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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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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[1] and is related to school success.[2–7] 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.[1] 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,[8] 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 1 **Definitions of Terms**

Term	Definition
Articulation	The production of speech sounds
Dysfluency	Interrupted flow of speech sounds, such as stuttering
Expressive language	The use of language to share thoughts, protest, or comment
Language	The conceptual processing of communication which may be receptive and or expressive
Morphology	The rules governing meanings of word units
Phonology	The set of rules for sound production
Pragmatics	Adaptation of language to the social context
Prosody	Appropriate intonation, rate, rhythm, and loudness of speech utterances
Receptive language	Understanding of language
Semantics	A set of words known to a person that are a part of a specific language (vocabulary)
Speech	Verbal production of language
Syntax	The way linguistic elements are put together to form phrases or clauses (grammar)
Voice disorders	Difficulty with speech sound production, at the level of the larynx, may be related to motor or anatomical issues (eg, hypernasal or hoarse speech)

review summarized prevalence data on speech delay, language delay, and combined delay in preschool- and school-aged children.[9] 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%,[10,11] and studies of language delay have reported prevalence rates ranging from 2.3% to 19%.[9,12–15] Untreated speech and language delay in preschool children has shown variable persistence rates (from 0% to 100%), with most studies reporting 40% to 60%.[9] 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.[16]

Preschool-aged children with speech and language delay may be at increased risk for learning disabilities once they reach school age.[17] They may have difficulty reading in grade school,[2] exhibit poor reading skills at age 7 or 8,[3–5] and have difficulty with written language,[6] in particular. This may lead to overall academic underachievement[7] and, in some cases, lower IQ scores[13] that may persist into young adulthood.[18] As adults, children with phonological difficulties may hold lower-skilled jobs than their non–language-impaired siblings.[19] 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.[20,21]

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.[22] 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.[23] 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,[24] Clinical Adaptive Test/Clinical Linguistic and Auditory Milestone Scale,[25] and Denver Developmental Screening Test,[26] include speech and language components. Instruments designed specific for communication domains include the McArthur Communicative Development Inventory,[27] Ward Infant Language Screening Test, Assessment, Acceleration, and Remediation (WILSTAAR),[28] Fluharty Preschool Speech and Language Screening Test,[29] Early Language Milestone Scale,[30] 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.

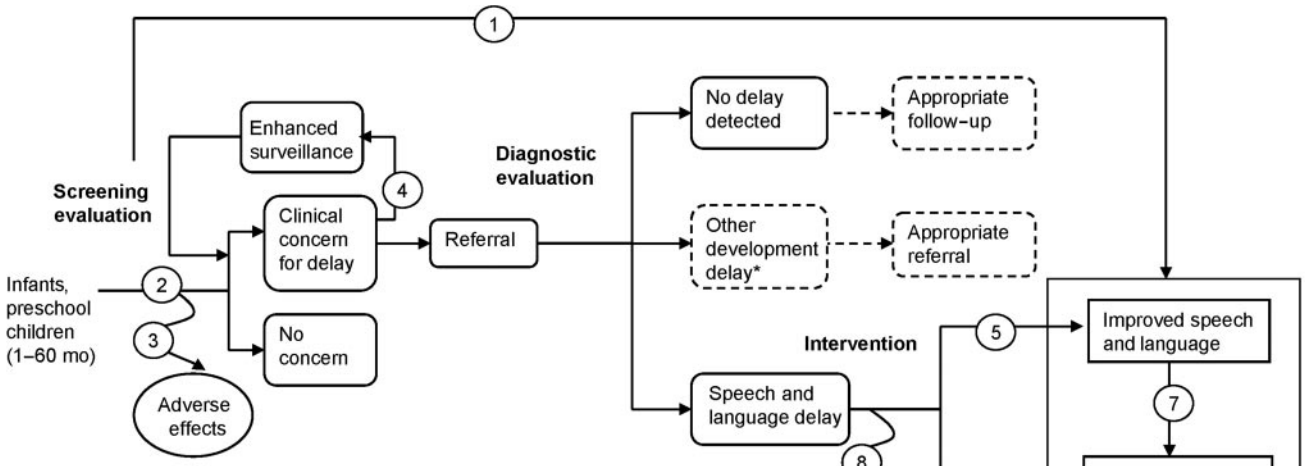
It is not clear how consistently clinicians screen for speech and language delay in primary care practice. In 1 study, 43% of parents reported that their young child (aged 10–35 months) did not receive any type of developmental assessment at their well-child visit, and 30% of parents reported that their child's physician had not discussed how the child communicates.[31] 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[32] 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



1. Does screening for speech and language delay result in improved speech and language as well as improved other non-speech and language outcomes?
2. Do screening evaluations in the primary care setting accurately identify children for diagnostic evaluation and interventions?
   a. Does identification of risk factors improve screening?
   b. What are screening techniques, and how do they differ by age?
   c. What is the accuracy of screening techniques, and how does it vary by age?
   d. What are the optimal ages and frequency for screening?
3. What are the adverse effects of screening?
4. What is the role of enhanced surveillance by primary care clinicians?
5. Do interventions for speech and language delay improve speech and language outcomes?
6. Do interventions for speech and language delay improve other non-speech and language outcomes?
7. Does improvement in speech and language outcomes lead to improved additional outcomes?
8. What are the adverse effects of interventions?

* Autism, mental retardation, fragile X syndrome, hearing loss, degenerative, and other neurologic disorders.
† School performance, family function, social behavior, and others.

FIGURE 1
Analytic framework and key questions. The analytic framework represents an outline of the evidence review and includes the patient population, interventions, outcomes, and adverse effects of the screening process. The 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).

(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.[33] Articles were also obtained from recent systematic reviews,[34,35] 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.[33] 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 populations[36–44] and 7 studies from non–English-speaking populations[45–51] 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[44] 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] Three[37,41,43] of 5 studies reported an association between lower maternal education level and language delay, and 3 studies[41–43] 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 parents[39] or younger mother[43] 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 2 Summary of Studies of Risk Factors

Authors (y)	Population	Age, mo	Speech and Language Domains	Family History	Male Gender	SES	Birth Order	Perinatal Factors	Parental Education	Medical Conditions	Other Associations
English-language studies											
Brookhouser et al[36] (1979)	24 referred from Boys Town Institute	28–62	Language	[b]	NR	NR	NR	NR	NR	[a]	NR
Campbell et al[37] (2003)	398 cases and 241 controls from a large, prospective study in Pittsburgh, PA	36	Speech	[a]	[a]	[a]	NR	NR	Mother[a]	NR	NR
Cantwell and Baker[38] (1985)	600 children referred from a speech and hearing clinic in Los Angeles, CA	20–191	Multiple types	NR	NR	NR	NR	NR	NR	NR	Psychiatric, behavioral, or developmental disorder[a]
Choudhury and Benasich[39] (2003)	42 cases with positive family histories and 94 controls from the New York City, NY, area	36	Language	[a]	[a]	[b]	NR	NR	Mother[b] Father[b]	Asthma[b]	Older parents,[a] more children in family[a]
Singer et al[40] (2001)	98 cases (VLBW/BPD), 70 VLBW/non-BPD controls, and 95 term controls from Cleveland, OH, region hospitals	36	Language	NR	NR	[a]	NR	NR	NR	BPD,[a] PDA[a]	Neurologic risk,[a] minority race[a]
Tallal et al[41] (1989)	76 cases and 54 controls from the San Diego, CA, Longitudinal Study	48–59	Language	[a]	NR	NR	NR	NR	Mother[a] Father[a]	NR	NR
Tomblin et al[42] (1991)	662 from a longitudinal cohort	30–60	Speech and language	[a]	[a]	NR	Born later[a]	NR	Mother[b] Father[a]	NR	NR
Tomblin et al[43] (1997)	177 cases and 925 controls from metropolitan regions of Iowa or Illinois	Kindergarten age	Speech and language	[a]	NR	NR	NR	Low birth weight[b]	Mother[a] Father[a]	NR	Younger mother,[a] less breastfeeding[a]
Whitehurst et al[44] (1991)	62 cases and 55 controls from Long Island, NY	24–38	Expressive language	[b]	NR	NR	NR	NR	NR	NR	NR
Non–English-language studies											
Fox et al[45] (2002) (Germany)	65 cases and 48 controls	32–86	Speech	[a]	NR	NR	NR	Birth difficulties,[a] sucking habits[a]	NR	NR	NR
Klein and Tzuriel[46] (1986) (Israel)	72 kindergarten children from a middle-class urban area	48–108	Vocabulary	NR	NR	NR	NR	NR	NR	NR	Child's behavior[b]
Kloth et al[47] (1995) (Netherlands)	93 referred because 1 or both parents were stutterers or had a history of stuttering	23–58	Stuttering	NR	NR	NR	NR	NR	NR	NR	Mother stutters,[b] Mother's speaking style or rate[b]
Lyytinen et al[48] (2001) (Finland)	107 with familial risk of dyslexia and 93 without	0–54	Speech and language	[a]	NR	NR	NR	NR	NR	NR	NR
Peters et al[49] (1997) (Netherlands)	946 from a Dutch birth cohort in Nijmegen	84–96	Language and educational attainment	NR	[b]	NR	NR	Preterm,[b] low birth weight[b]	[a]	NR	Dutch as a second language[a]
Weindrich et al[50] (2000) (Germany)	320 recruited at birth at a German hospital	Tested at 54 and 96 mo	Receptive and expressive language and articulation (54 mo); reading and spelling (96 mo)	NR	NR	NR	NR	Preterm,[a] toxemia,[a] low birth weight[a]	Mother[a] Father[a]	NR	Parental psychiatric disorder,[a] overcrowding,[a] parental broken home or delinquency,[a] 1-parent family,[a] unwanted pregnancy[a]
Yliherva et al[51] (2001) (Finland)	8370 recruited at birth from 2 northern provinces of Finland (99% of pregnant women in 1985–1986)	96	Speech, language, learning, motor abilities	NR	[a]	NR	NR	Preterm,[a] low birth weight[a]	Mother[b]	Impaired hearing[a]	Mother's age,[b] >4 children in family,[a] reconstructed family status[a]

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 3 **Instruments Used in Studies**

Instrument	Abbreviation	Components	Authors (y)
Bayley Infant Neurodevelopmental Screener[a]	BINS	Assesses 4 areas: (1) neurological function/intactness; (2) receptive function; (3) expressive function; and (4) cognitive processes	Macias et al[62] (1998)
Clinical Adaptive Test/Clinical Linguistic Auditory Milestone Scale	CAT/CLAMS	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	Clark et al[58] (1995)
Denver Developmental Screening Test-II[a]	DDST II	Domains include (1) language; (2) fine motor-adaptive; (3) personal-social; and (4) gross motor	Glascoe and Byrne[57] (1993)
Developmental Profile-II[a]	DP-II	5 subsets: (1) physical; (2) self-help; (3) social; (4) academic; and (5) communication	Glascoe and Byrne[57] (1993)
Early Language Milestone Scale		41 items covering 4 areas: (1) auditory expressive; (2) auditory receptive; (3) visual expressive; and (4) visual receptive	Coplan et al[30] (1982); Black et al[55] (1988); Walker et al[68] (1989)
Fluharty Preschool Speech and Language Screening Test		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	Blaxley et al[65] (1983); Sturner et al[53] (1993); Allen and Bliss[69] (1987)
Hackney Early Language Screening Test		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	Dixon et al[54] (1988); Law[67] (1994)
Language Development Survey	LDS	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	Klee et al[59] (1998); Klee et al[60] (2000); Rescorla and Alley[61] (2001)
Levett-Muir Language Screening Test		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	Levett and Muir[64] (1983)
Parent Evaluation of Developmental Status	PEDS	2 questions for parents to elicit concerns in general and specific areas; other items determine reasons for parents' concerns	Glascoe[56] (1991)
Parent Language Checklist[a]	PLC	12 questions for parents about their child's receptive and expressive language including 1 question for assessing hearing problems	Burden et al[11] (1996)
Pediatric Language Acquisition Screening Tool for Early Referral	PLASTER	Communication development milestones by age with 7 individual areas; each area contains 10 questions (5 relate to receptive language and 5 to expressive language)	Sherman et al[52] (1996)
Screening Kit of Language Development	SKOLD	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	Bliss and Allen[66] (1984)
Sentence Repetition Screening Test	SRST	15 sentences repeated 1 at a time by the child after demonstration by the tester	Sturner et al[71] (1996)
Structured Screening Test		20 questions covering both expressive and receptive language skills	Laing et al[63] (2002)
Test for Examining Expressive Morphology	TEEM	54 items targeting a variety of morphosyntactic structures using a sentence-completion task	Merrell and Plante[70] (1997)

[a] Speech and language are part of a broader screening instrument.

TABLE 4 **Studies of Screening Instruments for Children Up to 2 Years Old**

Authors (y)	N	Instrument	Reference Standard	Speech and Language Domains
Under 5 min to administer				
Glascoe[56] (1991)	157	Parent Evaluation of Developmental Status	Clinical assessment	Expressive language, articulation
Coplan et al[30] (1982)	191	Early Language Milestone Scale	Clinical assessment	Expressive and receptive language
Black et al[55] (1988)	48	Early Language Milestone Scale	Receptive-Expressive Emergent Language Scale, Bayley Scales of Infant Development	Expressive and receptive language
5–10 min to administer				
Glascoe and Byrne[57] (1993) Study 1	89	Developmental Profile II	Battery of measures	Fine motor adaptive, personal social, gross motor, and language
Sherman et al[52] (1996)	173	Pediatric Language Acquisition Screening Tool for Early Referral	Early Language Milestone Scale	Expressive and receptive language
10 min to administer				
Macias et al[62] (1998)	78	Bayley Infant Neurodevelopmental Screener	Bayley Scales of Infant Development II	Expressive and receptive language
Klee et al[59] (1998)	306	Language Development Survey	Infant Mullen Scales of Early Learning	Expressive vocabulary
Klee et al[60] (2000)	64	Language Development Survey	Infant Mullen Scales of Early Learning	Expressive vocabulary
Rescorla and Alley[61] (2001)	422	Language Development Survey	Bayley Scales of Infant Development, Stanford-Binet, Reynell Developmental Language Scales	Expressive vocabulary: delay 1, <30 words and no word combinations; delay 2, <30 words or no word combinations; delay 3, <50 words or no word combinations
Clark et al[58] (1995)	99	Clinical Linguistic and Auditory Milestone Scale	Sequenced Inventory of Communication Development	Syntax, pragmatics
Glascoe and Byrne[57] (1993) Study 2	89	Denver Developmental Screening Test II (communication components)	Battery of measures	Physical, self-help, social, academic, and communication

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

TABLE 4 **Continued**

Subjects	Setting	Screener	Sensitivity, %	Specificity, %	Study Quality Rating
From outpatient clinic or private practice; 78% white; 54% male; 6–77 mo	Clinic	Doctoral students in psychology or special education	72	83	Good
From private practices and pediatric outpatients of hospital; 80% white; 50% male; 0–36 mo	Physician's office	Medical students	97	93	Fair
From low socioeconomic groups; 8–22 mo	Large pediatric clinic, university teaching hospital	Not reported	83	100	Poor
From 5 day care centers; 52% male; 7–70 mo	Day care centers	Psychologist	73	76	Fair
123 high-risk infants; 50 normal controls; 3–36 mo	High risk: neonatal developmental follow-up clinic; control: speech and hearing clinic	Speech and language pathologist and graduate students	53	86	Fair
Randomly selected from those presenting for routine neonatal high-risk follow-up; 54% male; 62% black; 6–23 mo	Physician's office	Developmental pediatrician	73 (using middle-cut scores)	66 (using middle-cut scores)	Fair
Toddlers turning 2 y old during the study in Wyoming; 52% male; 24–26 mo	Home	Parent	91	87	Good-Fair
Children turning 2 y in a specific month in an area of Wyoming	Home	Parent	83 (at age 2); 67 (at age 3)	97 (at age 2); 93 (at age 3)	Fair
Toddlers in 4 townships of Delaware County, PA, turning 2 y old during the study	Home	Parent and research assistant	Delay 1: 70 (Bayley), 52 (Binet), 67 (Reynell); delay 2: 75 (Bayley), 56 (Binet), 89 (Reynell); delay 3: 80 (Bayley), 64 (Binet), 94 (Reynell)	Delay 1: 99 (Bayley), 98 (Binet), 94 (Reynell); delay 2: 96 (Bayley), 95 (Binet), 77 (Reynell); delay 3: 94 (Bayley), 94 (Binet), 67 (Reynell);	Fair
Infants turning 1 or 2 y old during study; 55% male; 0–36 mo	Home or school for the deaf	Speech and language pathologist	Receptive: 83 (14–24 mo), 68 (25–36 mo); expressive: 50 (14–24 mo), 88 (25–36 mo)	Receptive: 93 (14–24 mo), 89 (25–36 mo); expressive: 91 (14–24 mo), 98 (25–36 mo)	Fair
Children from 5 day care centers; 52% male: 7–70 mo	Day care centers	Psychologist	22	86	Fair

crowding.[50,51] These studies did not find associations with the mother's stuttering or speaking style or rate,[47] the mother's age,[51] or child temperament.[46]

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.[33] The studies used several different standardized and nonstandardized 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-

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

Authors (y)	*N*	Instrument	Reference Standard	Speech and Language Domains
5 min to administer				
Burden et al[11] (1996)	2590	Parent Language Checklist	Clinical judgement	Expressive and receptive language
Laing et al[63] (2002)	376	Structured Screening Test	Reynell Developmental Language Scales	Expressive and receptive language
Levett and Muir[64] (1983)	140	Levett-Muir Language Screening Test	Reynell Developmental Language Scales, Goldman-Fristoe Test of Articulation, Language Assessment and Remediation Procedure	Receptive language, phonology, syntax
Sturner[53] (1993) Study 1	279	Fluharty Preschool Speech and Language Screening Test	Arizona Articulation Proficiency Scale Revised, Test of Language Development Primary	Expressive and receptive language, articulation
Sturner et al[53] (1993) Study 2	421	Fluharty Preschool Speech and Language Screening Test	Test for Auditory Comprehension of Language Revised, Templin-Darley Test of Articulation	Expressive and receptive language, articulation
10 min to administer				
Law[67] (1994)	1205	Hackney Early Language Screening Test	Reynell Developmental Language Scales	Expressive language
Blaxley[65] (1983)	90	Fluharty Preschool Speech and Language Screening Test	Developmental Sentence Scoring	Expressive and receptive language, articulation
Bliss and Allen[66] (1984)	602	Screening Kit of Language Development	Sequenced Inventory of Communication Development	Expressive and receptive language
Dixon et al[54] (1988)	25	Hackney Early Language Screening Test	Clinical judgement	Expressive language
Walker et al[68] (1989)	77	Early Language Milestone Scale	Sequenced Inventory of Communication Development	Expressive and receptive language

dren with similar proportions of boys and girls. One study enrolled predominantly black children[52] and another children from rural areas.[53] Study sizes ranged from 25 subjects[54] to 2590 subjects.[11] 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,[30,55] Parent Evaluation of Developmental Status,[56] Denver Developmental Screening Test II (language component),[57] Pediatric Language Acquisition Screening Tool for Early Referral,[52] Clinical Linguistic and Auditory Milestone Scale,[58] Language Development Survey,[59–61] Development Profile II,[57] and the Bayley Infant Neurodevelopmental Screener[62] (Table 4). Of these studies, 6 tested expressive and/or receptive language,[30,52,55,57,62] 3 tested expressive vocabulary,[59–61] 1 tested expressive language and articulation,[56] and 1 tested syntax and pragmatics.[58]

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%.[30,52,56–62] Four studies reported sensitivity and specificity of ≥80% when using the Early Language Milestone Scale,[30] the Language Development Survey,[59,60] and the Clinical Linguistic and Auditory

TABLE 5 Continued

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

Milestone Scale.[58] The study of the Clinical Linguistic and Auditory Milestone Scale also determined sensitivity and specificity by age and reported higher sensitivity/specificity at 14 to 24 months of age (83%/93%) than 25 to 36 months of age (68%/89%) for receptive function but lower sensitivity/specificity at 14 to 24 months of age (50%/91%) than 25 to 36 months of age (88%/98%) for expressive function.[58] A study that tested expressive vocabulary by using the Language Development Survey indicated higher sensitivity/specificity at 2 years of age (83%/97%) than at 3 years of age (67%/93%).[60]

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 Scale[68] (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 Test[64] 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]

Ages 3 to 5 Years

Three studies used instruments that take ≤10 minutes to administer, including the Fluharty Preschool Speech and Language Screening Test,[69] Test for Examining Expressive Morphology,[70] and the Sentence Repetition Screening Test[71] (Table 6). Of these studies, 2 tested expressive and receptive language and articulation,[69,71] and 1 tested expressive vocabulary and syntax.[70] The 2 fair-quality studies reported sensitivity ranging from 57% to 62% and specificity ranging from 80% to 95%.[66,69,71]

Systematic Review

A Cochrane systematic review of 45 studies, including most of the studies cited above, summarized the sensitivity and specificity of instruments that take ≤30 minutes to administer.[34] Sensitivity of the instruments for normally 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 considered to be of higher quality tended to have higher specificity than sensitivity ($t = 4.41$; $P < .001$); however, high false-positive and false-negative rates were reported 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 normal speech and language as impaired, potentially leading to anxiety for children and families and additional testing and interventions. False-negative results would miss identifying children with impairment, potentially leading to progressive speech and language delay and other long-term effects including communication, 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 Care Clinicians?

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 criteria, including 1 rated good,[72] 13 rated fair,[73–85] and 11 rated poor quality[77,86–95] (Table 7). Studies were considered to be of poor quality if they reported important differences between intervention and comparison groups at baseline, did not use intention-to-treat analysis, 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 studies ranged from 18 to 75 months old, most studies included children 2 to 4 years old, and their results do not allow for determination of the optimal ages of intervention.

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, Assessment, Acceleration, and Remediation program[96] and the Hanen principles.[78,79,85,93] Others used more theoretical approaches such as focused stimulation,[78,79,86,87,93] auditory discrimination,[83,90] imitation or modeling procedures,[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 parents[77,78,80,85] and by scores on standardized instruments such as the Reynell Expressive and Receptive Scales,[74,77] the Preschool Language Scale,[72,75,85] and the MacArthur Communicative Development Inventories.[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, although 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 focusing on multiple language domains, expressive and receptive language, and phonology. Treatment for receptive auditory comprehension lead to significant improvement for the intervention group compared with the control group; however, results did not differ between groups for several expressive and phonology outcomes.[72]

Ages 2 to 3 Years

One good[72] and 6 fair-quality[77–80,84,85] studies evaluated speech and language interventions for children who

TABLE 6 Studies of Screening Instruments for Children 3 to 5 Years Old

Authors (y)	N	Instrument	Reference Standard	Speech and Language Domains	Subjects	Setting	Screener	Sensitivity, %	Specificity, %	Study Quality Rating
≤10 min to administer										
Allen and Bliss[69] (1987)	182	Fluharty Preschool Speech and Language Screening Test	Sequenced Inventory of Communication Development	Expressive and receptive language, articulation	From day care programs; 36–47 mo	Clinic	Speech and language pathologists	60	80	Fair
Sturner et al[71] (1996)	76	Sentence Repetition Screening Test	Speech and Language Screening Questionnaire	Receptive and expressive language, articulation	Children registering for kindergarten; 48% male; 65% white; 54–66 mo	School	Nonspecialists or school speech and language pathologists	62 (receptive and expressive); 57 (articulation)	91 (receptive and expressive); 95 (articulation)	Fair
Merrell and Plante[70] (1997)	40	Test for Examining Expressive Morphology	Kaufman Assessment Battery for Children, Structured Photographic Expression Language Test II	Expressive vocabulary, syntax	20 impaired and 20 unimpaired; 52% male 73% white; 48–67 mo	School or clinic	Speech and language pathologists	90	95	Poor

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,[80] parent-directed therapy for expressive delay,[77,78] and clinician-directed receptive auditory comprehension.[72] Lexical acquisition was improved with both clinician-directed[84,91] and group therapy approaches.[84] In 3 studies, there were no between-group differences for clinician-directed expressive[72,85] or receptive language therapy,[72,85] parent-directed expressive or receptive therapy,[85] or parent-directed phonology treatment.[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,[73,74,76,81,82] whereas 2 studies reported no differences.[75,83] Both group-based[81] and clinician-directed[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.[35] Twenty-three of these studies[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.[81]

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

Four good-[72] or fair-quality[80,81,85] intervention studies included functional outcomes other than speech and language. Increased toddler socialization skills,[80] improved child self-esteem,[85] and improved play themes[81] were reported for children in intervention groups in 3 studies. Improved parent-related functional outcomes included decreased stress[80] and increased positive feelings toward their children.[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.[72]

TABLE 7 **RCTs of Interventions**

Authors (y)	Speech and Language Domains	*N* (No. of Groups)	Age, mo	Interventions	Speech and Language Outcomes	Function and Health Outcomes	Study Quality Rating
Up to 2 y[a]							
Glogowska et al[72] (2000)	Expressive and receptive language and phonology	159 (2)	18–42	Clinician-directed individual intervention, routinely offered by the therapist for 12 mo, vs none	Improved auditory comprehension in intervention vs control group; no differences for expressive language, phonology error rate, language development, or improvement on entry criterion	No differences in well-being, attention level, play level, or socialization skills	Good
2 to 3 y							
Gibbard[77] (1994) Study 1	Expressive language	36 (2)	27–39	Parent-directed individual therapy for 60–75 min every other week for 6 mo vs none	Improved scores on several measures for intervention vs control group	Not reported	Fair
Girolametto et al[78] (1996)	Expressive language	25 (2)	23–33	Parent-directed individual focused stimulation intervention for 150 min/wk for 11 wk vs none	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	Not reported	Fair
Law et al[85] (1999)	Expressive and receptive language	38 (3)	33–39	Clinician-directed for 450 min/wk for 6 wk vs parent-directed for 150 min/wk for 10 wk vs none	No differences between groups	Improved parent perception of child's behavior and positivity toward child, improved child self-esteem	Fair
Robertson and Weismer[80] (1999)	Expressive and receptive language	21 (2)	21–30	Clinician-directed individual therapy 150 min/wk for 12 wk vs none	Improved mean length of utterances, total number of words, lexical diversity, vocabulary size, and percentage of intelligible utterances in intervention group vs control	Improved socialization skills, decreased parental stress for intervention group	Fair
Gibbard[77] (1994) Study 2	Expressive language	25 (3)	27–39	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	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	Not reported	Poor
Girolametto et al[93] (1996)	Expressive and receptive language	16 (2)	22–38	Parent-directed individual therapy for 150 min/wk for 10 wk vs none	More target words used in intervention group vs control; no differences in vocabulary development	Increased symbolic play gestures, decreased aggressive behavior in intervention group	Poor
Schwartz et al[91] (1985)	Expressive language and lexical acquisition	10 (2)	32–39	Clinician-directed individual therapy for 3 wk vs none	Improved multiword utterances from baseline in intervention group; no between-group differences reported	Not reported	Poor
Wilcox et al[84] (1991)	Lexical acquisition	20 (2)	20–47	Clinician-directed individual intervention for 90 min/	No differences between groups in use of target words; more use of	Not reported	Fair

TABLE 7 Continued

Authors (y)	Speech and Language Domains	*N* (No. of Groups)	Age, mo	Interventions	Speech and Language Outcomes	Function and Health Outcomes	Study Quality Rating
				wk for 3 mo vs classroom intervention for 360 min/wk for 3 mo	words at home in classroom group vs individual group		
Girolametto et al[79] (1997)	Lexical acquisition and phonology	25 (2)	23–33	Parent-directed individual therapy for eight 150-min sessions and 3 home sessions for 11 wk vs none	Improved level of vocalizations and inventory of consonants for intervention group vs control; no differences in the number of vocalizations	Not reported	Fair
3 to 5 y							
Barratt et al[74] (1992)	Expressive and receptive language	39 (2)	37–43	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)	Improved expression score on Reynell scale for intensive group vs weekly (or traditional) therapy group; no difference in comprehension scores, both were improved	Not reported	Fair
Courtright and Courtright[76] (1979)	Expressive language	36 (3)	47–83	3 clinician-directed approaches are compared for 5 mo: mimicry, clinician modeling, 3rd-person modeling for 5 mo	Increased number of correct responses in modeling groups vs mimicry group	Not reported	Fair
Robertson and Weismer[81] (1997)	Expressive and receptive language	30 (3)	44–61	2 clinician-directed play groups with language impairments (treatment vs control) with normal peers for 20 min/wk for 3 wk	More words used, greater verbal productivity, more lexical diversity, and more use of linguistic markers by normal peer play group (not normal group, treatment group with language impairment) vs control	Play-theme–related acts increased for the normal peer play group (not normal group, treatment group with language impairment)	Fair
Glogowska et al[72] (2002)	Expressive and receptive language and phonology	159 (2)	≤42	Clinician-directed for 12 mo vs none	Improved receptive language in intervention group vs control; no differences between groups for 4 other measures	Improved family response to child in intervention group	Poor
Almost and Rosenbaum[73] (1998)	Phonology	26 (2)	33–61	Clinician-directed individual therapy for two 30-min sessions/wk for 4 mo vs none	Higher scores on 3 of 4 measures for intervention vs control group	Not reported	Fair
Rvachew and Nowak[82] (2001)	Phonology	48 (2)	50 (mean)	Clinician-directed individual therapy 30–40 min/wk for 12 wk; compares interventions for phonemes that differ (most-knowledge/early-developing group vs	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	Not reported	Fair

				least-knowledge/latest-developing group)			
Shelton et al[83] (1978)	Phonology and articulation	45 (3)	27–55	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	No improvements for intervention groups vs control	Not reported	Fair
Fey et al[86] (1994)	Phonology and syntax	26 (3)	44–70	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	Improved grammatical output (developmental sentence scores) for both intervention groups vs control; no significant difference between groups for phonological output (percentage consonants correct)	Not reported	Poor
Reid and Donaldson[95] (1996)	Phonology	30 (2)	42–66	Clinician-directed individual therapy for 30 min/wk for 6–10 wk vs none	Improved scores on some measures from baseline for intervention and control groups; no between-group comparisons reported	Not reported	Poor
Ruscello et al[89] (1993)	Phonology	12 (2)	49–68	Clinician-directed vs clinician- and parent-directed individual therapy for 120 min/wk for 8 wk	Improved scores on measures from baseline for both intervention groups; no between-group comparisons reported	Not reported	Poor
Rvachew[90] (1994)	Phonology	27 (3)	42–66	Clinician-directed individual therapy for 45 min/wk for 6 wk; compares 3 groups listening to different sets of words	Improved scores on measures for 2 intervention groups vs third group	Not reported	Poor
Cole and Dale[75] (1986)	Syntax	44 (2)	38–69	Clinician-directed individual directive approach vs interactive approach for 600 min/wk for 8 mo	Improved scores on 6 of 7 measures from baseline for both intervention groups; no significant differences between groups	Not reported	Fair
Fey et al[92] (1993), first phase	Syntax	29 (3)	44–70	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	Improved scores on 3 of 4 measures for both intervention groups vs control; no differences between intervention groups	Not reported	Poor
Fey et al[87] (1997), second phase	Syntax	28 (3)	44–70	Clinician-directed vs parent-directed vs none for 5 mo continuing from prior study	Improved some developmental sentence scores from baseline in both intervention groups vs control; no between-group comparisons reported except that	Not reported	Poor

TABLE 7 Continued

Authors (y)	Speech and Language Domains	*N* (No. of Groups)	Age, mo	Interventions	Speech and Language Outcomes	Function and Health Outcomes	Study Quality Rating
					clinician-directed treatment groups had larger and more consistent gains than parent-directed treatment groups or control		
Mulac and Tomlinson[88] (1977)	Syntax	9 (3)	52–75	Clinician-directed individual Monteray language program vs Monteray language program with extended transfer training for 67 min/wk for 4 wk vs none	Improved scores for both intervention groups vs control; no significant differences between intervention groups	Not reported	Poor

[a] Studies with a range of ages are not repeated across categories.

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-

guage 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.[97] 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 independent 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.

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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

Type of Injury	Bantam Players in Ontario, *n* (%)	Bantam Players in Quebec, *n* (%)
Checking-related	582 (44)	357 (42)
Concussions	42 (3)	20 (2)
Fractures	344 (27)	199 (23)
Total hockey injuries	1312	856

Source: Canadian Hospitals Injury Reporting and Prevention Program.

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

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Errors appeared in the review by Nelson et al, titled "Screening for Speech and Language Delay in Preschool Children: Systematic Evidence Review for the US Preventive Services Task Force" published in the February 2006 issue of *Pediatrics Electronic Pages* (doi:10.1542/peds.2005-1467). On page e305, the two entries for Klee et al in Table 4 were incorrect. The corrected entries appear on the next page.

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%).[59]

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

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TABLE 4 **Studies of Screening Instruments for Children up to 2 Years Old**

Authors (y)	*N*	Instrument	Reference Standard	Speech and Language Domains	Subjects	Setting	Screener	Sensitivity/Specificity	Study Quality Rating
Klee et al[59] (1998)	306	Language Development Survey	Clinical judgment based on blinded, independent judgments of 2 speech-language pathologists and supported by 1 of 3 standardized measures falling below −1 SD	Expressive vocabulary and word combinations	Toddlers turning 2 y old during the study in Wyoming; 52% male; 24–26 mo	Home	Parent	Sample of 64/306 children screened and evaluated with reference standard at age 2 y: sensitivity = 91%; specificity = 87% Sample of 36/306 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%	Good-fair
Klee et al[60] (2000)	306	Language Development Survey with parental concern for delay or history of ≥6 ear infections	Clinical judgment based on blinded, independent judgments of 2 speech-language pathologists and supported by 1 of 3 standardized measures falling below −1 SD	Expressive vocabulary and word combinations	Toddlers turning 2 y old during the study in Wyoming; 52% male; 24–26 mo	Home	Parent	Sample of 64/306 children screened and evaluated with reference standard at age 2 y: sensitivity = 91%; specificity = 96%	Good-fair

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

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