screening and interventions for speech and language delay in preschool-aged children to determine the balance of benefits and adverse effects of routine screening in primary care for the development of guidelines by the US Preventive Services Task Force. The target population includes all children up to 5 years old without previously known conditions associated with speech and language delay, such as hearing and neurologic impairments.

METHODS. Studies were identified from Medline, PsycINFO, and CINAHL databases (1966 to November 19, 2004), systematic reviews, reference lists, and experts. The evidence review included only English-language, published articles that are available through libraries. Only randomized, controlled trials were considered for examining the effectiveness of interventions. Outcome measures were considered if they were obtained at any time or age after screening and/or intervention as long as the initial assessment occurred while the child was ≤5 years old. Outcomes included speech and language measures and other functional and health outcomes such as social behavior. A total of 745 full-text articles met our eligibility criteria and were reviewed. Data were extracted from each included study, summarized descriptively, and rated for quality by using criteria specific to different study designs developed by the US Preventive Services Task Force.

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Key Words
speech and language delay and disorders, preschool children, screening, interventions
Abbreviations
USPSTF—US Preventive Services Task Force
RCT—randomized controlled trial
SES—socioeconomic status
SMD—standard mean difference
CI—confidence interval
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RESULTS. The use of risk factors for selective screening has not been evaluated, and a list of specific risk factors to guide primary care physicians has not been developed or tested. Sixteen studies about potential risk factors for speech and language delay in children enrolled heterogeneous populations, had dissimilar inclusion and exclusion criteria, and measured different risk factors and outcomes. The most consistently reported risk factors included a family history of speech and language delay, male gender, and perinatal factors. Other risk factors reported less consistently included educational levels of the mother and father, childhood illnesses, birth order, and family size.

The performance characteristics of evaluation techniques that take ≤10 minutes to administer were described in 24 studies relevant to screening. Studies that were rated good to fair quality reported wide ranges of sensitivity and specificity when compared with reference standards (sensitivity: 17–100%; specificity: 45–100%). Most of the evaluations, however, were not designed for screening purposes, the instruments measured different domains, and the study populations and settings were often outside of primary care. No “gold standard” has been developed and tested for screening, reference standards varied across studies, few studies compared the performance of ≥2 screening techniques in 1 population, and comparisons of a single screening technique across different populations are lacking.

Fourteen good- and fair-quality randomized, controlled trials of interventions reported significantly improved speech and language outcomes compared with control groups. Improvement was demonstrated in several domains including articulation, phonology, expressive language, receptive language, lexical acquisition, and syntax among children in all age groups studied and across multiple therapeutic settings. Improvement in other functional outcomes such as socialization skills, self-esteem, and improved play themes were demonstrated in some, but not all, of the 4 studies that measured them. In general, studies of interventions were small and heterogeneous, may be subject to plateau effects, and reported short-term outcomes based on various instruments and measures. As a result, long-term outcomes are not known, interventions could not be compared directly, and generalizability is questionable.

CONCLUSIONS. Use of risk factors to guide selective screening is not supported by studies. Several aspects of screening have been inadequately studied to determine optimal methods, including which instrument to use, the age at which to screen, and which interval is most useful. Trials of interventions demonstrate improvement in some outcome measures, but conclusions and generalizability are limited. Data are not available addressing other key issues including the effectiveness of screening in primary care settings, role of enhanced surveillance by primary care physicians before referral for diagnostic evaluation, non–speech and language and long-term benefits of interventions, and adverse effects of screening and interventions.

SPEECH AND LANGUAGE development is considered by experts to be a useful indicator of a child’s overall development and cognitive ability and is related to school success. Identification of children at risk for developmental delay or related problems may lead to intervention services and family assistance at a young age when chances for improvement are best. This rationale supports preschool screening for speech and language delay, or primary language impairment/disorder, as a part of routine well-child care.

Several types of speech and language delay and disorders have been described, although terminology varies (Table 1). Expressive language delay may exist without receptive language delay, but often they occur together in children as a mixed expressive/receptive language delay. Some children also have disordered language. Language problems can involve difficulty with grammar (syntax), words or vocabulary (semantics), the rules and system for speech sound production (phonology), units of word meaning (morphology), and the use of language particularly in social contexts (pragmatics). Speech problems may include stuttering or dysfluency, articulation disorders, or unusual voice quality. Language and speech problems can exist together or by themselves.

Prevalence rates for speech and language delay have been reported across wide ranges. A recent Cochrane

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Articulation</td>
<td>The production of speech sounds</td>
</tr>
<tr>
<td>Dysfluency</td>
<td>Interrupted flow of speech sounds, such as stuttering</td>
</tr>
<tr>
<td>Expressive language</td>
<td>The use of language to share thoughts, protest, or comment</td>
</tr>
<tr>
<td>Language</td>
<td>The conceptual processing of communication which may be receptive and expressive</td>
</tr>
<tr>
<td>Morphology</td>
<td>The rules governing meanings of word units</td>
</tr>
<tr>
<td>Phonology</td>
<td>The set of rules for sound production</td>
</tr>
<tr>
<td>Pragmatics</td>
<td>Adaptation of language to the social context</td>
</tr>
<tr>
<td>Prosody</td>
<td>Appropriate intonation, rate, rhythm, and loudness of speech utterances</td>
</tr>
<tr>
<td>Receptive language</td>
<td>Understanding of language</td>
</tr>
<tr>
<td>Semantics</td>
<td>A set of words known to a person that are a part of a specific language (vocabulary)</td>
</tr>
<tr>
<td>Speech</td>
<td>Verbal production of language</td>
</tr>
<tr>
<td>Syntax</td>
<td>The way linguistic elements are put together to form phrases or clauses (grammar)</td>
</tr>
<tr>
<td>Voice disorders</td>
<td>Difficulty with speech sound production, at the level of the larynx may be related to motor or anatomical issues (e.g., hypernasal or hoarse speech)</td>
</tr>
</tbody>
</table>
review summarized prevalence data on speech delay, language delay, and combined delay in preschool- and school-aged children. For preschool-aged children, 2 to 4.5 years old, studies that evaluated combined speech and language delay have reported prevalence rates ranging from 5% to 8%, and studies of language delay have reported prevalence rates ranging from 2.3% to 19%. Untreated speech and language delay in preschool children has shown variable persistence rates (from 0% to 100%), with most studies reporting 40% to 60%. In 1 study, two thirds of preschool-aged children who were referred for speech and language therapy and given no direct intervention proved eligible for therapy 12 months later.

Preschool-aged children with speech and language delay may be at increased risk for learning disabilities once they reach school age. They may have difficulty reading in grade school, exhibit poor reading skills at age 7 or 8, and have difficulty with written language, in particular. This may lead to overall academic underachievement and, in some cases, lower IQ scores that may persist into young adulthood. As adults, children with phonological difficulties may hold lower-skilled jobs than their non–language-impaired siblings. In addition to persistent speech- and language-related underachievement (verbal, reading, spelling), language-delayed children have also shown more behavior problems and impaired psychosocial adjustment.

Assessing children for speech and language delay and disorders can involve a number of approaches, although there is no uniformly accepted screening technique for use in the primary care setting. Milestones for speech and language development in young children are generally acknowledged. Concerns for delay arise if there are no verbalizations by the age of 1, if speech is not clear, or if speech or language is different from that of other children of the same age. Parent questionnaires and parent concern are often used to detect delay. Most formal instruments were designed for diagnostic purposes and have not been widely evaluated for screening. Instruments constructed to assess multiple developmental components, such as the Ages and Stages Questionnaire, Clinical Adaptive Test/Clinical Linguistic and Auditory Milestone Scale, and Denver Developmental Screening Test, include speech and language components. Instruments designed specific for communication domains include the McArthur Communicative Development Inventory, Ward Infant Language Screening Test, Assessment, Acceleration, and Remediation (WILSTAAAR), Fluhrty Preschool Speech and Language Screening Test, Early Language Milestone Scale, and several others.

A specific diagnosis is made most often by a speech and language specialist using a battery of instruments. Once a child has been diagnosed with a speech and/or language delay, interventions may be prescribed. Therapy takes place in various settings including speech and language specialty clinics, home, and schools or classrooms. Direct therapy or group therapy provided by a clinician, caretaker, or teacher can be child-centered and/or include peer and family components. The duration of the intervention varies. Intervention strategies focus on ≥1 domains depending on individual needs, such as expressive language, receptive language, phonology, syntax, and lexical acquisition. Therapies can include naming objects, modeling and prompting, individual or group play, discrimination tasks, reading, and conversation.

It is not clear how consistently clinicians screen for speech and language delay in primary care practice. In 1 study, 43% of parents reported that their young child (aged 10–35 months) did not receive any type of developmental assessment at their well-child visit, and 30% of parents reported that their child’s physician had not discussed how the child communicates. Potential barriers to screening include lack of time, no clear protocols, and the competing demands of the primary care visit.

This evidence review focuses on the strengths and limits of evidence about the effectiveness of screening and interventions for speech and language delay in preschool-aged children. Its objective is to determine the balance of benefits and adverse effects of routine screening in primary care for the development of guidelines by the US Preventive Services Task Force (USPSTF). The target population includes all children up to 5 years old without previously known conditions associated with speech and language delay, such as hearing and neurologic impairments. The evidence synthesis emphasizes the patient’s perspective in the choice of tests, interventions, outcome measures, and potential adverse effects and focuses on those that are available and easily interpreted in the context of primary care. It also considers the generalizability of efficacy studies performed in controlled or academic settings and interprets the use of the tests and interventions in community-based populations seeking primary health care.

METHODS

Analytic Framework and Key Questions

Evidence reviews for the USPSTF follow a specific methodology, beginning with the development of an analytic framework and key questions in collaboration with members of the USPSTF. The analytic framework represents an outline of the evidence review and includes the patient population, interventions, outcomes, and adverse effects of the screening process (Fig 1). Corresponding key questions examine a chain of evidence about the effectiveness, accuracy, and feasibility of screening children aged 5 years and younger for speech and language delay in primary care settings (key questions 1 and 2), adverse effects of screening (key question 3), the role of enhanced surveillance in primary care.
(key question 4), effectiveness of interventions for children identified with delay (key questions 5, 6, and 7), and adverse effects of interventions (key question 8).

Studies addressing key question 1, corresponding to the overarching arrow in Fig 1, would include all components in the continuum of the screening process, including the screening evaluation, diagnostic evaluation for children identified with delay by the screening evaluation, interventions for children diagnosed with delay, and outcome measures allowing determination of the effectiveness of the overall screening process. Enhanced surveillance in primary care relates to the practice of closely observing children who may have clinical concern for delay but not of the degree warranting a referral (“watchful waiting”). Outcome measures in this review include speech- and language-specific outcomes as well as non–speech and language health and functional outcomes such as social behavior, self-esteem, family function, peer interaction, and school performance. Key question 5 examines whether speech and language interventions lead to improved speech and language outcomes. Key question 6 examines whether speech and language interventions lead to improved non–speech and language outcomes. Key question 7 evaluates the subsequent effects of improved speech and language, such as improved school performance at a later age.

Literature Search and Selection
Relevant studies were identified from multiple searches of Medline, PsycINFO, and CINAHL databases (1966 to November 19, 2004). Search terms were determined by the investigators and a research librarian and are described elsewhere. Articles were also obtained from recent systematic reviews, reference lists of pertinent studies, reviews, editorials, and Web sites and by consulting experts. In addition, the investigators attempted to collect instruments and accompanying manuals; however, these materials are not generally available and must be purchased, which limited the evidence review to published articles.
The investigators reviewed all abstracts that were identified by the searches and determined eligibility of full-text articles based on several criteria. Eligible articles had English-language abstracts, were applicable to US clinical practice, and provided primary data relevant to key questions. Studies of children with previously diagnosed conditions known to cause speech and language delay (eg, autism, mental retardation, fragile X syndrome, hearing loss, degenerative and other neurologic disorders) were not included because the scope of this review is screening children without known diagnoses.

Studies of risk factors were included if they focused on children aged 5 years or younger, reported associations between predictor variables and speech and language outcomes, and were relevant to selecting candidates for screening. Otitis media as a risk factor for speech and language delay is a complex and controversial area and was not included in this review.

Studies of techniques to assess speech and language were included if they focused on children aged 5 years and younger, could be applied to a primary care setting, used clearly defined measures, compared the screening technique to an acceptable reference standard, and reported data that allowed calculation of sensitivity and specificity. Techniques that take ≤10 minutes to complete and could be administered in a primary care setting by nonspecialists are most relevant to screening and are described in this report. Instruments that take >10 minutes and up to 30 minutes or for which administration time was not reported are described elsewhere. In general, if the instrument was administered by primary care physicians, nurses, research associates, or other nonspecialists for the study, it was assumed that it could be administered by nonspecialists in a clinic. For questionable cases, experts in the field were consulted to help determine appropriateness for primary care. Studies of broader developmental screening instruments such as the Ages and Stages Questionnaire and Denver Developmental Screening Test were included if they provided outcomes related to speech and language delay specifically.

Only randomized, controlled trials (RCTs) were considered for examining the effectiveness of interventions. Outcome measures were considered if they were obtained at any time or age after screening and/or intervention as long as the initial assessment occurred while the child was ≤5 years old. Outcomes included speech and language measures as well as other functional and health outcomes as described previously.

Data Extraction and Synthesis
Investigators reviewed 5377 abstracts that were identified by the searches. A total of 690 full-text articles from searches and an additional 55 nonduplicate articles from reference lists and experts met eligibility criteria and were reviewed. Data were extracted from each study, entered into evidence tables, and summarized by descriptive methods. For some studies of screening instruments, sensitivity and specificity were calculated by the investigators if adequate data were presented in the article. No statistical analyses were performed because of the heterogeneity of studies. The investigators independently rated the quality of studies by using criteria specific to different study designs developed by the USPSTF (Appendix).32 The quality of the study does not necessarily indicate the quality of an instrument or intervention but may influence interpretation of the results of the study.

RESULTS

Key Question 1: Does Screening for Speech and Language Delay Result in Improved Speech and Language as well as Improved Other Non–Speech and Language Outcomes?
No studies directly addressed this question.

Key Question 2: Do Screening Evaluations in the Primary Care Setting Accurately Identify Children for Diagnostic Evaluation and Interventions?

Key Question 2a: Does Identification of Risk Factors Improve Screening?
Nine studies conducted in English-speaking populations36–44 and 7 studies from non–English-speaking populations45–51 met inclusion criteria (Table 2). The most consistently reported risk factors include a family history of speech and language delay, male gender, and perinatal risk factors; however, their role in screening is unclear. A list of specific risk factors to guide primary care physicians in selective screening has not been developed or tested.

English-language studies include case-control,37,39–41,43 cross-sectional,36,38,42 and prospective-cohort designs. Most studies evaluated risk for language delay with or without speech delay, and 1 restricted the evaluation to expressive language only.44 Family history was the most consistent significantly associated risk factor in 5 of 7 studies that examined it.37,39,41,43 Family history was defined as family members who were late to talk or had language disorders, speech problems, or learning problems. Male gender was a significant factor in all 3 of the studies that examined it.37,39,42 Three37,41,43 of 5 studies reported an association between lower maternal education level and language delay, and 3 studies41–43 of 4 that evaluated paternal education level reported a similar relationship. Other associated risk factors that were reported less consistently included childhood illnesses,36,40 born late in the family birth order,42 family size,39 older parents39 or younger mother at birth, and low socioeconomic status (SES) or minority race.40 One study that evaluated history of asthma found no association with speech and language delay.39

The 7 studies that assessed risk in non–English-speak-
<table>
<thead>
<tr>
<th>Authors (yr)</th>
<th>Population</th>
<th>Age, mo</th>
<th>Speech and Language Domains</th>
<th>Male Gender</th>
<th>SES</th>
<th>Birth Order</th>
<th>Perinatal Factors</th>
<th>Parental Education</th>
<th>Medical Conditions</th>
<th>Other Associations</th>
</tr>
</thead>
<tbody>
<tr>
<td>English-language studies</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Brookhouser et al (1979)</td>
<td>24 referred from Boys Town Institute</td>
<td>26–62</td>
<td>Language</td>
<td>b</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Campbell et al (2003)</td>
<td>39 cases and 241 controls from a large, prospective study in Pittsburgh, PA</td>
<td>36</td>
<td>Speech</td>
<td>a</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Cantwell and Baker (1985)</td>
<td>600 children referred from a speech and hearing clinic in Los Angeles, CA</td>
<td>20–191</td>
<td>Multiple types</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Psychiatric, behavioral, or developmental disorder</td>
</tr>
<tr>
<td>Oudejans and Benasich (2003)</td>
<td>42 cases with positive family histories and 94 controls from the New York City, NY, area</td>
<td>36</td>
<td>Language</td>
<td>a</td>
<td>a</td>
<td>b</td>
<td>NR</td>
<td>NR</td>
<td>Mothera, Fatherb</td>
<td>Asthma</td>
</tr>
<tr>
<td>Choudhury and Benasich (2003)</td>
<td>42 cases with positive family histories and 94 controls from the New York City, NY, area</td>
<td>36</td>
<td>Language</td>
<td>a</td>
<td>b</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Motherb, Fathera</td>
<td>Asthma</td>
</tr>
<tr>
<td>Singer et al (2001)</td>
<td>98 cases (VLBW/BPD), 70 VLBW/non-BPD controls, and 95 term controls from Cleveland, OH, region hospitals</td>
<td>36</td>
<td>Language</td>
<td>NR</td>
<td>a</td>
<td>NR</td>
<td>b</td>
<td>NR</td>
<td>NR</td>
<td>BPD, PDA, Neurologic risk, minority race</td>
</tr>
<tr>
<td>Tallal et al (1989)</td>
<td>76 cases and 54 controls from the San Diego, CA, Longitudinal Study</td>
<td>48–59</td>
<td>Language</td>
<td>a</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Mothera, Fatherb</td>
</tr>
<tr>
<td>Tomblin et al (1991)</td>
<td>66 cases from a longitudinal cohort of Iowa or Illinois</td>
<td>30–60</td>
<td>Speech and language</td>
<td>a</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Younger mother, less breastfeeding</td>
</tr>
<tr>
<td>Kloth et al (1995)</td>
<td>93 referred because 1 or both parents were stutterers or had a history of stuttering</td>
<td>23–58</td>
<td>Stuttering</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Lyytinen et al (2001)</td>
<td>107 with familial risk of dyslexia and 93 without</td>
<td>0–54</td>
<td>Speech and language</td>
<td>a</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Peters et al (1997)</td>
<td>946 from a Dutch birth cohort in Nijmegen</td>
<td>84–96</td>
<td>Language and educational attainment</td>
<td>NR</td>
<td>b</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Preterm, low birth weight</td>
<td></td>
</tr>
<tr>
<td>Weindrich et al (2000)</td>
<td>42 recruited at birth at a German hospital</td>
<td>Tested at 54 and 96 mo</td>
<td>Receptive and expressive language and articulation (54 mo); reading and spelling (96 mo)</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Preterm, low birth weight</td>
<td></td>
</tr>
<tr>
<td>Yliherva et al (2001)</td>
<td>107 with familial risk of dyslexia and 93 without</td>
<td>96</td>
<td>Speech, language, learning, motor abilities</td>
<td>NR</td>
<td>a</td>
<td>NR</td>
<td>NR</td>
<td>Preterm, low birth weight</td>
<td>Motherb</td>
<td>Impaired hearing</td>
</tr>
</tbody>
</table>

NR indicates not reported; VLBW, very low birth weight; BPD, bronchopulmonary dysplasia; PDA, patent ductus arteriosus.

a Statistically significant association.

b Variable was examined and not associated with delay.
<table>
<thead>
<tr>
<th>Instrument</th>
<th>Abbreviation</th>
<th>Components</th>
<th>Authors (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayley Infant Neurodevelopmental Screener</td>
<td>BINS</td>
<td>Assesses 4 areas: (1) neurological function/intactness; (2) receptive function; (3) expressive function; and (4) cognitive processes</td>
<td>Macias et al² (1998)</td>
</tr>
<tr>
<td>Clinical Adaptive Test/Clinical Linguistic</td>
<td>CAT/CLAMS</td>
<td>Includes psychometrics and speech and language milestones; CAT: 19 age sets with 12 instruments and 57 items for visual motor skills; CLAMS: 19 age sets with 3 instruments up to 24 mo and 4 instruments after 24 mo; includes 43 items for language skills</td>
<td>Clark et al⁸ (1995)</td>
</tr>
<tr>
<td>Denver Developmental Screening Test-II</td>
<td>DDST II</td>
<td>Domains include (1) language; (2) fine motor-adaptive; (3) personal-social; and (4) gross motor</td>
<td>Glascoe and Byrne⁵² (1993)</td>
</tr>
<tr>
<td>Developmental Profile-II</td>
<td>DP-II</td>
<td>5 subsets: (1) physical; (2) self-help; (3) social; (4) academic; and (5) communication</td>
<td>Glascoe and Byrne⁵² (1993)</td>
</tr>
<tr>
<td>Early Language Milestone Scale</td>
<td></td>
<td>41 items covering 4 areas: (1) auditory expressive; (2) auditory receptive; (3) visual expressive; and (4) visual receptive</td>
<td>Coplan et al⁶² (1982); Black et al⁶⁵ (1988); Walker et al⁶⁵ (1989)</td>
</tr>
<tr>
<td>Fluharty Preschool Speech and Language</td>
<td></td>
<td>35 items separated into 3 sections (A–C) including identification of 15 common objects (phoneme), nonverbal responses to 10 sentences (syntax), and imitation of 10 1-sentence picture descriptions; assess identification, articulation, comprehension, and repetition</td>
<td>Blaxley et al⁶² (1983); Sturmer et al⁶² (1993); Allen and Bliss⁶² (1987)</td>
</tr>
<tr>
<td>Hackney Early Language Screening Test</td>
<td></td>
<td>20-item test in 7 sections: (1) comprehension: following instructions to manipulate toys; (2) expression: tester manipulates toys and asks child questions about this; (3) comprehension: following instructions for placing toys; (4) comprehension: child chooses picture from 3 options; (5) expression: child answers question about pictures; (6) expression: child names objects; and (7) comprehension: child chooses picture from 4 options</td>
<td>Dixon et al⁶² (1988); Law⁶² (1994)</td>
</tr>
<tr>
<td>Language Development Survey</td>
<td>LDS</td>
<td>310 words arranged in 14 semantic categories; parents indicate which words their child has spoken and describe word combinations of ≥2 words that their child has used</td>
<td>Klee et al⁶² (1998); Klee et al⁶² (2000); Rescorla and Alley⁶² (2001)</td>
</tr>
<tr>
<td>Levett-Muir Language Screening Test</td>
<td></td>
<td>Test is divided into 6 sections: (1) comprehension: child is asked to pick toys from group; (2) vocabulary: child’s ability to name the toys; (3) comprehension: using pictures, child is required to respond to questions; (4) vocabulary: child’s ability to name what’s in the pictures; (5) comprehension and representation: child’s ability to answer “what” and “who” questions; and (6) overall: child is asked to explain the detailed composite picture</td>
<td>Levett and Muir⁶⁴ (1983)</td>
</tr>
<tr>
<td>Parent Evaluation of Developmental Status</td>
<td>PEDS</td>
<td>2 questions for parents to elicit concerns in general and specific areas; other items determine reasons for parents’ concerns</td>
<td>Glascoe⁶⁴ (1991)</td>
</tr>
<tr>
<td>Parent Language Checklist</td>
<td>PLC</td>
<td>12 questions for parents about their child’s receptive and expressive language including 1 question for assessing hearing problems</td>
<td>Burden et al¹¹ (1996)</td>
</tr>
<tr>
<td>Pediatric Language Acquisition Screening Tool</td>
<td>PLASTER</td>
<td>Communication development milestones by age with 7 individual areas; each area contains 10 questions (5 relate to receptive language and 5 to expressive language)</td>
<td>Sherman et al¹² (1996)</td>
</tr>
<tr>
<td>Screening Kit of Language Development</td>
<td>SKOLD</td>
<td>Vocabulary comprehension, story completion, sentence completion, paired-sentence repetition with pictures, individual sentence repetition with pictures, individual sentence repetition without pictures, and auditory comprehension of commands</td>
<td>Bliss and Allen⁶⁴ (1984)</td>
</tr>
<tr>
<td>Sentence Repetition Screening Test</td>
<td>SRST</td>
<td>15 sentences repeated 1 at a time by the child after demonstration by the tester</td>
<td>Sturner et al⁶¹ (1996)</td>
</tr>
<tr>
<td>Structured Screening Test</td>
<td></td>
<td>20 questions covering both expressive and receptive language skills</td>
<td>Laing et al⁶³ (2002)</td>
</tr>
<tr>
<td>Test for Examining Expressive Morphology</td>
<td>TEEM</td>
<td>54 items targeting a variety of morphosyntactic structures using a sentence-completion task</td>
<td>Merrell and Plante⁶⁵ (1997)</td>
</tr>
</tbody>
</table>

* Speech and language are part of a broader screening instrument.
ing populations included case-control,\textsuperscript{47} cross-sectional,\textsuperscript{45} prospective-cohort,\textsuperscript{48–51} and concurrent-comparison\textsuperscript{46} designs. Studies evaluated several types of delay including vocabulary,\textsuperscript{46} speech,\textsuperscript{45} stuttering,\textsuperscript{47} language,\textsuperscript{48–51} and learning.\textsuperscript{49–51} Significant associations were reported in the 2 studies that evaluated family history\textsuperscript{45,48} and 1 of 2 studies that evaluated male gender.\textsuperscript{51} Three of 4 non–English-language studies, including a cohort of >8000 children in Finland,\textsuperscript{51} reported significant associations with perinatal risk factors such as prematurity,\textsuperscript{50,51} birth difficulties,\textsuperscript{45} low birth weight,\textsuperscript{50,51} and sucking habits.\textsuperscript{45} An association with perinatal risk factors was not found in the 1 English-language study that examined low birth weight.\textsuperscript{43} Other associated risk factors that were reported less consistently include parental education level\textsuperscript{49,50} and family factors such as size and over-

### Table 4: Studies of Screening Instruments for Children Up to 2 Years Old

<table>
<thead>
<tr>
<th>Authors (y)</th>
<th>N</th>
<th>Instrument</th>
<th>Reference Standard</th>
<th>Speech and Language Domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 5 min to administer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glascoe\textsuperscript{46} (1991)</td>
<td>157</td>
<td>Parent Evaluation of Developmental Status</td>
<td>Clinical assessment</td>
<td>Expressive language, articulation</td>
</tr>
<tr>
<td>Coplan et al\textsuperscript{46} (1982)</td>
<td>191</td>
<td>Early Language Milestone Scale</td>
<td>Clinical assessment</td>
<td>Expressive and receptive language</td>
</tr>
<tr>
<td>Black et al\textsuperscript{46} (1988)</td>
<td>48</td>
<td>Early Language Milestone Scale</td>
<td>Receptive-Expressive Emergent Language Scale, Bayley Scales of Infant Development</td>
<td>Expressive and receptive language</td>
</tr>
<tr>
<td>S–10 min to administer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glascoe and Byrne\textsuperscript{47} (1993) Study 1</td>
<td>89</td>
<td>Developmental Profile II</td>
<td>Battery of measures</td>
<td>Fine motor adaptive, personal social, gross motor, and language</td>
</tr>
<tr>
<td>Sherman et al\textsuperscript{47} (1996)</td>
<td>173</td>
<td>Pediatric Language Acquisition Screening Tool for Early Referral</td>
<td>Early Language Milestone Scale</td>
<td>Expressive and receptive language</td>
</tr>
<tr>
<td>10 min to administer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macias et al\textsuperscript{42} (1998)</td>
<td>78</td>
<td>Bayley Infant Neurodevelopmental Screener</td>
<td>Bayley Scales of Infant Development II</td>
<td>Expressive and receptive language</td>
</tr>
<tr>
<td>Klee et al\textsuperscript{41} (1998)</td>
<td>306</td>
<td>Language Development Survey</td>
<td>Infant Mullen Scales of Early Learning</td>
<td>Expressive vocabulary</td>
</tr>
<tr>
<td>Klee et al\textsuperscript{41} (2000)</td>
<td>64</td>
<td>Language Development Survey</td>
<td>Infant Mullen Scales of Early Learning</td>
<td>Expressive vocabulary</td>
</tr>
<tr>
<td>Rescorla and Alley\textsuperscript{41} (2001)</td>
<td>422</td>
<td>Language Development Survey</td>
<td>Bayley Scales of Infant Development, Stanford-Binet, Reynell Developmental Language Scales</td>
<td>Expressive vocabulary: delay 1, &lt;30 words and no word combinations; delay 2, &lt;30 words or no word combinations; delay 3, &lt;50 words or no word combinations</td>
</tr>
<tr>
<td>Clark et al\textsuperscript{46} (1995)</td>
<td>99</td>
<td>Clinical Linguistic and Auditory Milestone Scale</td>
<td>Sequenced Inventory of Communication Development</td>
<td>Syntax, pragmatics</td>
</tr>
<tr>
<td>Glascoe and Byrne\textsuperscript{47} (1993) Study 2</td>
<td>89</td>
<td>Denver Developmental Screening Test II (communication components)</td>
<td>Battery of measures</td>
<td>Physical, self-help, social, academic, and communication</td>
</tr>
</tbody>
</table>
crowding. These studies did not find associations with the mother’s stuttering or speaking style or rate, the mother’s age, or child temperament.

Key Questions 2b and 2c: What Are Screening Techniques and How Do They Differ by Age? What Is the Accuracy of Screening Techniques and How Does It Vary by Age?

A total of 22 articles that reported performance characteristics of 24 evaluations met inclusion criteria. The studies used several different standardized and non-standardized instruments (Table 3), although many were not designed specifically for screening purposes. Results of the instruments were compared with those of a variety of reference standards, and no “gold standard” was acknowledged or used across studies, which limited comparisons between them.

The studies provided limited demographic details of subjects, and most included predominantly white chil-
dren with similar proportions of boys and girls. One study enrolled predominantly black children and another children from rural areas. Study sizes ranged from 25 subjects to 2590 subjects. Testing was conducted in general health clinics, specialty clinics, day care centers, schools, and homes by pediatricians, nurses, speech and language specialists, psychologists, health visitors, medical or graduate students, teachers, parents, and research assistants. Studies are summarized below by age categories according to the youngest ages included, although many studies included children in overlapping age categories.

**Ages 0 to 2 Years**

Eleven studies from 10 publications used instruments that take ≤10 minutes to administer for children up to 2 years old, including the Early Language Milestone Scale, Parent Evaluation of Developmental Status, Denver Developmental Screening Test II (language component), Pediatric Language Acquisition Screening Tool for Early Referral, Clinical Linguistic and Auditory Milestone Scale, Language Development Survey, Development Profile II, and the Bayley Infant Neurodevelopmental Screener. Of these studies, 6 tested expressive and/or receptive language, 3 tested expressive vocabulary, and 1 tested syntax and pragmatics.

For the 10 fair- and good-quality studies that provided data to determine sensitivity and specificity, sensitivity ranged from 22% to 97% and specificity ranged from 66% to 97%.

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**TABLE 5**  
**Studies of Screening Instruments for Children 2 to 3 Years Old**

<table>
<thead>
<tr>
<th>Authors (y)</th>
<th>N</th>
<th>Instrument</th>
<th>Reference Standard</th>
<th>Speech and Language Domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burden et al (1996)</td>
<td>2590</td>
<td>Parent Language Checklist</td>
<td>Clinical judgement</td>
<td>Expressive and receptive language</td>
</tr>
<tr>
<td>Sturmer (1993) Study 1</td>
<td>279</td>
<td>Fluharty Preschool Speech and Language Screening Test</td>
<td>Arizona Articulation Proficiency Scale Revised, Test of Language Development Primary</td>
<td>Expressive and receptive language, articulation</td>
</tr>
<tr>
<td>Sturmer et al (1993) Study 2</td>
<td>421</td>
<td>Fluharty Preschool Speech and Language Screening Test</td>
<td>Test for Auditory Comprehension of Language Revised, Templin-Darley Test of Articulation</td>
<td>Expressive and receptive language, articulation</td>
</tr>
<tr>
<td>Law (1994)</td>
<td>1205</td>
<td>Hackney Early Language Screening Test</td>
<td>Reynell Developmental Language Scales</td>
<td>Expressive language</td>
</tr>
<tr>
<td>Blaxley (1983)</td>
<td>90</td>
<td>Fluharty Preschool Speech and Language Screening Test</td>
<td>Developmental Sentence Scoring</td>
<td>Expressive and receptive language, articulation</td>
</tr>
<tr>
<td>Bliss and Allen (1984)</td>
<td>602</td>
<td>Screening Kit of Language Development</td>
<td>Sequenced Inventory of Communication Development</td>
<td>Expressive and receptive language</td>
</tr>
<tr>
<td>Walker et al (1989)</td>
<td>77</td>
<td>Early Language Milestone Scale</td>
<td>Sequenced Inventory of Communication Development</td>
<td>Expressive and receptive language</td>
</tr>
</tbody>
</table>
Ages 2 to 3 Years

Ten studies in 9 publications used instruments that take ≤10 minutes to administer for children aged 2 to 3, including the Parent Language Checklist,11 Structured Screening Test,63 Levett-Muir Language Screening Test,64 Fluharty Preschool Speech and Language Screening Test,53,65 Screening Kit of Language Development,66 Hackney Early Language Screening Test,54,67 and Early Language Milestone Scale68 (Table 5). All the studies tested expressive and/or receptive language.11,53,54,63–68 In addition, 3 studies tested articulation,53,65 and 1 studied syntax and phonology.64

For the 8 fair- and good-quality studies that provided data to determine sensitivity and specificity, sensitivity ranged from 17% to 100% and specificity ranged from 45% to 100%. Two studies reported sensitivity and specificity of ≥80% when using the Levett-Muir Language Screening Test64 and the Screening Kit of Language Development.66 The study of the Screening Kit of Language Development reported comparable sensitivity/specificity at 30 to 36 months (100%/98%), 37 to 42 months (100%/91%), and 43 to 48 months of age (100%/93%).66

### Table 5

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Setting</th>
<th>Screener</th>
<th>Sensitivity, %</th>
<th>Specificity, %</th>
<th>Study Quality Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>All children turning 36 mo; 52% male; 41% urban</td>
<td>Home (mailed)</td>
<td>Parent</td>
<td>87</td>
<td>45</td>
<td>Good</td>
</tr>
<tr>
<td>Children from 2 low-SES counties in London; mean age: 30 mo</td>
<td>Physician’s office</td>
<td>Health visitor</td>
<td>66 (severe); 54 (needs therapy)</td>
<td>89 (severe); 90 (needs therapy)</td>
<td>Fair</td>
</tr>
<tr>
<td>Private practice population; 34–40 mo</td>
<td>Physician’s office</td>
<td>Medical practitioners</td>
<td>100</td>
<td>100</td>
<td>Fair</td>
</tr>
<tr>
<td>46% male; 74% white; 86% rural; 24–72 mo</td>
<td>Preschool</td>
<td>Teacher</td>
<td>43 (speech and language); 74 (speech); 38 (language)</td>
<td>82 (speech and language); 96 (speech); 85 (language)</td>
<td>Fair</td>
</tr>
<tr>
<td>52% male; 75% white; 24–72 mo</td>
<td>Preschool</td>
<td>Teacher</td>
<td>31 (speech and language); 43 (speech); 17 (language)</td>
<td>93 (speech and language); 93 (speech); 97 (language)</td>
<td>Fair</td>
</tr>
<tr>
<td>Children attending routine developmental checkups; mean age: 30 mo</td>
<td>Home</td>
<td>Health visitor</td>
<td>98</td>
<td>69</td>
<td>Good-Fair</td>
</tr>
<tr>
<td>Children referred for speech and/or language assessment and intervention and controls; 24–72 mo</td>
<td>Speech and hearing clinic in western Ontario</td>
<td>Clinician</td>
<td>36 (10th percentile); 30 (25th percentile)</td>
<td>95 (10th percentile); 100 (25th percentile)</td>
<td>Fair</td>
</tr>
<tr>
<td>From day care centers in Detroit, MI; 30–48 mo</td>
<td>Speech and language hearing clinic, day-care center, physician’s office, educational and health facilities</td>
<td>Paraprofessionals and speech and language pathologists</td>
<td>100 (30–36 mo); 100 (37–42 mo); 100 (43–48 mo)</td>
<td>98 (30–36 mo); 91 (37–42 mo); 93 (43–48 mo)</td>
<td>Fair</td>
</tr>
<tr>
<td>Pilot study at 1 clinic setting in Hackney; mean age: 30 mo</td>
<td>Physician’s office</td>
<td>Health visitor</td>
<td>95</td>
<td>94</td>
<td>Poor</td>
</tr>
<tr>
<td>All children attending a study clinic; mean age: 36 mo</td>
<td>Clinic</td>
<td>Speech and language pathologist</td>
<td>0 (0–12 mo); 100 (13–24 mo); 100 (25–36 mo)</td>
<td>86 (0–12 mo); 60 (13–24 mo); 75 (25–36 mo)</td>
<td>Poor</td>
</tr>
</tbody>
</table>
High false-positive and false-negative rates were re-
tected to be of higher quality tended to have higher spec-
100% and for children from clinical settings it ranged
normally developing children ranged from 17% to

differences between intervention and comparison
comes.72

Systematic Review
A Cochrane systematic review of 45 studies, including
most of the studies cited above, summarized the sensi-
tivity and specificity of instruments that take ≤30 min-
utes to administer.34 Sensitivity of the instruments for
ormally developing children ranged from 17% to
100% and for children from clinical settings it ranged
from 30% to 100%. Specificity ranged from 43% to
100% and 14% to 100%, respectively. Studies consid-
ered to be of higher quality tended to have higher spe-
cificity than sensitivity (t = 4.41; P < .001); however,
high false-positive and false-negative rates were re-
ported often.34

Key Question 2d: What Are the Optimal Ages and Frequency
for Screening?
No studies addressed this question.

Key Question 3: What Are the Adverse Effects of Screening?
No studies addressed this question. Potential adverse
effects include false-positive and false-negative results.
False-positive results can erroneously label children with
ormal speech and language as impaired, potentially
leading to anxiety for children and families and addi-
tional testing and interventions. False-negative results
would miss identifying children with impairment, po-
tentially leading to progressive speech and language de-
lay and other long-term effects including communica-
tion, social, and academic problems. In addition, once
delay is identified, children may be unable to access
services because of unavailability or lack of insurance
coverage.

Key Question 4: What Is the Role of Enhanced Surveillance by
Primary CareClinicians?
No studies addressed this question.

Key Question 5: Do Interventions for Speech and Language
Delay Improve Speech and Language Outcomes?
Twenty-five RCTs in 24 publications met inclusion cri-
teria, including 1 rated good,72 13 rated fair,73–85 and 11
rated poor quality77,86–95 (Table 7). Studies were consid-
ered to be of poor quality if they reported important
differences between intervention and comparison
groups at baseline, did not use intention-to-treat analy-
sis, no method of randomization was reported, or there
were <10 subjects in the intervention or comparison
groups. Limitations of studies, in general, include small
numbers of participants (only 4 studies enrolled >50
subjects), lack of consideration of potential confounders,
and disparate methods of assessment, intervention, and
outcome measurement. As a result, conclusions about
effectiveness are limited. Although children in the stud-
ies ranged from 18 to 75 months old, most studies in-
cluded children 2 to 4 years old, and their results do not
allow for determination of the optimal ages of interven-
tion.

The studies evaluated the effects of individual or
group therapy directed by clinicians and/or parents that
focused on specific speech and language domains. These
domains included expressive and receptive language,
articulation, phonology, lexical acquisition, and syntax.
Several studies used established approaches to therapy
such as the Ward Infant Language Screening Test, As-
seSSment, Acceleration, and Remediation program96 and
the Hanen principles.78,79,93 Others used more theoret-
ical approaches such as focused stimulation78,79,86,87,93 au-
ditory discrimination,83,90 imitation or modeling proce-
dures,76,92 auditory processing or work mapping,85 and
play narrative language.80,81 Some interventions focused
on specific words and sounds, used unconventional
methods, or targeted a specific deficit.

Outcomes were measured by subjective reports from
parents77,78,80,85 and by scores on standardized instru-
m ents such as the Reynell Expressive and Receptive
Scales,74,77 the Preschool Language Scale,72,75,85 and the
MacArthur Communicative Development Invento-
ries.80,93 The most widely used outcome measure was
mean-length utterances, used by 6 studies,73,75,77,80,85

Studies rated as good or fair quality are described
below by age categories according to the youngest ages
included, although many studies included children in
overlapping categories

Ages 0 to 2 Years
No studies examined this age group exclusively, al-
though 1 good-quality study enrolled children who were
18 to 42 months old.72 The clinician-directed, 12-month
intervention consisted of 10-minute weekly sessions fo-
cusing on multiple language domains, expressive and
receptive language, and phonology. Treatment for re-
ceptive auditory comprehension lead to significant im-
provement for the intervention group compared with
the control group; however, results did not differ be-
tween groups for several expressive and phonology out-
comes.72

Ages 2 to 3 Years
One good72 and 6 fair-quality77–80,84,85 studies evaluated
speech and language interventions for children who
were 2 to 3 years old. The studies reported improvement on a variety of communication domains including clinician-directed treatment for expressive and receptive language,\textsuperscript{80} parent-directed therapy for expressive delay,\textsuperscript{77,78} and clinician-directed receptive auditory comprehension.\textsuperscript{72} Lexical acquisition was improved with both clinician-directed\textsuperscript{84,91} and group therapy approaches.\textsuperscript{84} In 3 studies, there were no between-group differences for clinician-directed expressive\textsuperscript{72,85} or receptive language therapy,\textsuperscript{72,85} parent-directed expressive or receptive therapy,\textsuperscript{85} or parent-directed phonology treatment.\textsuperscript{79}

**Ages 3 to 5 Years**

Five fair-quality studies reported significant improvements for children who were 3 to 5 years old and undergoing interventions compared with controls,\textsuperscript{73,74,76,81,82} whereas 2 studies reported no differences.\textsuperscript{75,83} Both group-based\textsuperscript{81} and clinician-directed\textsuperscript{74} interventions were successful in improving expressive and receptive competencies.

**Systematic Review**

A Cochrane systematic review included a meta-analysis using data from 25 RCTs of interventions for speech and language delay for children up to adolescence.\textsuperscript{35} Twenty-three of these studies\textsuperscript{72–92,95} also met criteria for this review and are included in Table 7, and 2 trials were unpublished. The review reported results in terms of standard mean differences (SMDs) in scores for a number of domains (phonology, syntax, and vocabulary). Effectiveness was considered significant for both the phonological (SMD: 0.44; 95% confidence interval [CI]: 0.01–0.86) and vocabulary (SMD: 0.89; 95% CI: 0.21–1.56) interventions. Less effective was the receptive intervention (SMD: 0.04; 95% CI: 0.64–0.56), and results were mixed for the expressive syntax intervention (SMD: 1.02; 95% CI: 0.04–2.01). When interventions were comparable in duration and intensity, there were no differences between interventions when they were administered by trained parents or clinicians for expressive delays. Use of normal-language peers as part of the intervention strategy also proved beneficial.\textsuperscript{81}

**Key Question 6: Do Interventions for Speech and Language Delay Improve Other Non–Speech and Language Outcomes?**

Four good-\textsuperscript{72} or fair-quality\textsuperscript{60,81,85} intervention studies included functional outcomes other than speech and language. Increased toddler socialization skills,\textsuperscript{60} improved child self-esteem,\textsuperscript{85} and improved play themes\textsuperscript{85} were reported for children in intervention groups in 3 studies. Improved parent-related functional outcomes included decreased stress\textsuperscript{85} and increased positive feelings toward their children.\textsuperscript{85} Functional outcomes that were studied but did not show significant treatment effects included well-being, levels of play and attention, and socialization skills in 1 study.\textsuperscript{72}
<table>
<thead>
<tr>
<th>Authors (y)</th>
<th>Speech and Language Domains</th>
<th>N (No. of Groups)</th>
<th>Age, mo</th>
<th>Interventions</th>
<th>Speech and Language Outcomes</th>
<th>Function and Health Outcomes</th>
<th>Study Quality Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2 y&lt;sup&gt;+&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glogowska et al&lt;sup&gt;72&lt;/sup&gt; (2000)</td>
<td>Expressive and receptive language and phonology</td>
<td>159 (2)</td>
<td>18–42</td>
<td>Clinician-directed individual intervention, routinely offered by the therapist for 12 mo, vs none</td>
<td>Improved auditory comprehension in intervention vs control group; no differences for expressive language, phonology error rate, language development, or improvement on entry criterion</td>
<td>No differences in well-being, attention level, play level, or socialization skills</td>
<td>Good</td>
</tr>
<tr>
<td>2 to 3 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gibbard&lt;sup&gt;77&lt;/sup&gt; (1994) Study 1</td>
<td>Expressive language</td>
<td>36 (2)</td>
<td>27–39</td>
<td>Parent-directed individual therapy for 60–75 min every other week for 6 mo vs none</td>
<td>Improved scores on several measures for intervention vs control group</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Girolametto et al&lt;sup&gt;78&lt;/sup&gt; (1996)</td>
<td>Expressive language</td>
<td>25 (2)</td>
<td>23–33</td>
<td>Parent-directed individual focused stimulation intervention for 150 min/wk for 11 wk vs none</td>
<td>Larger vocabularies, use of more different words, more structurally complete utterances and multiword utterances in intervention group vs control; no differences in several other measures</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Law et al&lt;sup&gt;85&lt;/sup&gt; (1999)</td>
<td>Expressive and receptive language</td>
<td>38 (3)</td>
<td>33–39</td>
<td>Clinician-directed for 450 min/wk for 6 wk vs parent-directed for 150 min/wk for 10 wk vs none</td>
<td>No differences between groups</td>
<td>Improved parent perception of child’s behavior and positivity toward child, improved child self-esteem</td>
<td>Fair</td>
</tr>
<tr>
<td>Robertson and Weissmer&lt;sup&gt;80&lt;/sup&gt; (1999)</td>
<td>Expressive and receptive language</td>
<td>21 (2)</td>
<td>21–30</td>
<td>Clinician-directed individual therapy 150 min/wk for 12 wk vs none</td>
<td>Improved mean length of utterances, total number of words, lexical diversity, vocabulary size, and percentage of intelligible utterances in intervention group vs control</td>
<td>Improved socialization skills, decreased parental stress for intervention group</td>
<td>Fair</td>
</tr>
<tr>
<td>Gibbard&lt;sup&gt;77&lt;/sup&gt; (1994) Study 2</td>
<td>Expressive language</td>
<td>25 (3)</td>
<td>27–39</td>
<td>Clinician-directed individual therapy for 60–75 min every other week for 6 mo vs parent-directed for 60–75 min every other week for 6 mo vs none</td>
<td>Improved scores on all 5 measures for parent-directed group vs control; improvement on 2 measures for clinician-directed group vs control; improvement on 1 measure for parent vs clinician group</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
<tr>
<td>Girolametto et al&lt;sup&gt;93&lt;/sup&gt; (1996)</td>
<td>Expressive and receptive language</td>
<td>16 (2)</td>
<td>22–38</td>
<td>Parent-directed individual therapy for 150 min/wk for 10 wk vs none</td>
<td>More target words used in intervention group vs control; no differences in vocabulary development</td>
<td>Increased symbolic play gestures; decreased aggressive behavior in intervention group</td>
<td>Poor</td>
</tr>
<tr>
<td>Schwartz et al&lt;sup&gt;91&lt;/sup&gt; (1985)</td>
<td>Expressive language and lexical acquisition</td>
<td>10 (2)</td>
<td>32–39</td>
<td>Clinician-directed individual therapy for 3 wk vs none</td>
<td>Improved multiword utterances from baseline in intervention group; no between-group differences reported</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
<tr>
<td>Wilcox et al&lt;sup&gt;94&lt;/sup&gt; (1991)</td>
<td>Lexical acquisition</td>
<td>20 (2)</td>
<td>20–47</td>
<td>Clinician-directed individual intervention for 90 min/</td>
<td>No differences between groups in use of target words; more use of</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Authors (y)</td>
<td>Speech and Language Domains</td>
<td>N (No. of Groups)</td>
<td>Age, mo</td>
<td>Interventions</td>
<td>Speech and Language Outcomes</td>
<td>Function and Health Outcomes</td>
<td>Study Quality Rating</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------</td>
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<td>----------------------------</td>
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<td>----------------------</td>
</tr>
<tr>
<td>Girolametto et al (1997)</td>
<td>Lexical acquisition and phonology</td>
<td>25 (2)</td>
<td>23–33</td>
<td>Parent-directed individual therapy for eight 150-min sessions and 3 home sessions for 11 wk vs none</td>
<td>Improved level of vocalizations and inventory of consonants for intervention group vs control; no differences in the number of vocalizations</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Barratt et al (1992)</td>
<td>Expressive and receptive language</td>
<td>39 (2)</td>
<td>37–43</td>
<td>Clinician-directed interactive language therapy for 40 min/wk for 6 mo (traditional group) vs 40 min for 4 days/wk for 3 wk in two 3-mo blocks (intensive group)</td>
<td>Improved expression score on Reynell scale for intensive group vs weekly (or traditional) therapy group; no difference in comprehension scores, both were improved</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Courtright and Courtright (1979)</td>
<td>Expressive language</td>
<td>36 (3)</td>
<td>47–83</td>
<td>3 clinician-directed approaches are compared for 5 mo: mimicry, clinician modeling, 3rd-person modeling for 5 mo</td>
<td>Increased number of correct responses in modeling groups vs mimicry group</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Robertson and Weismer (1997)</td>
<td>Expressive and receptive language</td>
<td>30 (3)</td>
<td>44–61</td>
<td>More words used, greater verbal productivity, more lexical diversity, and more use of linguistic markers by normal peer group (not normal group, treatment group with language impairment)</td>
<td>Play-theme–related acts increased for the normal peer play group (not normal group, treatment group with language impairment)</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Glogowska et al (2002)</td>
<td>Expressive and receptive language and phonology</td>
<td>159 (2)</td>
<td>15–42</td>
<td>Clinician-directed for 12 mo vs none</td>
<td>Improved receptive language in intervention group vs control; no differences between groups for 4 other measures</td>
<td>Improved family response to child in intervention group</td>
<td>Poor</td>
</tr>
<tr>
<td>Almost and Rosenbaum (1998)</td>
<td>Phonology</td>
<td>26 (2)</td>
<td>33–61</td>
<td>Clinician-directed individual therapy for two 30-min sessions/wk for 4 mo vs none</td>
<td>Higher scores on 3 of 4 measures for intervention vs control group</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Rvachew and Nowak (2001)</td>
<td>Phonology</td>
<td>48 (2)</td>
<td>50 (mean)</td>
<td>Clinician-directed individual therapy 30–40 min/wk for 12 wk; compares interventions for phonemes that differ (most-knowledge/early-developing group vs comparison (least-knowledge/latest-developing) group</td>
<td>Improved scores on measures from baseline for both intervention groups; greater improvement for most-knowledge/early-developing phonemes group vs comparison (least-knowledge/latest-developing) group</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Authors</td>
<td>Area</td>
<td>Number of Sessions</td>
<td>Duration</td>
<td>Intervention Details</td>
<td>Comparison</td>
<td>Scores Provided</td>
<td>Quality</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------</td>
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<td>---------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Shelton et al.</td>
<td>Phonology &amp; Articulation</td>
<td>45 (3)</td>
<td>27-55</td>
<td>Parent-directed individual therapy for 5 min per day (listening group) vs 15 min per day (reading and talking group) for 57 days vs none</td>
<td>No improvements for intervention groups vs control</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Fey et al.</td>
<td>Phonology &amp; Syntax</td>
<td>26 (3)</td>
<td>44-70</td>
<td>Clinician-directed sessions (individual and group) for 3 h/wk for 20 wk vs parent-directed sessions for 8 h/wk for weeks 1-12 (includes intensive parent training) then 4 h/wk for weeks 13-20 vs none</td>
<td>Improved grammatical output (developmental sentence scores) for both intervention groups vs control; no significant difference between groups for phonological output (percentage consonants correct)</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
<tr>
<td>Reid and Donaldson</td>
<td>Phonology</td>
<td>30 (2)</td>
<td>42-66</td>
<td>Clinician-directed individual therapy for 30 min/wk for 6-10 wk vs none</td>
<td>Improved scores on some measures from baseline for intervention and control groups; no between-group comparisons reported</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
<tr>
<td>Ruscello et al.</td>
<td>Phonology</td>
<td>12 (2)</td>
<td>49-68</td>
<td>Clinician-directed vs clinician- and parent-directed individual therapy for 120 min/wk for 8 wk</td>
<td>Improved scores on measures from baseline for both intervention groups; no between-group comparisons reported</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
<tr>
<td>Ruchewitch</td>
<td>Phonology</td>
<td>27 (3)</td>
<td>42-66</td>
<td>Clinician-directed individual therapy for 45 min/wk for 6 wk; compares 3 groups listening to different sets of words</td>
<td>Improved scores on measures for 2 intervention groups vs third group</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
<tr>
<td>Cole and Dale</td>
<td>Syntax</td>
<td>44 (2)</td>
<td>38-69</td>
<td>Clinician-directed individual directive approach vs interactive approach for 600 min/wk for 8 mo</td>
<td>Improved scores on 6 of 7 measures from baseline for both intervention groups; no significant differences between groups</td>
<td>Not reported</td>
<td>Fair</td>
</tr>
<tr>
<td>Fey et al.</td>
<td>Syntax</td>
<td>29 (3)</td>
<td>44-70</td>
<td>Clinician-directed sessions (individual and group) for 3 h/wk for 20 wk vs parent-directed sessions for 8 h/wk for weeks 1-12 (includes intensive parent training) then 4 h/wk for weeks 13-20 vs none</td>
<td>Improved scores on 3 of 4 measures for both intervention groups vs control; no differences between intervention groups</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
<tr>
<td>Fey et al.</td>
<td>Syntax</td>
<td>28 (3)</td>
<td>44-70</td>
<td>Clinician-directed vs parent-directed vs none for 5 mo continuing from prior study</td>
<td>Improved some developmental sentence scores from baseline in both intervention groups vs control; no between-group comparisons reported except that</td>
<td>Not reported</td>
<td>Poor</td>
</tr>
</tbody>
</table>
Key Question 7: Does Improvement in Speech and Language Outcomes Lead to Improved Additional Outcomes?
No studies addressed this question.

Key Question 8: What Are the Adverse Effects of Interventions?
No studies addressed this question. Potential adverse effects of treatment programs include the impact of time and cost of interventions on clinicians, parents, children, and siblings. Loss of time for play and family activities, stigmatization, and labeling may also be potential adverse effects.

CONCLUSIONS
Studies are not available that address the overarching key question about the effectiveness of screening (key question 1), adverse effects of screening (key question 3), the role of enhanced surveillance in primary care (key question 4), long-term effectiveness of interventions on non–speech and language outcomes for children identified with delay (key question 7), and adverse effects of interventions (key question 8). No studies have determined the optimal ages and frequency for screening (key question 2d). Relevant studies are available regarding the use of risk factors for screening (key question 2a), techniques for screening (key questions 2b and 2c), and effectiveness of interventions on short-term speech and language and non–speech and language outcomes for children identified with delay (key questions 5 and 6).

The use of risk factors for selective screening has not been evaluated, and a list of specific risk factors to guide primary care physicians has not been developed or tested. Sixteen studies about potential risk factors for speech and language delay in children enrolled heterogeneous populations, had dissimilar inclusion and exclusion criteria, and measured different risk factors and outcomes. The most consistently reported risk factors included a family history of speech and language delay, male gender, and perinatal factors. Other risk factors that were reported less consistently include educational levels of the mother and father, childhood illnesses, birth order, and family size.

Although brief evaluations are available and have been used in a number of settings with administration by professional and nonprofessional individuals, including parents, the optimal method of screening for speech and language delay has not been established. The performance characteristics of evaluation techniques that take ≤10 minutes to administer were described in 24 studies that were relevant to screening. The studies that were rated as good to fair quality reported wide ranges of sensitivity and specificity when compared with reference standards (sensitivity: 17–100%; specificity: 45–100%). In these studies, the instruments that provided the highest sensitivity and specificity included the Early Lan-
language Milestone Scale, Clinical Linguistic and Auditory Milestone Scale, Language Development Survey, Screening Kit of Language Development, and the Levett-Muir Language Screening Test. Most of the evaluations, however, were not designed for screening purposes, the instruments measured different domains, and the study populations and settings were often outside primary care. No gold standard has been developed and tested for screening. Reference standards varied across studies, few studies compared the performance of ≥2 screening techniques in 1 population, and comparisons of a single screening technique across different populations are lacking.

RCTs of multiple types of interventions reported significantly improved speech and language outcomes compared with control groups. Improvement was demonstrated in several domains including articulation, phonology, expressive language, receptive language, lexical acquisition, and syntax among children in all age groups studied and across multiple therapeutic settings. However, studies were small and heterogeneous, may be subject to plateau effects, and reported short-term outcomes based on various instruments and measures. As a result, long-term outcomes are not known, interventions could not be directly compared to determine optimal approaches, and generalizability is questionable.

There are many limitations of the literature relevant to screening for speech and language delay in preschool-aged children, including a lack of studies specific to screening as well as difficulties inherent in this area of research. This evidence review is limited by the use of only published studies of instruments and interventions. Data about performance characteristics of instruments, in particular, are not generally accessible and are often only available in manuals that must be purchased. Interventions vary widely and may not be generalizable. In addition, studies from countries with different health care systems, such as the United Kingdom, may not translate well to US practice.

Although speech and language development is multidimensional, the individual constructs that comprise it are often assessed separately. Numerous evaluation instruments and interventions that accommodate children across a wide range of developmental stages have been developed to identify and treat specific abnormalities of these functions. As a result, studies include many different instruments and interventions that most often are designed for purposes other than screening. Also, studies of interventions typically focus on 1 or a few interventions. In clinical practice, children are provided with individualized therapies consisting of multiple interventions. The effectiveness of these complex interventions may be difficult to evaluate. Adapting the results of this heterogeneous literature to determine benefits and adverse effects of screening is problematic. Also, behavioral interventions are difficult to conduct in long-term randomized trials, and it is not possible to blind parents or clinicians. Randomly assigning children to therapy or control groups when clinical practice standards support therapy raises ethical dilemmas.

Speech and language delay is defined by measurements on diagnostic instruments in terms of a position on a normal distribution. Measures and terminology are used inconsistently, and there is no recognized gold standard. This is challenging when defining cases and determining performance characteristics of screening instruments in studies.

Identification of speech and language delay may be associated with benefits and adverse effects that would not be captured by studies of clinical or health outcomes. The process of screening alerts physicians and caretakers to developmental milestones and focuses attention on the child’s development, potentially leading to increased surveillance, feelings of caregiver support, and improved child self-esteem. Alternatively, caretakers and children may experience increased anxiety and stress during the screening and evaluation process. Detection of other conditions during the course of speech and language evaluation, such as hearing loss, is an unmeasured benefit if appropriate interventions can improve the child’s status.

Future research should focus on determining optimal approaches of identifying preschool-aged children with speech and language delay in primary care settings who would be appropriate candidates for additional evaluations and possibly speech and language interventions. These approaches should be integrated into routine developmental surveillance practices of clinicians who care for children. Studies that evaluate the effectiveness of validated brief screening instruments that include child and caretaker components could lead to a more standardized approach. Studies of specific speech and language components of currently available broad developmental screening instruments, such as the Ages and Stages Questionnaire, would be useful. Incorporation of risk factors and parent report in studies of screening approaches could provide information about their added value. Additional studies that compare screening instruments and methods in large primary care populations could lead to defining gold standards and acceptable referral criteria. Evaluating these criteria in different populations of children would minimize cultural and language biases.

Additional work about the effectiveness of interventions, including speech and language domain-specific results, may provide new insights. School-based efforts could be designed to complement strategies developed for young children improving long-term outcomes. Results of these studies may help determine optimal ages and intervals for screening. Functional long-term outcomes such as school performance, high school–graduation rates, in-grade retention, special education place-
ment/duration, and social adjustment need to be addressed more thoroughly. Cost-effectiveness evaluations of effective approaches that consider cost of treatment, the time that caregivers spend in transit to treatment locations, the time they spend participating in the program on site or in the home, and long-term outcomes, among other factors, would be useful.

**APPENDIX: USPSTF QUALITY-RATING CRITERIA**

**Diagnostic Accuracy Study Criteria**
- Screening test should be relevant, available for primary care, and adequately described
- Study should use a credible reference standard that is performed regardless of test results
- Reference standard should be interpreted independently of screening test
- Study should handle indeterminate results in a reasonable manner
- A spectrum of patients should be included in study
- Sample size
- A reliable screening test should be administered

**Definition of Ratings Based on the Diagnostic Accuracy Study Criteria**

**Good**
Evaluates a relevant, available screening test; uses a credible reference standard; interprets the reference standard independently of screening test; assesses the reliability of the test; has few or handles indeterminate results in a reasonable manner; and includes a large number (>100) of broad-spectrum patients with and without disease.

**Fair**
Evaluates a relevant, available screening test; uses reasonable (although not the best) standard; interprets the reference standard independently of screening test; and has a moderate sample size (50–100 subjects) and a “medium” spectrum of patients.

**Poor**
Has important limitations such as: uses inappropriate reference standard; administers the screening test improperly; ascertains the reference standard in a biased manner; and/or has a very small sample size of very narrow selected spectrum of patients.

**RCT and Cohort Study Criteria**
- Initial assembly of comparable groups—RCTs: adequate randomization, including concealment and whether potential confounders were distributed equally among groups; cohort studies: consideration of potential confounders with either restriction or measurement for adjustment in the analysis and consideration of inception cohorts
- Maintenance of comparable groups (includes attrition, cross-overs, adherence, contamination)
- Important differential loss to follow-up or overall high loss to follow-up
- Equal, reliable, and valid measurements (includes masking of outcome assessment)
- Clear definition of interventions
- Important outcomes considered
- Analysis—adjustment for potential confounders for cohort studies, or intention-to-treat analysis for RCTs (ie, analysis in which all participants in the trial are analyzed according to the intervention to which they were allocated regardless of whether they completed the intervention)

**Definition of Ratings Based on the RCT and Cohort Study Criteria**

**Good**
Meets all criteria: comparable groups are assembled initially and maintained throughout the study (follow-up: at least 80%); reliable and valid measurement instruments are used and applied equally to the groups; interventions are spelled out clearly; important outcomes are considered; and appropriate attention is given to confounders in analysis.

**Fair**
Studies will be graded as fair if any or all of the following problems occur, without the important limitations noted in the “poor” category below: generally comparable groups are assembled initially, but some question remains whether some (although not major) differences occurred in follow-up; measurement instruments are acceptable (although not the best) and generally applied equally; some but not all important outcomes are considered; and some but not all potential confounders are accounted for.

**Poor**
Studies will be graded as poor if any of the following major limitations exist: groups assembled initially are not close to being comparable or maintained throughout the study; unreliable or invalid measurement instruments are used or not applied at all equally among groups (including not masking outcome assessment); and key confounders are given little or no attention.

**ACKNOWLEDGMENTS**
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REFERENCES


57. Glascoe FP, Byrne KE. The accuracy of three developmental screening tests. *J Early Intervention.* 1993;17:368–379


Screening for Speech and Language Delay in Preschool Children: Systematic Evidence Review for the US Preventive Services Task Force
Heidi D. Nelson, Peggy Nygren, Miranda Walker and Rita Panoscha
Pediatrics 2006;117;e298
DOI: 10.1542/peds.2005-1467

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Page e146, Table 2 should read as follows:

**TABLE 2**

Comparison of Checking Injuries and Concussions in 14- to 15-Year-Old (Bantam) Players in Ontario (With 2 to 4 Years of Body-Checking Experience) and Quebec (Experiencing Body Checking for the First Time), 1995–2002

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>Bantam Players in Ontario, n (%)</th>
<th>Bantam Players in Quebec, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checking-related</td>
<td>582 (44)</td>
<td>357 (42)</td>
</tr>
<tr>
<td>Concussions</td>
<td>42 (3)</td>
<td>20 (2)</td>
</tr>
<tr>
<td>Fractures</td>
<td>344 (27)</td>
<td>199 (23)</td>
</tr>
<tr>
<td>Total hockey injuries</td>
<td>1312</td>
<td>856</td>
</tr>
</tbody>
</table>

Source: Canadian Hospitals Injury Reporting and Prevention Program.

The authors ensure that the changes do not affect the conclusions or implications for injury prevention.

doi:10.1542/peds.2006-0928


On page e308, column 1, lines 8 to 11 should read: “A study testing expressive vocabulary and word combinations using the Language Development Survey indicated higher sensitivity/specificity at age 2 years (83%/93%) than at age 3 years (67%/90%).”

The authors maintain that the errors do not affect the rest of the paper or the recommendations.

doi:10.1542/peds.2006-0940
<table>
<thead>
<tr>
<th>Authors (y)</th>
<th>N</th>
<th>Instrument</th>
<th>Reference Standard</th>
<th>Speech and Language Domains</th>
<th>Subjects</th>
<th>Setting</th>
<th>Screener</th>
<th>Sensitivity/Specificity</th>
<th>Study Quality Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klee et al. (1998)</td>
<td>306</td>
<td>Language Development Survey</td>
<td>Clinical judgment based on blinded, independent judgments of 2 speech-language pathologists and supported by 1 of 3 standardized measures falling below −1 SD</td>
<td>Expressive vocabulary and word combinations</td>
<td>Toddlers turning 2 y old during the study in Wyoming; 52% male; 24–26 mo</td>
<td>Home</td>
<td>Parent</td>
<td>Sample of 64/306 children screened and evaluated with reference standard at age 2 y: sensitivity = 91%; specificity = 87%</td>
<td>Good-fair</td>
</tr>
<tr>
<td>Klee et al. (2000)</td>
<td>306</td>
<td>Language Development Survey with parental concern for delay or history of ≥6 ear infections</td>
<td>Clinical judgment based on blinded, independent judgments of 2 speech-language pathologists and supported by 1 of 3 standardized measures falling below −1 SD</td>
<td>Expressive vocabulary and word combinations</td>
<td>Toddlers turning 2 y old during the study in Wyoming; 52% male; 24–26 mo</td>
<td>Home</td>
<td>Parent</td>
<td>Sample of 64/306 children screened and evaluated with reference standard at ages 2 and 3 y: Age 2 y: sensitivity = 83%; specificity = 93% Age 3 y: sensitivity = 67%; specificity = 90%</td>
<td>Good-fair</td>
</tr>
</tbody>
</table>
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